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INDEX TO TWENTY-FIFTH VOLUME.

MISCELLANEOUS.

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NATIONAL CAR AND LOCOMOTIVE BUILDER

JANUARY, 1894.

CONTENTS.

The Hercules Iron Works, of Aurora, Ill., have started again.

The wickes Refrigerator and Car Company will build 250 refrigerator cars.

The Chicago & Alton car shops at Bloomington began running full time Dec. 4.

The Eureka Steel Casting Co., of Chester, Pa., is erecting an addition to its plant.

The old Aspen Short Line Railroad Company has consolidated with the Colorado Midland.

United States locomotive builders have exported 430 locomotives during the past two years.

The Edgar Thomson Steel Works at Braddock, Pa., employing 800 hands, have resumed work.

The Quimby Brush Co. has been organized in Boston for the manufacture of machine brushes.

The Buffalo Car Works have completed 250 coal cars with air brakes, for the Beech Creek Railroad.

The Haskell & Barker Car Company has resumed operations, employing about half the usual force.

The Richmond Locomotive Works is overhauling ten consolidation engines for the Peoria & Eastern road.

The Brooks Locomotive Works, Dunkirk, N. Y., are building a mogul engine for the Baltimore & Lehigh.

The Pennsylvania Railroad's World's Fair exhibit has been given to the Columbian Museum at Chicago.

The Erie & Pittsburgh Railroad Co. has put its entire shop force on ten hours a day at its shops, at Erie, Pa.

Three hundred men have resumed work at the Wilmington (Del.) shops of the Pullman Palace Car Company.

The project of cutting a ship canal between Chesapeake Bay and the Delaware River has recently been revived.

The Michigan Peninsular Car Company has secured a contract to build 600 cars for the Chicago & Northwestern.

A passenger train collided with a freight train near Sosnowica, Lublin, southwest Russia, Dec. 14. Eleven persons were killed.

The H. K. Porter Machine Co., of Pittsburgh, Pa., will soon build a brick machine shop, 72 by 135 feet, at a cost of $18,000.

The Colorado Fuel & Iron Company has contracted with the Receivers of the Union Pacific for the delivery of 26,000 tons of rails.

The Griffin Car Wheel Co., of Chicago, has been incorporated by T. A. Griffin, G. G. Willard and W. W. Evans. Capital, $1,000,000.

The Universal Coal Dumping Car Company, of Springfield, Ill., with a capital of $250,000 has been incorporated by James A. Philbrook and T. H. Pearce.

The Wagner Palace Car Company's train which was exhibited at the World's Fair has started for California, where it will be shown at the midwinter exposition.

The dates for regular meetings of the Central Railway Club, at Buffalo, are now on the fourth Wednesday of January, March, April, September and October.

The Chicago & Northwestern has ordered 300 stock cars of the Pullman Company, and 100 box and 200 double deck stock cars of the Michigan Car Company.

The Baldwin Locomotive Works have an order for six compound freight and four compound passenger engines for the Philadelphia, Reading & New England.

The New York, Ontario & Western has let an order for 500 coal cars to the Michigan Peninsular Car Company. The cars are to be delivered during February and March.

The Baltimore & Ohio Railroad Company's World's Fair exhibit has all reached Baltimore. It is stated that a formal tender of the exhibit has been made to the city of Baltimore.

The Manchester Ship Canal, which has been some six years in building, was opened for traffic on Dec. 7. It is 35½ miles long and cost $75,000,000, or about $2,100,000 per mile.

The Laclede Car Company is building 300 cable cars for the Philadelphia Traction Company, and 100 cable cars for the Broadway line of the Metropolitan Traction Company, New York.

The Baldwin Locomotive Works, of Philadelphia, Pa., have sold the double-end express engine "Columbia," exhibited at the Columbian Exposition, to the Chicago, Milwaukee & St. Paul Railroad.

The Pennsylvania Railroad has recently completed at its shops at Fort Wayne, Ind., the last of 22 Class X engines, ordered early in 1893. Most of these engines were built for the lines west of Pittsburgh.

The Basic City Car Works, of Basic City, Va., are making some improvements calculated to increase the output of the plant. These works have just finished 30 improved coal cars for the Chesapeake & Ohio.

Miss Dorothea Klumpke, of San Francisco, read an astronomical thesis Dec. 14, before the professors of the Sorbonne and several hundred others, at Paris, and received the degree of Doctor of Sciences.

The proposed grand central railroad station in Buenos Ayres will not be built for some time to come, the bill for authorizing its construction having been laid aside for one year by a vote of the Argentine Senate.

Heavy fog caused a rear end collision between two freight trains on the New York division of the Pennsylvania road, Dec. 23, wrecking three cars and injuring three men, and blocking the road for several hours.

Forty-eight thousand tons of steel rails have been ordered by the Pennsylvania Railroad to complete the work of double tracking the Pittsburgh, Fort Wayne & Chicago road from Crestline to Chicago.

A new vestibuled train called the Chicago & Pittsburgh limited was put on by the Baltimore & Ohio road between Chicago and Pittsburgh, Dec. 3, leaving daily at 3 p. m. Dining car service will be maintained.

The locomotive "John Bull' and its train of early passenger cars, which were exhibited at the World's Fair, have been returned to the Smithsonian Institution at Washington. The engine made the trip under steam.

The Alps are to be pierced by another railroad tunnel. This time it is the Simplon that is to be attacked, by a company recently formed in Switzerland for the purpose. The work is estimated to cost $15,000,000 and to occupy five and a half years.

The assignees of the Grant Locomotive Works have advertised that they will receive until Jan. 15, 1894, sealed proposals for the purchase of the entire property of the company now in their hands. The office of the assignees is at 100 Washington Street, Chicago.

Four Texas train robbers have been given 35 years in the State Prison within a week of the date of the commission of their crime. This, too, is the lightest sentence for that crime known to the Texas law. Traveling will henceforth be enviably safe in Texas.

The Ensign Manufacturing Company, at Huntington, W. Va., which has been closed for several monfhs, has resumed operations in full, giving employment to about 1,000 men. The company has contracts for work which will keep its shops in full operation for three months.

A collision between the Bissel accommodation on the Baltimore & Ohio Railroad and a yard engine of the Carnegie Steel Company, hauling slag, occurred Dec. 19 on the trestle spanning Turtle Creek, near Braddock, Pa. One man was killed and 15 were injured.

President Bacon, of the Baltimore & Ohio Southwestern, has received from the Pullmans a new private car which is called "Virginia." It is of the combination pattern, 75 feet 5 inches long, and the interior is finished in vermilion and satinwood, trimmed with embroidered leather.

An engine on the Pennsylvania Railroad drawing a special car carrying a physician summoned on a case of emergency on Nov. 24 made the run from Philadelphia to Harrisburg, 105 miles, in 110 minutes. The fastest time previously made between these places was 125 minutes.

Application will be made at the next session of the Dominion Parliament for the incorporation of a railroad to run from Regina, Northwest Territory, southerly to the boundary near Wood Mountain; also from Regina northeasterly to the Saskatchewan River, east of the second meridian.

The Third Avenue cable railway, in New York, was officially opened to traffic on Dec. 4 from 130th to 6th street. The Laclede Car Company has built the cars for this road. They are 30 feet long over all, with 22-feet bodies, and are lighted by the Pintsch compressed gas system.

Mr. Frank W. Hawley, Vice-President of the Cataract General Electric Company, of New York, said recently that electric power from Niagara Falls would be ready for transmission early in the spring, and the officers of the company believe they will be able to transmit the power as far as Albany at a profit.

The central power station at the Falls is nearly completed, and the hydraulic power plant will be in position in a few days, electric installation will be delivered in a few months, and possibly the first of the generators will be delivered soon after March 1, and a line completed to Buffalo by the early spring.

A collision between a passenger and a freight train occurred on the Richmond & Danville road Dec. 20, caused by an open switch letting the passenger train run onto a side track where the feight was awaiting its arrival. Five persons were injured, and three freight cars and both engines were wrecked.

A 20-foot trestle, weakened by flood, gave way under a passenger train on the Western New York & Pennsylvania road, Dec. 15, piling the engine, baggage and smoking cars, and one day coach between the banks of a creek 31 miles from Dunkirk, N. Y. Five persons were killed and a number of others wounded.

The latest suggestion in reference to the proposed transcontinental railroad from Pernambuco, Brazil, to Valparaiso, Chili, is that connecting links between existing lines in Brazil should be built, and that the resulting Brazilian system should then be connected by a line through Paraguay and Northern Argentine with the Argentine systems.

A locomotive boiler explosion occurred on the Fitchburg Railroad, at Baldwinsville, Mass., Dec. 7. A double-header freight train had stopped at the water tank, and while the first engine was taking water the boiler of the second exploded. According to press reports the crown sheet collapsed owing to low water in the boiler. Two men were injured.

Plans have been completed for the new plant of the Westinghouse Electric Company to be erected near Pittsburgh. The following buildings are included in the plan: A machine shop, 75 by 231 feet, two stories; warehouse, 76 by 754 feet; foundry, 150 by 700 feet; shop, 75 by 300 feet; power house, 76 by 300 feet; a punch department, 76 by 250 feet, and others.

The following have been elected officers of the Southern & Southwestern Railway Club for the ensuing year: President, Pulaski Leeds, Louisville & Nashville; First Vice-President, E. M. Roberts, South Carolina; Second Vice-President, F. H. McGee, Central Railroad & Banking Company of Georgia; Treasurer, A. G. Steinbrenner, St. Louis; Secretary, S. A. Charpiot, Macon, Ga.

In answer to some comments on the recent discharge of 1,000 men by the New York Central, Third Vice-President Walter Webb said: "There is nothing unusual in the discharge of the men. They are principally carpenters, painters and artisans in general, who are catalogued as extra employees. On December 1 every year many men are discharged, for the reason that there is no work for them to do."

The largest tank in the world is being constructed in Sixty-fifth Street, New York City, for the Consolidated Gas Company. Its capacity when fully inflated will be a trifle more than 4,155,000 cubic feet. It will rise 165 feet above the surface of the street and extend 43 feet below the surface, making a total column of gas 208 feet high by about 150 feet in diameter. Nine hundred tons of iron will be used in its construction.

The Secretary of State of Missouri has granted a charter to the Missouri River and Chicago Railway Company, capital stock, $1,200,000. The road will be constructed from a point on the Missouri, Kansas & Eastern Railroad, in Callaway County, near St. Aubert, thence in a northwesterly direction to Fulton and Columbia, thence in a northeasterly direction to the Wabash, near Centralia, and thence to Hannibal, about 120 miles.

The New York, Lake Erie & Western road passed through the ordeal of carrying the excessively heavy World's Fair passenger traffic more fortunately than any of its competitors. It carried over 300,000 passengers during the time the Exposition was open, without an accident. It is said that no road in the world has ever heretofore carried so large a number of tourists, in a like period, absolutely free from disasters involving injury and death.

The Missouri Pacific Railroad is trying the Knapp car ventilating system on one of its passenger cars, and with satisfactory results, it is said. The device consists of a T-shaped pipe, the vertical leg of which extends into the car, and has openings near the floor, while the horizontal leg is on the car roof and is fitted with funnel-shaped ends. The air current through the horizontal pipe when the car is running induces an upward current in the vertical pipe.

Evidence of the extension of coal mining in India is afforded by the increasing ratio of Indian coal consumed on the railways there. Of fully a million tons of coal used last year, 876,000 tons were Indian coal, and only 204,603 tons English. The increase on the former—the native coal—for the year was equal to 11.92 per cent., and on the latter there was a decrease of 5.64 per cent. The East Indian Railway is alone using coke, but several lines still adopt wood, of which 300,682 tons were consumed last year—a decreasing quantity.

The Atchison, Topeka & Santa Fe has ordered 91 locomotives. The Baldwin Locomotive Works will build 71 of these, and the Richmond Locomotive Works will build 20—ten consolidation, and ten 10-wheel engines. The Baldwin order is for the following engines: ten 20 by 26-inch cylinder consolidation engines, six 19 by 26-inch cylinder 10-wheel engines, ten 18 by 24-inch cylinder 10-wheel engines, fifteen 17 by 24-inch cylinder 10-wheel engines, twenty 17 by 24-inch cylinder 8-wheel engines, ten 19 by 24-inch cylinder mogul engines. Of these 42 are to be built immediately, and the remainder will be constructed during the year 1894. The six 19 by 24-inch cylinder 10-wheel engines are for the Southern California road, the ten 19 by 24-inch cylinder moguls are for the St. Louis & San Francisco, and the remainder are for the Santa Fe system proper.

onsolidation Compound Locomotive, Exhibited at the World's Fair.

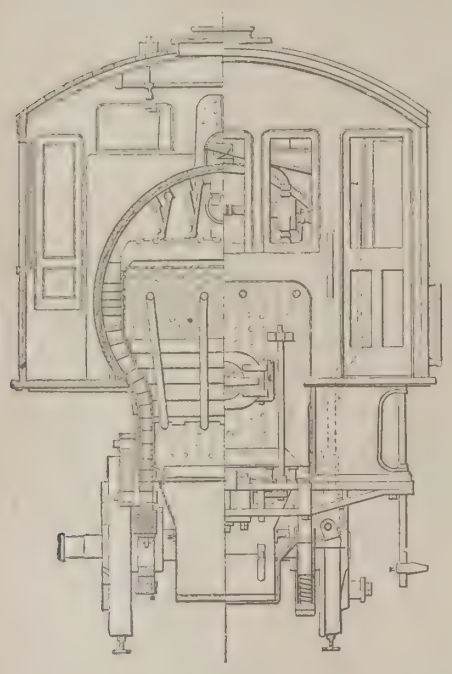
The photographic view and line engravings on this nd the opposite page show the appearance and illusrate the construction of a consolidation compound locootive built by the Schenectady Locomotive Works, nd which has been on exhibition at the Columbian Exposition. The engine is designed to burn bituminous oal, and weighs 149,000 pounds, of which weight 132,-00 pounds rest upon the drivers, and 17,000 pounds est upon the engine truck. The total wheel base of he engine is 21 feet 7 inches, the driving or rigid wheel ase being 14 feet. One distinguishing feature of this ngine is its very large low-pressure cylinder, 32 inches y 26 inches, which is the largest locomotive cylinder in merica, if not in the world. It is possible that this iameter has been equaled by some of the Webb three-ylinder compounds in England. This engine is of the wo-cylinder type, using the Schenectady Locomotive

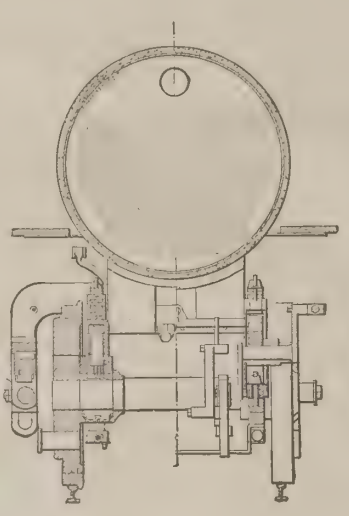
The boiler is of the wagon-top type, 62 inches in diameter at the smallest ring, and is designed to carry 180 pounds of steam per square inch as a working pressure. It is substantially attached to the frames at the firebox end.

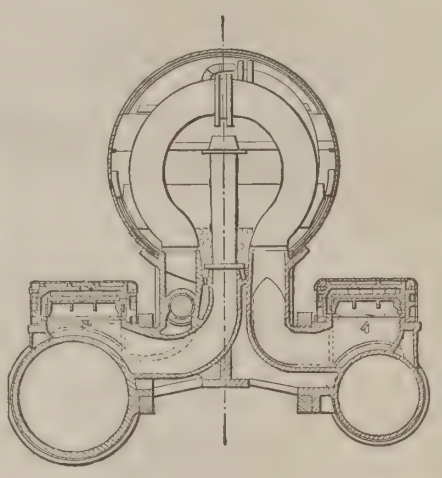
The firebox has a double riveted mud ring, and is provided with a firebrick arch supported upon four water tubes. The ashpan is of simple form, made with upper and lower sections, which are bolted together near the horizontal center line of axle.

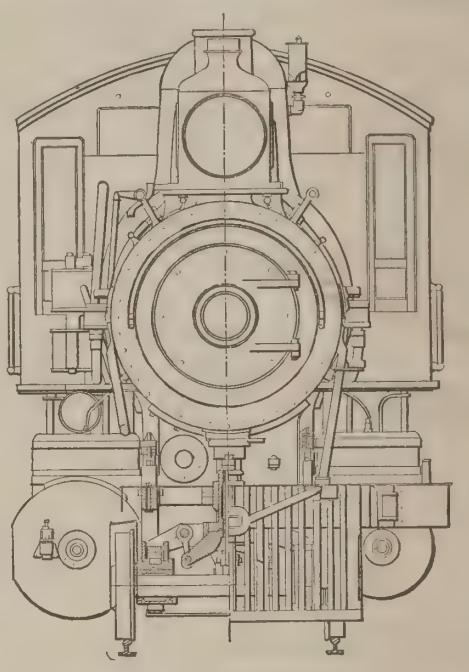
The following table gives some further information in reference to the boiler, firebox, etc.:

Boiler, thickness of steel	½ in. $\frac{9}{16}$ in. and $\frac{5}{8}$ in
" maker "	Worth
" horizontal seams	Sextuple riveted, butt joints
Fire-box, length	108$\frac{3}{16}$ ins.
" width	41$\frac{3}{8}$ ins.
" depth	Front, 62¾ ins.; back, 59¾ ins.
" thickness of steel	Crown, $\frac{5}{8}$ in.; tube, ½ in.; sides, $\frac{5}{16}$ in.; back, $\frac{9}{16}$ in.
" maker "	Otis
" water space	Front, 4 in.; sides, 3 in.; back, 3 in.
" crown stayed by	6 in. × ¾ in. crown bars









Works' standard intercepting valve invented by Mr. . J. Pitkin. The high-pressure cylinder is 22 inches in iameter by 26-inch stroke. The extensions of both pis-on rods are carried through long sleeve bearings of omposition metal in front cylinder heads. The cross-eads are of the Laird type, substantially built, and re made of cast steel. The main rods are fluted; and the arallel rods are made with solid ends, excepting the onnection at the main crank pin; which is made with arted bearings, strap, bolts and two keys. The oil ups on all the rods are worked out of the solid iron, nd have brass caps screwed on.

The following table gives some further information f interest in regard to the pistons, valve and driving heel details:

ston, horizontal thickness of	4¾ ins. and 5¾ ins.
" packing, kind	Cast iron rings
" rod, diam	4 ins.
" rod packing, kind	U. S. Metallic
eam ports, size	R. H., 21 ins. × 2⅛ ins.; L. H., 19 ins. × 2⅛ ins.
xhaust " "	R. H., 21 ins. × 3 ins.; L. H., 19 ins. × 3 ins.
ridges, width	1⅜ ins.
ice valves, kind	Richardson balanced
" " greatest travel	5½ ins.
" " lap of	Outside, ¾ in.; inside, 0 ins.
" " lead, in full stroke	$\frac{1}{16}$ in.
alve stem packing, kind	U. S. Metallic
riving wheels, diam. outside of tire	51 ins.
" journals	8½ ins. dia. × 9 ins. long
ngine truck, style	2 wh'l swing, bolster
" " wheels, kind	Krupp steel tired, spoke center
" " diam	30 ins.
" " journals	6 ins. dia. × 10 ins. long
rank pin journals, main pin, main rod	6 " × 6 "
" " " " side "	6½ " × 5¼ "
" " " inter. " " "	5½ " × 4½ "
" " " front " " "	5 " × 3¾ "
" " " back " " "	5 " × 3¾ "

Tubes, material	Charcoal iron
" No. of	301
" outside diam. and thickness	2 in. O. D. × No. 11 W. G.
" length over tubesheets	12 ft.
Heating surface, tubes, in sq. ft	1,878.
" " firebox " "	168.2
" " total " "	2,046.2
Grate surface, in sq. ft	31.1
" style	Rocking
Ashpan, style	Sectional
Exhaust nozzles, style	Single
" " diameter	5 ins., 5¼ ins. and 5½ ins
Throttle	Balanced valve, double poppet
Smokestack, inside diameter	14 ins. near bottom
" top above rail	14 ft. 5 ins. eng. central
Boiler supplied by	Two No. 10 Monitor injectors

The tender, empty, weighs 35,000 pounds, and carries eight tons of coal and 4,000 gallons of water. The total wheel base of the engine and tender is 47 feet 2½ inches, and the total length of both is 57 feet 1⅝ inches.

The cab is of good size, and has a trap ventilator in the roof, and has the levers, injectors, valves, etc., arranged as conveniently as possible with this style of engine. The injector check pipe is kept close to the running board in its forward length, offering no opportunity as a footstep in reaching the sand-box, a step for this purpose being attached to the boiler, as also a step for reaching the headlight (not shown on illustration).

The engine is equipped with the combined Westinghouse and American driver brake, the tender having Westinghouse brakes on all wheels and Central steel brakebeams.

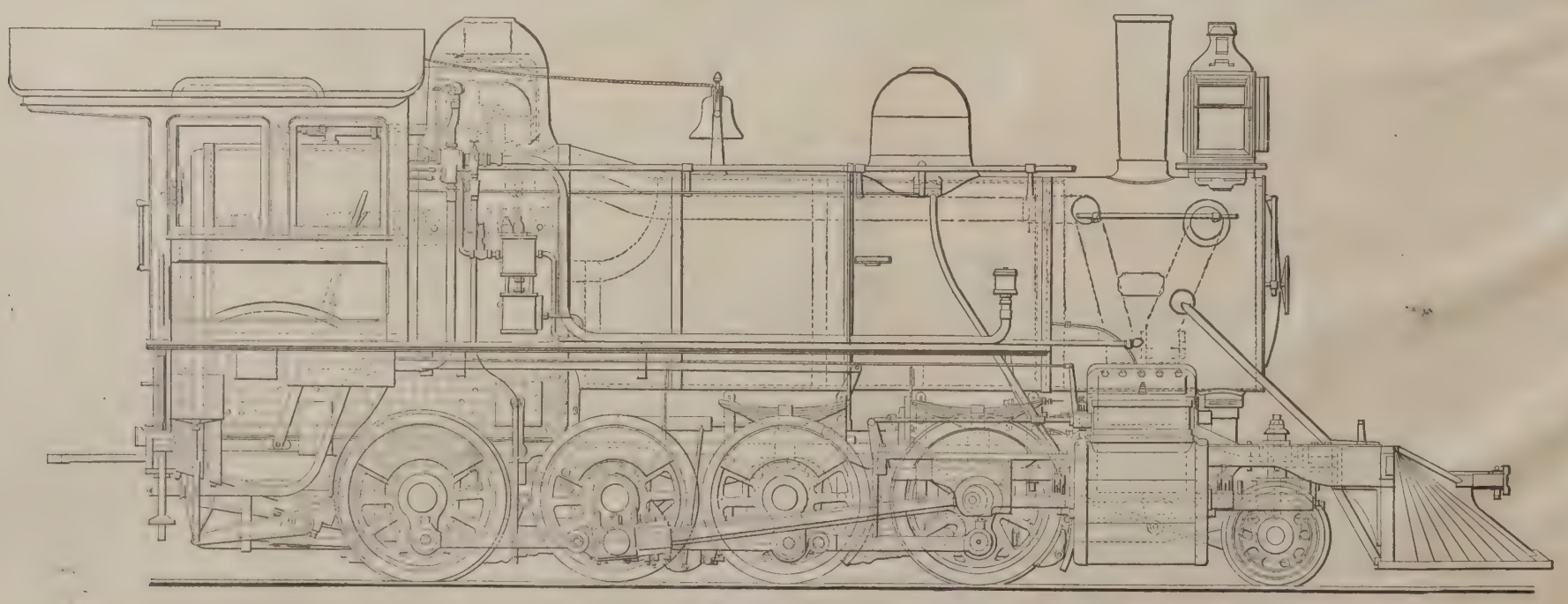
Passenger Car Construction.

BY ERNEST MERRICK.

It is not infrequently asserted by some carbuilders that we have reached the limit of advancement in pasenger car construction. That is to say, that within the specified, and now definitely settled width and height of our cars, we have perfected a design affording to Americans the best possible comfort in traveling.

Certainly in so far as interior arrangement, comfortable sittings and luxuriant apartments are concerned, it is indeed difficult to see how we are to advance much further. Silk head linings, onyx washstands, silverplated trimmings, and a rich display of plush in sittings and draperies, are combined with elaborate hand carvings, spindle work and heavy beveled mirrors to produce a most dazzling effect. Everything is placed at the disposal of the designer, and expense is in no way considered. In many instances it might well seem that we are over-doing this interior work; overlapping the ornaments, and in some cases actually infringing upon the strength of the post framing. If a car is properly set for easy riding, has good systems of heating and lighting, and the seats are comfortable there is little to be gained in a display of showy embellishments. All these extras do not add to the comfort of traveling half so much as the fact of knowing that one is within a good, strong framework in case of accident.

Foreigners at the World's Fair said that we Americans put our time and money on the inside of cars, and leave the framework naked of steel plating, strengthening devices and proper trussing. Such criticism is not without truth, for one has but to note the frightful destruction of cars in a collision, to come to the conclusion that the skeleton design of our cars does need attention, fully as much if not more than the interior decoration. All has not yet been done to give us a satisfactory framework; a fact well attested by a comparison of cars after a wreck. Nor will it suffice simply to make every member larger and stronger, or to build the car entirely of iron. There are defects in the general exterior design of our cars, and especially in the end framing. Take, for instance, the ordinary platform as now constructed, it is a pieced out projection on which is hung a congested mass of heavy appliances, sagging it down and rendering it capable of little resistance in case of a collision. Also, the large door placed in the center of the end, cuts right through the backbone of the system of bracing and seriously weakens the strength of it, when considered as a breastwork.



COMPOUND CONSOLIDATION LOCOMOTIVE.

That some radical change is needed in the end construction of our passenger cars is plainly evident; and it is a subject that some carbuilders are giving much attention to. It might seem to some that the present type of vestibule, and especially the Pullman wide end vestibule, affords as strong an end structure as can possibly be designed over such area; and moreover, that cars equipped with vestibules are held steady on curves in fast running, and are seldom telescoped. This is to a large extent true, but it must be noted that the purely anti-telescoping feature of the vestibule, and its merits of safety could all be preserved, and the whole thing stripped of about half of its present regalia. A properly constructed car without platforms, and with an overhead buffer plate, would possess every factor of safety now claimed for the vestibule.

Under its present construction the vestibule entails a cost that almost prohibits its application to common coaches, and consequently but few cars are thus equipped. The new Pullman wide end vestibule is still more costly, and but very little, if any improvement over the old. No new features of safety are incorporated, and the opportunity conferred for loafing in the vestibule is to many a serious objection. Again, nothing is added to the room space of the car, and all this extra framing is so much more weight set out on the end of the platform.

If the floor space of the new wide end vestibule was utilized as heater room space, or for one of the saloons, and at the same time a means of egress afforded, as well as a passageway between cars, the new design would indeed present a very decided improvement. It would lengthen the car just the length of the platforms without extra cost, and give room for four additional seats. It would, in fact, be a car without platforms, and the plan of taking the space for the saloons, or heater room, would afford an excellent opportunity for an end wall with plated-framing.

The subject of doing away with the platforms on a passenger car is by no means a new one, but like every improvement of a more or less radical nature that has characterized car building for the last ten years, it will have to plead its way slowly, for the tendency is to seek standards and not changes. However, if everything was reduced to a standard there would be no progress, and carbuilding is of necessity bound to keep pace with accessory improvements in the demand for more rapid and safe traveling. Whatever may be done toward improving the roadbed, amending the system of signals and educating competent employees, collisions will never be entirely eliminated, and we carbuilders are duty bound to give the public the best possible car to cope with such.

The enormous strains of pulling, buffing and twisting require a more rigid construction than can possibly be had by bolting on a projection in the shape of a platform, which soon sags down and becomes loose, so that when a collision occurs it is either easily pusned back under the car or easily mounted, and the body of the car given six feet momentum to go crashing into its neighbor. We have plated its timbers, bolted it and trussed it in every conceivable way, and now it is time to do away with it entirely. But what is to take its place? Nothing at all. Simply extend the sills and place the draft gear directly on them, and abolish the use of platform timbers altogether. Place a door on each corner of the car at such an angle that it will be both convenient to get out and go from one car to the other. This would make four outside doors to the car, and leave the center of each end a solid breast for iron plating in such a manner that telescoping would be nigh impossible. The end of the car would of course be rounded off and have a projecting end sill, upon which the present combination buffer plate should be lengthened to the width of the car, and the attending parallel lever, buffer springs and stems made to conform. This would at all times afford a continuous passage at the corner doors, beside being a more serviceable buffer plate, by virtue of its length and weight.

As to the question of steps, they could either be of the extension type, or swing out from under the car. No mechanical engineer who has made a careful study of the devices presented at the World's Fair would be backed down by this problem, which is undoubtedly practical.

An overhead buffer plate would be required, and its construction would be that of the parallel lever and stems carrying out much the same principle on which the upper part of the Pullman vestibule is operated. The overhead buffer is necessary to hold the cars steady. And it could also extend the full width of the car and be made to serve as a substantial covering.

Thus it would appear that the present platform and vestibule with its enormous cost and rigging can be entirely done away with, and a simple construction substituted without the sacrifice of any factor of safety. In fact its chief advantage, that of anti-telescoping, would be greatly improved. At least five feet of available space is added to the interior of the car, and it will not take a railroad man long to figure out the additional profit to his company by being able to add four more seats in the same length of car over platforms, and also get a car of less cost and much easier to maintain. All the rigging and trappings that go to make up the present combination platform have rendered the cost of this part of the car far in excess of any other section of the car of equal length. And when it is considered that the platform space between two passenger cars is dead-head space, and in no way available while the cars are in motion, this extra cost is indeed a large item.

Going now to the interior of the car with a door at each corner, the opportunity for advantageous arrangement is equal (if not greater) to the best designs now in use. The space between the doors and right against the end of the car is the place for the saloon and heater room at one end, and the ladies' toilet at the other end of the car. The corner made by the aisle to the door and the seats, is the place for a washstand and cooler, and the corner opposite, the place for the locker. All such additions as bulkhead partitions and elaborate mirrors at the end of the main aisle will appear in this arrangement to the best advantage.

The whole end structure should be as simple as possible, and the chief aim of a change like this must be in the interests of safe traveling. If the departure as outlined above does not carry with it such pre-eminence, any little conveniences or embellishments made possible thereby are not worth mentioning.

In the old carbuilders' dictionary the definition for a platform is given as "a floor at the end of a car supported by projecting timbers below the car body, to facilitate ingress and egress." Certainly it is within the province of the present knowledge on car building "to facilitate ingress and egress" without perpetuating this complicated and expensive projection.

That there is, among carbuilders, a tendency of thought in this direction is plainly evident from the general tone of contributions in our railroad journals, brought out possibly by the marked lessons of recent frightful collisions, and the broadening knowledge of car construction as seen at the Columbian Exposition. It is not too sweeping a statement to say that as car-building progresses the platform will be ultimately abolished. It is expensive, complicated, and all its present uses can be very much broadened in a car of better design.

In the design of corner doors the question of interchangeability with old cars might at first thought seem a very serious hindrance. But when it is considered that the only objection raised, is that of inconvenience in passing from the corner doors to the old platform, the objection is slight, and can be readily overcome by the application of trap doors, and platform gates. These gates are a safeguard to passengers as it is, and should be used more extensively, even with the present platform.

A solid train made up of passenger cars without platforms, with overhead buffers, and the ends well framed with steel plating would be in some presentable shape to meet another train on the same track; would stand the shock better as a combined whole, and destruction of life and property would not be imparted to each car by the giving away of platforms in succession. This great advantage is now to be had in riding in a solid vestibule train, but the same advantage can, and should be brought within the scope of the every day coach. Furthermore, a car with four corner doors would afford a quick means of escape in case of an accident, and the feature of swinging the steps back under the car when the train leaves the station is certainly an advantage in prohibiting belated passengers from grabbing a hold when the train is in motion.

The old Miller platform has done some good service and has been in use now for many years, but it is undoubtedly a fact that it must soon give way to a better and safer form of end construction.

The largest diamond ever discovered was recently unearthed in the Jagersfontein mine in the African Free State. It is described as a pure white diamond, weighing no less than 971 carats.

The longest reach of railway without a curve is claimed to be that of the new Argentine Pacific Railway from Buenos Ayres to the foot of the Andes. For 211 miles it is without a curve, and has no cutting or embankment deeper than two or three feet.

Frank Parmelee, the famous bus man, of Chicago, has sold his business to a corporation to be known as the Parmelee Company, of which John N. Abbott, formerly general passenger agent of the Erie Railroad, will be the General Manager. Frank Parmelee is 78 years old and has lived in Chicago over 40 years. His transfer and bus business is the largest in the country, and his wealth is estimated at $1,500,000.

SCHENECTADY COMPOUND CONSOLIDATION LOCOMOTIVE.

Passenger Cars at the Columbian Exposition.

The following table names and describes the passenger cars that were exhibited at the World's Fair, in Chicago. It accompanied the paper on "Passenger Train Equipment," raed before the Western Railway Club, by Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Railway:

PASSENGER TRAIN EQUIPMENT AT THE WORLD'S COLUMBIAN EXPOSITION.

Exhibitor.	Built for—	Service of car.	Seating capacity.	Size of body. Length over frame.		Size of body. Width over frame.		Truck dimensions. Kind.	Wheel base.		Dia. of wh'l.	Kind of wheel.	Center to center of trucks.		Weight of car complete.	Weight per passenger carried.
				Ft.	In.	Ft.	In.		Ft.	In.			Ft.	In.	Lbs.	Lbs.
Canadian Pacific	Canadian Pacific	Baggage	—	63	9	9	10	6-wheel	10	6	40-in.	Steel tire			59,600	
" "	" "	Second-class sleeper	64	64	4			4 "	10	6	"	" "			65,300	1,020
" "	" "	First-class coach	56	64	4			4 "	10	6	"	" "			65,300	1,166
" "	" "	Dining	30	70	10			6 "	10	6	"	" "			85,000	2,833
" "	" "	Sleeper	44	77	2			6 "	10	6	"	" "			94,000	2,136
Wagner Palace Car Co		Combination baggage and buffet	15	72	0	9	8	6 "	10	6	36-in.	" "			90,000	6,000
" " "		Parlor	26	72	0	9	8	6 "	10	6	"	" "			90,000	3,461
" " "		Compartment sleeper	12	72	0	9	8	6 "	10	6	"	" "			100,000	8,333
" " "		Section sleeper	27	72	0	9	8	6 "	10	6	"	" "			100,000	3,703
" " "		Dining	30	72	0	9	8	6 "	10	6	"	" "			100,000	3,333
Pullman Palace Car Co		Combination baggage and buffet	23	69	0	9	8	6 "	6	10	"	" "			112,200	4,834
" " "		Dining	40	69	6	9	8	6 "	6	10	"	" "			114,460	2,861
" " "		Section sleeper	27	69	10	9	8	6 "	6	10	"	" "			111,900	4,144
" " "		Compartment sleeper	20	69	10	9	8	6 "	6	10	"	" "			112,360	5,618
" " "		Sleeper and observation	16 sleep., 17 chairs	69	6	9	8	6 "	6	10	"	" "			104,920	6,171
" " "		Parlor	35	69	6	9	8	6 "	6	10	"	" "			106,200	3,034
" " "		Day coach	64	60	0	9	8	6 "	6	10	"	" "			80,800	1,262
" " "		Mail	—	60	8	9	8	6 "	6	10	"	" "			90,930	
Krehbiel Palace Car Co		Composite drawing room and sleeper	20	63	0	9	8	6 "	10	0	"	" "	43	0	64,000	3,200
Jackson & Sharp Co	C., B. & Q. Ry	Day coach	60	53	0	9	8	4 "	7	2	33-in.	Chilled	39	6	53,500	891
" " "	C., M. & St. P. Ry	Mail	—	60	10	10	0	6 "	9	1½	"	" "	46	2	67,000	
" " "	Intramural Railway	Elevated railroad passenger														
Harlan & Hollingsworth	Central of New Jersey	"Club" coach	68	71	6	9	6	6 "	10	0	36-in.	Steel tire	56	2	84,200	1,238
" " "	South America	Officers' car	—	54	0	10	0	4 "	7	10	37-in.	" "	40	4	55,300	
" " "	Camden & Amboy	Old passenger car "Columbian"	48	32	0	8	6	4 "	4	9	33-in.	Ct. ir. sp.			18,000	375
L. S. & M. S	L. S. & M. S. Ry	Postal letter car	—	60	9	9	8	6 "	10	10	42-in.	Steel tire	44	9	85,000	
" " "	" "	Postal paper car	—	60	9	9	8	6 "	10	10	"	" "	44	5	83,000	
Baltimore & Ohio	Baltimore & Ohio Ry	Day coach	67	60	0	9	8	4 "	8	0	36-in.	" "	46	0	70,600	1,053
" " "	" " "	Combinat'n passenger and baggage car	56	60	0	9	8	4 "	8	0	"	" "	46	0		
N. Y. C. & H. R	N. Y. C. & H. R. R. R.	Empire State express coach	84	72	0	10	2½	6 "	10	6	"	" "	55	11	95,400	1,135
" " "	" " "	Combination smoking and baggage car	48	69	2½	10	2½	6 "	10	6	"	" "	54	0	92,000	1,917
Pennsylvania R. R	Pennsylvania Ry	Day coach	66	54	1	9	6	6 "	10	6	"	Chilled			84,900	1,240
Illinois Central	Illinois Central Ry	World's Fair express trains	80	35	0	8	6	4 "	5	0	"	" "	24	3	31,300	391
Old Colony	O. C. R. R.	Day coach	78	60	4	9	8	4 "	8	0	38-in.	Steel tire			65,700	842
Breslauer Actien Gesellschaft für Eisenbahnwagen Bau.	Royal Prussian State Railway	First and second-class passenger cars	26	34	2	8	6½	6 "	24	7	"	" "	Axles, 12	8½	39,340	1,513
Van der Zypen & Charlier	" " " "	First-class coach		33	0	9	10	4 "	6	6	33-in.	" "	23	6		
Western of France	Western Railway of France	Second-class sub, with imperial	68	22	0	9	2	4 "	12	4	40-in.	" "				
London & N. W	London & North Western	"Corridor" sleeper	12					4 "								
" "	" " "	Composite day coach	34					4 "								

Mr. Gibbs' paper was discussed at considerable length at the November meeting, and we present the following abstracts from the discussion:

Mr. Rhodes: In order to start the thing, I have something to say on a portion of the paper, and I would like a little later to have an opportunity to say something further on the subject. What I want to refer to, in the first place, is a matter which the paper does not seem to have referred to very particularly. That is, a comparison of the draft rigging on American as compared with the European-built cars. It seems to me, in looking over this foreign equipment, that one of the most striking differences between the European and our equipment is the draft rigging. I heard a prominent master mechanic, in looking over some of the couplings between the engines and tenders, between tenders and coaches and coaches and freight cars, almost ridicule the connection between the two vehicles. He made this remark: "I wonder how long such a rigging would stand and hold together on our lines"! Now, as a matter of fact, there is a great difference between the two when you look at them at first, but if you look at the rigging and consider only the pulling features of the rigging and compare these hook connections between the engines and tanks and other equipment with our link you find that there is no difference, that our link connection is just as trivial and just as small as any of the connections on this foreign equipment. So there is no difference there. What does make the difference, then? Is it because our equipment is ponderous and heavy compared to theirs? It is simply this, that the foreign equipment does not perform in its draft rigging the double function that we do in this country. We have—I think very unfortunately—a draft rigging that has to perform two functions. It has to pull and it has to buff. You cannot get up anything which would be so destructive to machinery as just that style of connection. Now if you look at these foreign exhibits at the World's Fair, you will find that those two functions are separate and distinct. The part which has to do the pulling does pulling alone and nothing else. The part that has to do the buffing does buffing alone and nothing else. I think at the present time there is perhaps nothing more important than a thorough understanding of that simple fact. The reason of its importance is that we are just entering into this matter of automatic couplings and we are adopting a device which has got to go backward and forward all the time. We are trying to make that kind of thing perfect and I do not believe we shall until we separate those two parts as they have done in foreign countries. There are, I think, some quite interesting points that are worth considering in that connection. If you look at the framing under this foreign equipment you will find the draft sills there, but when it comes to the pulling connections, in place of the draft timbers running out to the end sills, as we have them, they diverge and go out to the buffer, so that at the end of the car there is practically no center sill at all. With us we are obliged to concentrate everything to the center; not only draft sills, but we have to have intermediate sills and we get them as close to the center as we can, so as to concentrate our strength in the middle of the car.

I was very much interested in an argument that came up between a foreign engineer and an American master mechanic. The American master mechanic was wondering and asking how they managed in Europe to run their engines without any headlights, or with a comparatively small headlight, and the foreign engineer said, "Well, our lines are all thoroughly fenced in. No trespassers are allowed to get on the property in any way; cattle are not allowed to come on the property, and there is no necessity for the big, glaring headlight that you use in this country." The American master mechanic thought that he had the foreign engineer by making this remark to him, "Maybe that may do on your main lines, but you surely have to ship cars at night and you have to go into yards after freight cars, and if you do not have any headlights, how can you tell when you get to your freight cars"? But the foreigner said: "Well, we know where they are. We are told what track they are on and we go in there at seven or eigh miles an hour and when we strike them we know that we have got them." That showed in a very clear way that they were not afraid of knocking their draft rigging all to pieces as we are here. That question doesn't come up there. They have buffers which take all the blows and all the strains and the draft rigging is not damaged at all. Now in this country there is nothing more expensive than the maintenance of draft rigging on our freight cars, and is a thing which will surely come, and a curious thing is that the lines in the East are not supporting this matter the way they ought to. The reason is this, that they have had draft rigging with double deadwoods on their cars in the past, and have had no experience without. Since the introduction of the M. C. B. coupler, however, they have curiously enough dropped the double deadwoods. They are now going to get experience without the deadwoods, and I think after a year or two that we will find them very glad to adopt some kind of protection to their draft rigging, the same as they had before.

I do not wish to be understood as advocating the style of buffers used on the foreign equipment. They have difficulties with their buffers, as they are spread too far apart, and I understand there is considerable difficulty on curves, by one buffer getting caught behind the other. I think that our deadwoods, placed near the center would probably be about what we want.

Mr. Herr: I think that the point Mr. Gibbs makes in regard to the excessive decoration and consequent expense of the Pullman cars is a point very well taken. It is certainly possible to make a sleeping car equally as comfortable as the cars in which so much decoration is used, with very much less expense. Much of the decoration in both the Pullman and Wagner trains was of such a character as to be either very easily soiled or very difficult to clean after it was soiled.

Mr. Barnes: On page 33, Figs. 21 and 22, is shown the use of iron and steel plates to strengthen the cars. It seems to me there is a point that could be discussed with a great deal of profit just now, some means of strengthening cars in collisions. If I remember correctly, in three collisions lately nearly 70 people have lost their lives because the master car builders have permitted cars to run which were unsafe. I think somebody is morally responsible for running such villainous equipment as ran on the road at that time. I had friends—engineers—who were present at the wreck, and they told me that the cars went all to pieces and split up. I have talked with car builders and they say they no longer build cars that way, except on specifications of railroads. Even the specifications of the car builders are better than some railroad specifications. One car company has a plan by which it puts horizontal plates on a car and prevents splitting. I would like to get an expression of opinion from the members with regard to the justice of putting people in a passenger car with no provision to prevent the car splitting open.

Mr. Rhodes: In reference to the point Mr. Barnes has brought up, about the strengthening of the timbers with iron plates, I had never looked upon the placing of iron plates on the draft timbers as being a device one would call by the important name of "non-telescoping." A great many lines have plated the sides of their trucks for some time past with iron, and the object in that has been to preserve the strength of the truck frame, and at the same time to make up for the weakness in the truck frame brought about by holes being put through. I do not think that the placing of iron plates on draft timbers has been brought about on account of the liability of the cars telescoping, but because the draft timbers break so frequently on account of the holes through them that it has been found economy to line them with iron to save them breaking in ordinary service.

I do think the strengthening of the fronts and sides of the cars is a very important matter, and some ten years ago it was noticed on one road that I was connected with, that in accidents that happened the sleepers got more damage than the coach equipment, and in remonstrating, at one time, with a subordinate official of the sleeping car company, he made this remark to me: "We don't build cars to run on their sides," and I said to him: "Don't you? You only build them to run on wheels? You had better start at once to build them to run on their sides, too. Cars get on their sides quite often, and it is very important that they be able to stand the service when they get on their sides." It is also, as Mr. Barnes says, very important to have them come together, without going together, like an accordeon. In the paper attention is called to one construction as used on the C., B. & Q., termed the Challender Truss. There is no patent on that device, and I do think it is a matter which is worth considerable attention. In that construction there is a heavy plate running throughout the sides of the car. The great advantage of that is that we get the full benefit of the posts without having them cut through by framing and bracing as is necessary where you do not use that construction. I believe that if some of the master car builders would look at the way they have riddled and cut and put holes through their posts and pillars, they would see that they have practically cut the life out of them. The particular feature of the Challender truss is that all those posts are made solid and intact without any holes bored through them. The plate is screwed to that and it makes a very strong construction.

I would like to call attention to some points in Mr. Gibbs' paper, which I think are worthy of attention, especially at the present time, when it is so evident to every one that the railroads have got to be operated cheaper in the future in order to make ends meet. Mr. Gibbs, I am very glad to say, has criticised the lavishness and expense of some of the equipment in a very free way. It is also interesting to note that an official of a prominent Eastern railroad, who probably never saw this paper at all, has come out boldly in the same way, and said that the expense of some of our equipment is not warranted by the returns the railroads get for it. It is mentioned in this paper, I believe, that some of the equipment, even the smoking car, I believe, is finished in vermilion wood. Now, vermilion wood costs $300 a thousand, which is a pretty expensive finish for an ordinary car. A great many of our sleepers are now finished in that way. There is also much of the coach equipment which is expensively finished; it hasn't yet got to vermilion wood, but it has got to mahogany, which costs $200 a thousand. The Canadian Pacific car is furnished throughout in white mahogany, which costs about $200 a thousand. One thing I was glad to see in looking over the paper, and subsequently looking over the cars, and that is that the cars of one of the foremost roads in the country, the Pennsylvania lines, are finished in oak, and I have since learned that this is the standard finish for the Pennsylvania coaches. Quartered oak costs about $40 a thousand. Now there are many lines not near as well off as the Pennsylvania Railroad which are running into timber costing $200 a thousand. I believe it is because they have not fully weighed up the question. It is not absolutely necessary, if you want to get these colors, that you should use such expensive wood. A beech or a birch, or a maple, which can be bought from $25 to $45 a thousand, can be stained so that one cannot tell the difference between them and mahogany, or if you want to represent white mahogany, you can use some of that style of lumber, and there is not one in fifty who ride in these cars who will know the difference. It seems to me that in future construction, if we have got to operate our railroads cheaper, one way for us to do is to use a cheaper lumber in our equipment.

In looking over the equipment of the Canadian Pacific, I noticed an interesting point about couplers. The M. C. B. form was used under that equipment with the Miller platform and with the buffing arrangements separate and distinct from the drawbar. I think it is interesting to notice on the Canadian Pacific that there is a separation under passenger equipment of the two features of a drawbar, the arrangements for pulling and buffing being entirely separate. Also, that the Canadian equipment had a vestibule, the diaphragms of which are made of canvas. I do not know just what the cost of the canvas is, but it must be very cheap compared with rubber. Some of the master car builders will remember well the enormous prices charged for these vestibules, and especially the rubber diaphragms. We have paid as high as $120 each per curtain, though afterward, when they got to be used more, the price got down to about $90. I would advise those who are putting on vestibules to look into this question and find if they can't use canvas as well as rubber. I think they will find it would cost $1 to every $10 or $20 it does with rubber.

I should call a strictly non-telescoping car one constructed like the Chicago & Alton, with the Blackstone platform, but if we want to give these other devices those names we can, of course, do so.

In looking over the lighting of the cars, I was struck by some things which are hardly in keeping with some of the talk we get from the advocates of improved lights. The roads that use them do not seem to be quite sure of them, and in place of having a single lighting equipment, they have a double lighting equipment. That is not in the line of economy. If you want to have your equipment maintained in the most economical way it ought only to be necessary to have one set of lights. If you have two, it must be that you are not very sure as to how the first is going to answer, so you must have the second to fall back on. If you have to buy two, of course it costs a great deal more than if you have to buy one.

There are some other matters which in our modern cars we have gradually drifted into which are worth attention. One is the matter of curtains as used on cars as against blinds. I had rather got the impression that the curtain was a cheaper thing to use in a coach than a blind, and I dare say it would strike most people that way, if they had not given it some little thought, but some figures made by the general foreman of our Aurora shops surprised me by showing that the curtains in a first-class coach cost about

$120, and that the blinds cost about $82 a car. The curtains probably won't last more than from three to four years, while the blinds last as long as the car. In looking over the equipment at the World's Fair you will find this is an expense that the railroads are gradually drifting into, and I believe without fully weighing up the cost. The same thing applies to seats. It used to be the practice to make iron seats. We have now gotten into the way of making wooden seats. At first sight you would think the wooden seat was, of course, cheaper, but as a matter of fact it is more expensive, especially if you make it of cherry, which costs $100 a thousand, or mahogany, $200 a thousand, and they do not last half as long.

Now, I am aware that as an offset to these criticisms, it will be said, "Well, you have got to make some changes. If you don't people will regard you as old fogy and say you are not keeping up to the times." That is true, but we must remember that if you carry out all details in the same lavish, expensive way, we may get your road into bad shape. I believe managers should give more attention to many of these points than they have in the past. I do not think they have weighed up the fact that everything extravagant to begin with is also extravagant to maintain, and the more expensive your equipment is, the more expensive its maintenance is going to be.

Mr. Barnes: I would like to set myself right in regard to the use of metal plates. I quite agree with Mr. Rhodes that a longitudinal plate is not a non-telescoping device. What I had reference to is a plate such as is shown on page 9, Fig. 24, for instance. There is no excuse for not using a piece of steel that will reduce the effect of a collision at least 100 per cent., when the steel would cost $4 or $5 and the car is worth $3,000 or more. The devices which are efficient, as far as I know, are these plates placed transversely, the double floor laid diagonally and the vestibule end.

President Forsyth: I would like to ask Mr. Barnes, if the body of the car which collides raises above this structure what good would it do?

Mr. Barnes: There are plates on the tops of some of these cars and also an angle iron framing for the end. The angle iron framing to prevent that shearing off the top of the car is better than nothing. At present nothing is provided but a very light timber.

President Forsyth: Mr. Rhodes took the paper, I think, as covering freight cars and passenger cars and criticised our American equipment as not being well provided with buffers. Now, as the question relates to passenger cars, I do not think that the criticism is fair, because a large part of our American equipment at the World's Fair was provided with the most elaborate buffers which extended to the thing which is called a vestibule. Mr. McIlvaine brought that point out, and I think what Mr. Rhodes evidently intended was that the foreign equipment has buffers not only on the passenger cars, but on the freight cars, and that the tendency since we have adopted a complex structure for a coupler for freight cars, that we should now protect it with buffers as the foreigners have done, and I thoroughly indorse that idea. Mr. Gibbs' paper and the discussion here have emphasized, I think, the elaborate decoration and the sacrifice to luxury which are met in a large number of these cars, and I want to call especial attention to the result. It has resulted in an increase in weight in our American passenger cars to a degree which I think we ought to call a burden, and you will find in this table that some single cars at the World's Fair weigh as much as 114,000 pounds, and numbers of them over 100,000 pounds. Now, if the managers of our railroads are satisfied with this, and if they overlook it in allowing the sleeping car companies to compel us to haul these heavy cars, you might say we cannot help ourselves, but in the matter of coaches we certainly can. The master mechanic in charge of the motive power can have something to say about the coaches, in their construction and weight. Now it is a surprising thing, in looking at this table, to find that a number of our American coaches on exhibition at the World's Fair weigh over 80,000 pounds, though the capacity is from 60 to 65 passengers. The first one I call attention to is a day coach, built by the Pullman Company. Seating capacity, 64 people; 60 feet long. Weights 80,800 pounds, and its weight per passenger is 1,262 pounds.

The next one is a day coach built for the Baltimore & Ohio by the Pullman Company. Capacity, 67 passengers. Length, 60 feet. Weight, 70,600 pounds. Weight per passenger, 1,053 pounds.

The next one is a day coach built for the Pennsylvania road by the Pullman Company, weighing 81,900 pounds. Its length is only 54 feet, and its capacity 66 passengers.

The Old Colony has a day coach built by the Pullman Company. Capacity, 78 passengers. Length, 60 feet 4 inches. Weight, 65,700 pounds. Weight per passenger, 842 pounds. That coach holds a large number of people and its weight per passenger is comparatively light.

Then, without special pride, I want to call attention to the C., B. & Q. coach built by Jackson & Sharp, which has a capacity of 60 passengers; length, 53 feet; weight, 53,500 pounds; weight per passenger, 291 pounds. Now I will venture to say that that coach is just as strong as any of the others I have mentioned, and yet it is very much lighter.

One reason why some of these coaches weigh so much is because they have under them six-wheeled trucks, some of them with large wheels, 36-inch cast iron wheels and 30-inch steel-tired wheels. Now I will give the weight of some trucks. A four-wheeled truck with 33-inch wheels weighs 9,100 pounds; with 36-inch wheels, weighs 10,000 pounds. A six-wheeled truck with 33-inch wheels weighs 13,000 and a six-wheeled truck with 36-inch wheels weighs 14,500. Now, in the case of a coach built by the Pullman Company, weighing 30,800 pounds, with two of those six-wheeled trucks under it, the body of the car weighs 51,800 pounds, which is nearly as much as our whole coach. The Pennsylvania coach has two six-wheeled trucks with 36-inch chilled wheels, and the body of the car actually weighs more than our whole coach, truck and all. It must weigh 55,900, the two trucks 20,000, making a total of 81,900. Now, if any of the people are here who represent these heavy coaches, I would like to ask them what their object is in putting six-wheeled trucks under coaches. That, it seems to me, as I said in the beginning, is one of the things which the railroad shop people themselves are inflicting on the locomotive department, and I thoroughly advocate, as strongly as I can, never to build a coach that is so heavy that it will require anything more than a four-wheeled truck.

Secretary Street: There are two points with regard to the discussion on which I want to say something on the other side, not necessarily because I believe that the views that have been advanced are wrong, but because I think that we should be reminded of the fact that there is another side.

One of these is in regard to the excessive decorations in the cars. I myself believe that they have been carried to an extreme, but as a justification thereof, I think you would find that the passenger agents would all advocate these decorations and also the very expensive woods which Mr. Rhodes speaks of. If a passenger agent can state that a small piece of furniture inside of the car is of some solid, expensive wood, he can make a great deal of capital out of it. If he can state that the exterior of his car is mahogany or some other expensive wood, he can make still more capital out of that, and railroads generally seem to recognize the fact that the passenger agents must have something to talk about, and in the terrible struggle for passengers which is going on between the railroads, the passenger agents on some roads have a good deal to say about the finish of the cars, and it is very easy to see how pressure brought to bear from this source might lead to an ill-advised expenditure in decorations.

As to the weight of the coaches, I thoroughly indorse everything that Mr. Forsyth has said, but I think he did not mention the excessive weight of the coaches on the Empire State Express. I think they are the heaviest in the list, and in considering the excessive weight there, we should give a great deal of credit to the persons who designed those coaches, for the fact that they are put together as strongly as it is possible to construct a coach, plates being laid along the sides of the sills and reinforced end posts being used. This would necessarily add greatly to the weight of the cars and increases their strength, and as I think that the Empire State Express was largely in the form of an experiment and ran at speeds which are not usual, that the construction of these cars was commendable. The advisability of making them such an unusual length might be questioned, but if this length was decided upon, they should unquestionably have been made as strong as was possible to construct a coach. With regard to this construction of the end, I had quite a lengthy conversation with a master car builder who had had coaches so constructed, running on his road for some time, and he told me that he had seen coaches come out of a collision with the end platforms completely stripped from the car and the whole end bent in from 18 inches to two feet, showing that without that construction the car would have been literally torn to pieces, while, as it was, not a passenger was severely injured.

Mr. Peck: I had occasion once to see a platform pulled off a sleeping car and all that held it to the car was two ⅞ bolts. The draft timbers were mortised in and not bolted. When they set a brake there was nothing to hold but the strength of the steps and the whole platform pulled off. If that happened on the road, with the brakes set a little tighter behind than in front, and anybody had been on the platform they would have been thrown to the ground. You will notice on the sleeper platforms there is not a bolt, although they have great heavy safety chains to couple by. That was the first time I ever knew there was such poor fastening in the platform of a heavy car.

Mr. Herr: One word in regard to so-called non-telescoping devices. I think while there is no excuse for not taking every measure that can be adopted to strengthen our cars as much as possible, we make it as difficult to break up a car as it possibly can be made, and we should not forget that strong as we make our equipment, there must be something give way when we have a collision. The amount of energy that has to be absorbed there is too great for the spring or buffing gear to take, however strong the balance of the car may be made. I think the true solution of the non-telescoping car is to adopt some form of signals on the road that will make collisions as few and far between as possible. The space interval seems to be the only reliable expedient.

Mr. Whyte: Speaking of non-telescoping devices, it might be as well to describe the one adopted by the president of one of the large car building companies for use on his private car.

The sills of themselves make a solid floor; they are laid close to each other and tongued together with narrow strips. On top of these are two thicknesses of flooring each ¾ inch thick and laid diagonally. The sides, except at the windows, are also solid and are somewhat thicker than usual; the usual spaces between framing are filled by vertical pieces similar to the posts. There are three thicknesses of sheathing inside the middle one extending vertically and the other two lengthwise of the car. There are two thicknesses outside, the outer one placed vertically. This arrangement probably protects this car, but it is hard to say what would happen in case of a collision to ordinary cars in the same train, were this one at the rear. It would then probably become a telescoping device.

Mr. Rhodes: Can you give the weight of that car?

Mr. White: About 109,000. There are two such cars now running.

Mr. Barr: The trouble in getting up devices for insuring safety in collision is that when we get into a collision the things never behave the way that we figure on. We can build a car with a bottom of solid steel; it will make a nice, heavy battering ram when it happens to get above the platform of the car ahead of it and the car ahead stops suddenly, it will go right through. You can build the sides of solid steel; if the two cars happen to get a few inches out of line they are going into each other, and the heavier you make them in cases of that kind the further they will go. Now, any one that has observed the telescoping of cars, has found that it is not the floor and the sills, and very often it is not the sides, that give way. It is the ends; and those cars, instead of keeping in line with each other, as we figure on, and build them to do, get a little to one side and in they go and clear out the whole inside of the car. Any one that has had a few years' experience on a railroad knows that. I have seen cars telescoped with the platform almost intact. How the other car got up there I don't know, but it got there, and I am inclined to think that the excessive weight of cars is a greater threat of danger to us to-day, in the matter of collisions, than almost anything else. Now, instead of looking at a train, the track, the engine and all the cars, as a machine, and designing the different parts of the proper strength, what do we do? One party makes the track, another makes the locomotive, another makes the coaches in the front of the train, another makes the sleeping cars in the rear of the train, and, taking the whole thing, I do not believe we could get up a better machine for killing people in case of collision that what we have now. It is really a fact, and until we take the whole thing into consideration and work it out as a whole, I do not believe that we will make any improvement. We may patch plates of steel on here and there and brace it up and so on, but we will never get a reasonable freedom from telescoping and difficulty of that kind in collision, until we take the thing as a whole and work it up in that way.

Master Mechanics' Association Circulars.

The following committee circulars have been issued by the Secretary of the American Railway Master Mechanics' Association:

Oiling Devices for Locomotives.

The undersigned, a committee instructed to investigate the subject of "Oiling Devices for Long Locomotive Runs," ask if you, in making long runs without stop, find any necessity for special oiling conveniences (other than the old type of separate oil-cups, each to be filled by hand when engine is standing), that you kindly give us the benefit of your experience and experiments, and, if possible, supplement the letter by drawings? Also say if any special kind of oil, either in hot or cold weather, is necessary to insure the certain working of the peculiar cup, pumps, pipes, or other device used.

J. DAVIS BARNETT, JOHN D. CAMPBELL, GEO. W. STEVENS, GEO. W. WEST, C. E. SMART, GEORGE H. BAKER Committee.

Send replies to J. Davis Barnett, G. T. R., Stratford, Ontario, Can.

Tire Treatment.

Your Committee on Tire Treatment desires information as to your practice and experience on the following points:

Q. 1. What shrinkage do you use per foot in diameter of each size wheel center above 56 inches?

Q. 2. In wheel centers above 62 inches diameter, do you think it necessary to increase the shrinkage per foot?

Q. 3. If so, how much, in your opinion, should be the shrinkage for each of the following standard sizes of wheel centers, viz.: 66 inches, 70 inches, 74 inches, 78 inches, 82 inches, 86 inches and 90 inches?

Q. 4. The shrinkage used by railroads previous to the use of the driver brakes was about 1-80 of an inch per foot in diameter of wheel center. Do you consider an increased shrinkage necessary on account of the application of the driver brake? If yes, please state reasons and amount.

Q. 5. For tires of the large diameters mentioned (66 inch and above), do you consider retaining rings necessary for increased safety?

Q. 6. If retaining rings are used, how much thinner can you wear your tires with safety before condemning?

Q. 7. If retaining rings are used, what difference in shrinkage of tires per foot in diameter of center, if any, would you recommend from the usual shrinkage without retaining rings?

Q. 8. If you are using retaining rings for securing the tires on your driving wheel centers, please advise diameter of all wheel centers such retaining rings are applied to—the name of such retaining rings, and furnish blueprints or sketches showing method of fastening, giving all measurements and location of bolts or rivets.

Q. 9. What is the minimum thickness of tires you consider safe to run without retaining rings in—

a. Passenger service?
b. Freight service?
c. Switching service?

Q. 10. What is the minimum thickness of tires you consider safe to run with retaining rings in—

a. Passenger service?
b. Freight service?
c. Switching service?

Note—In above questions speed of passenger trains to be considered from 40 to 112 miles per hour, and of freight trains from 20 to 50 miles per hour.

Q. 11. In establishing the minimum limit of thickness to which tires can be safely worn, do you take into consideration the weight on drivers? If yes, please state your practice and your reasons therefor.

Q. 12. In establishing the minimum limit of thickness to which tires can be safely worn, do you make any distinction between engines equipped with driver brakes and those that are not? If yes, please state your practice and reasons therefor.

Q. 13. What is the greatest permissible depth of wear on tread of driving wheels you consider—

a. Safe for the engine?
b. Safe for the track?

Q. 14. What is your condemning limit for wear of tread of tires?

Q. 15. What is the greatest permissible depth of flange of tires you consider safe to run?

Q. 16. How do you measure depth of wear of tread? Please furnish sketch.

Q. 17. How do you measure depth of flange on tires with worn tread? Please furnish sketch.

Q. 18. To avoid omission of names on replies, please give your name and railroad on which employed.

The committee would be pleased to receive any information you may have as to cost of applying retaining rings on various sizes of wheels.

In order that the committee may have ample time to compile and work up its report, kindly have all replies forwarded not later than Feb. 15, to A. E. Mitchell, Superintendent Motive Power, N. Y., L. E. & W. R. R., 21 Cortlandt Street, New York City.

A. E. MITCHELL, G. W. WEST, THOS. MILLEN, J. H. MCCONNELL, A. J. CROMWELL, JOHN Y. SMITH, Committee.

He—"Do you think I could get a pass on your father's road?" She—"No; they don't pass anything but dividends on his road. I've heard him say so."

Commodore Vanderbilt was a friend of the late Dr. Deems, and one was about as clerical looking as the other. The two were riding in a Fourth avenue car in New York one day, when two drunken men got in. One of the newcomers swore and his companion reproved him for such conduct in the presence of a parson. The offender thereupon, turning not to Dr. Deems, but to the old Commodore, said: "You think I'm going to hell, don't you?" "No," said the Commodore, "I hope not," and drunkard No. 2 said with conviction in reply to a glance from his friend, "He must be a Universalist."

The following paragraph giving the cost of different classes of freight and passenger cars has been published, and is approximately correct:

Flat car, $380; coal car, flat bottom, 50,000 pounds capacity, $475; coal car, drop bottom, 60,000 pounds capacity, $493; coal car, double hopper bottom, $525; coke car, double hopper bottom, $540; ore car hopper bottom, 53,760 pounds capacity, $450; box car, $600; stock car, $550; fruit car, ventilated, $700; refrigerator car, $800; caboose, four-wheel, $550; eight-wheel, $700; mail and baggage car, 50 feet long, $3,500; passenger car, second class, $4,800; passenger car, first class, $5,500; passenger car, New York Central Railroad, 80 feet long, $8,720; sleeping car, Pullman or Wagner, $15,000.

The "Practical Engineer," of London, publishes some information in regard to the manufacture of briquettes, a combination of coal dust and other refuse with pitch, which, if they are not a substitute for coal, are a very useful auxiliary when they can be obtained at a cheap rate in times of scarcity. It appears that during the colder portion of the year 11,000 tons per week are made in England and Scotland alone, and of this quantity over 2,500 tons are produced in London. In South Wales the average weekly export to foreign countries—especially to France and Italy—exceeds 10,000 tons. The manufacture in Great Britain is largely on the increase, although it has been checked by the recent disturbance in the coal trade.

The Harvey Steel Car Company, of Harvey, Ill., has the contract for remodeling the Illinois Central Railroad special World's Fair cars, which were illustrated and described in page 154, National Car and Locomotive Builder, October, 1892. They are to be standard fruit cars, and the changes will consist in the removing of seats, windows and the whole of both sides. Ordinary side sheathing will be put on, and the cars will be fitted with standard doors, intermediate posts and bracing, six ventilators on each side and five on the ends. Ceilings and roof ventilators are also to be put in. There will be the Schoen standard slide doors with covered ventilators on the outside, and Chicago grain doors will also be used, with Cobourne trolley door fixtures.

Repairing Locomotives—VII.

BY J. T. HEFFERNAN.

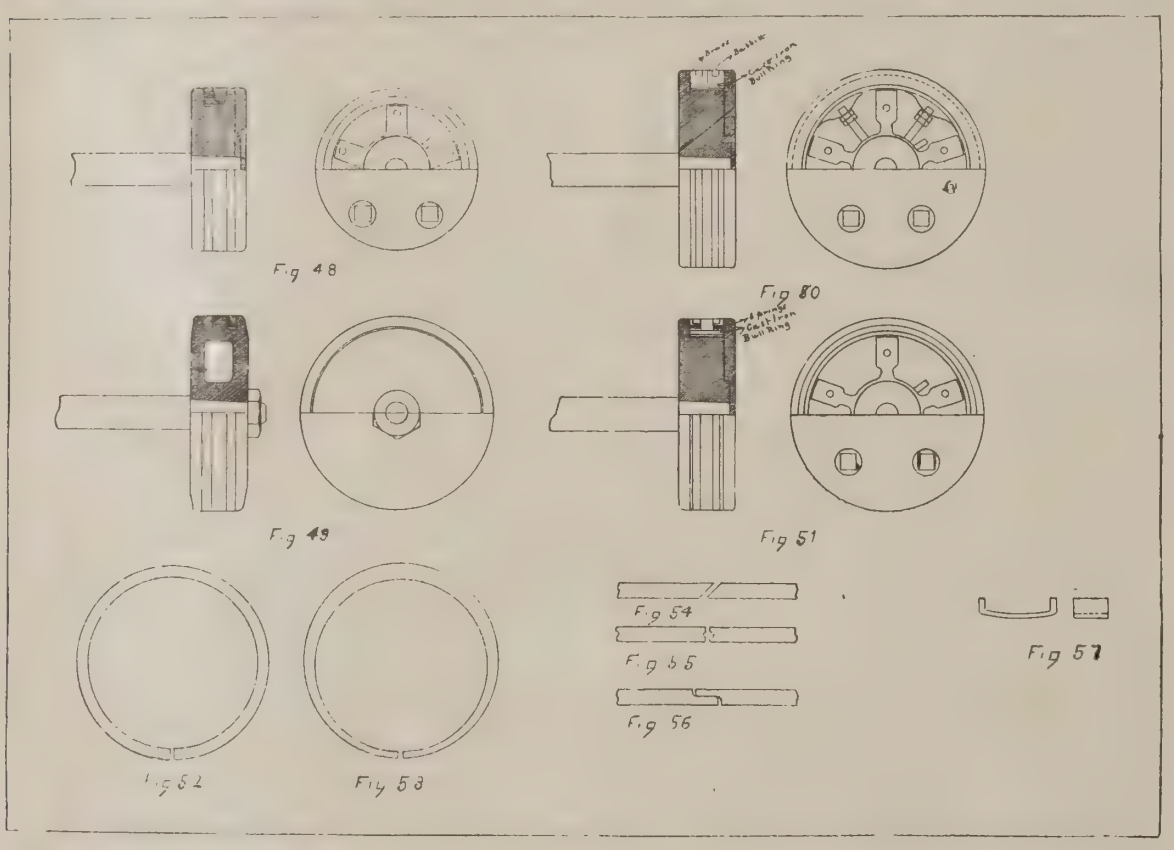
(Continued from page 113, National Car and Locomotive Builder for July, 1893.)

In this paper we will take up pistons. Fig. 48 represents one style of piston which is very popular on a great many roads. In this piston two snap rings are used working in a space formed by a bull ring. The snap rings are used the same as in a solid piston, but are put in place without springing over the piston; the follower being bolted on allows it to be taken off and the bull ring removed. Fig. 50 also represents another style of piston which is not in as common use as it was some years back.

This piston is composed of a piston head, follower, two brass rings, one bull ring. The bull ring in this style of piston is re-enforced in its spring by additional springs set inside of it and acting onto it. The brass rings are grooved in the center to receive a strip of babbitt; the object of the babbitt in connection with the brass is to retain any small cuttings which bed themselves in it, and not cut the cylinder.

This packing has gradually gone out of use of late years, however, and has given place to the style of piston and packing shown in Fig. 49. This is what is called the solid piston, and is here shown with two rings, but sometimes three and four rings are used. This piston has a great many things to commend it. It is simple, cheap to make, and has the fewest possible parts. The piston can be made very light, and there is nothing to get out of order on it, and rings can be renewed very easily.

Fig. 51 shows a style of piston with what is called the Dunbar packing. This packing is composed of two rings, one fitting onto the other, and after being fitted together are generally cut into six parts; the claim being made that packing so cut will better adapt itself to the walls of the cylinder.



This packing being cut, of course has no spring in itself, so the spring is furnished by three or four wire springs acting on each ring. This piston is formed in close connection with the bull ring very much like the piston shown in Fig. 48. The bull ring is held tight in those built-up pistons by the follower when screwed up tight to the head. As the most common packing is the snap rings, we show a cut of those also in Figs. 52 and 53. Fig. 52 shows the ring turned true. Fig. 53 shows the ring turned eccentric. As to the method of cutting rings, Fig. 54 represents one side, Fig. 55 represents another, and 56 another.

The style shown in Fig. 56 is really the best way to cut a ring, as when the ring is cut this way there need be no dowel pins, leaving the ring free to revolve in the cylinder, tending to wear it true and smooth. I believe a piston ring should be designed so as to permit it to revolve. The style shown in Fig. 55, which has a dowel pin set in the cut, does not revolve, and with the style of cut, as shown in Fig. 54, is used, when the ring works around to the top of the cylinder it will permit the steam to blow through.

But if there are three of these rings used in the piston it will be safe to say the cut of one of the rings will so form a joint as to prevent the steam from blowing through.

Sometimes pistons are fitted up with one ring, as shown in Fig. 55, having a dowel pin in it, and that dowel pin fastened to the bottom of the piston, which will prevent it from working around and therefore making a joint with the piston on the bottom. And other pistons have two rings, as shown in Fig. 54, without any dowel pins, thus permitting them to revolve.

In Fig. 48 the piston is turned a little smaller than the bull ring on the inside, and the fit of the piston in the cylinder is also a little looser than the fit of the bull ring. After running some time the piston has a tendency to wear downward. The piston rod should always work central in the cylinder so as to line with the stuffing box and the guides.

To keep the piston rod central in the cylinder when the piston wears downward, shims or liners, as shown in Fig. 51, are inserted between the bull ring and the lugs on the piston. The piston being always arranged, where it is a five-lug piston, with one lug standing to the top of the cylinder, then the two bottom lugs will stand so as to receive bolts, as shown by the end view on the piston, Fig. 48. In setting this piston true with the cylinder some differ as to whether it should be set from the bore of the cylinder or from the counter-bore. I believe the counter-bore is the right place to set it from, and in setting it bring the piston to the forward end of the cylinder and then caliper from the flange on piston, as shown by A, Fig. 48. That is, take a pair of inside calipers and caliper from this boss to the walls of the counter-bore. On very large pistons there may be more than five lugs used, and if so, be very careful in arranging the lugs so as to bring one lug on the bottom and two lugs on either side, but never shim the piston so tightly but what it has a little play up and down and sideways. After the piston is shimmed up, move it to the back end of the cylinder and see that the gland enters the stuffing box freely. Suppose that when the piston was forward in the cylinder we lined it up central, then on moving it to the back end of the cylinder we found that it bound hard against the top of the cylinder, we would bring the piston forward again and take out a thin liner from between the piston and bull ring, then move it back again, and try the gland in and adjust it until the gland went in freely. Of course, in a case like this the cylinder must be out of line with the hole in the back cylinder head, which is the result of an error either in boring out the cylinder or the hole in the back head. On new work it is very easy to bring everything into line, but very often on old work, especially in lining up a piston that has been run for some time, a case like this will occur, but always take the safe side—that is, make sure the gland will enter the stuffing box freely at any part of the stroke, and then there will be no danger from a piston rod cutting or burning out the packing. With a solid piston, however, all this shimming up is done away with. When a cylinder has been bored out and a piston like that shown in Fig. 49 is used, it should be turned about a 1-32 smaller than the cylinder, getting as full a bearing as possible for the rings. When an engine comes in and reports piston packing blowing, a piston like that shown in Fig. 48 can be got at very easily by taking out the five follower bolts, removing the follower and bull ring without disturbing the piston rod from the cross head, but a piston as shown in Fig. 49 must be removed from the crosshead before anything can be done to the rings. The snap rings, as shown in the pistons in Figs. 48 and 49, which are the same as are shown in Fig. 52, may, when they become loose in the cylinder, be opened on the inside, thus giving them more spring. The light snap rings should have ¼-inch spring per foot of diameter—that is, an 18-inch ring should have ⅜ of an inch spring.

In opening a ring first put it in the cylinder, press it out tight against the walls of the cylinder, then measure the distance the cut is open, then remove it and open it so it will spring out from this distance about 1¼ inches; of course judgment on the size and thickness of the ring will govern the amount of spring to be given, but for an 18-inch ring with a cross section half-inch square, a spring about 1¼ inches on the circumference will be found to work very nicely. Rings, as shown in Fig. 53, and turned eccentric, have the claim made for them that they hold the spring better, and they do, but I doubt if any more wear can be got out of them than out of the plain ring. The labor of making them is about the same where they are made in a lathe using a single tool, but of course on a machine that will bore and turn at the same time the plain ring is much cheaper.

In making these rings, to bring them all to the same width they are put on a mandrel, and a tool used cutting down both sides of the ring at the same time. When they are made by just turning up the blank to the right thickness, and then each ring cut off separate it does not make a very good job, because if a tool is used which is ground square on the end it is bound to leave a small break in the iron around on the inside of the ring.

A very good and quick way is to turn the blank to size, then bore out to about 1-16 of an inch of the finish size, then using a cutting off tool rough cut in as many rings as the blank will make, but only cutting down to the thickness of the finished ring; then take a tool whose cutting edges resemble the letter U and made to the required width of the finished ring, and take a cut down each ring. Now the rings are all the right thickness and are true, and all that remains is to cut them off. Put in a boring tool and take a cut out of the inside of the blank, bringing it to the finish size, when, as the tool feeds along, each ring will drop off finished onto the tool.

Where the eccentric rings are to be used the outside should be turned first to the finish size and then the blank shifted on the face plate the amount required and bored out on the inside. The rings can then be cut off in the same manner as the plain rings. Always face off the lugs on a packing ring before turning it. On some roads they require the rings to be turned to a fit with the cylinder after being cut. This can be done very easily by making a chuck off the end of the blank that the rings are cut off of—that is, turn a small recess in it, about 1-32 deep and 1-32 larger than the cylinder, spring the ring into it, and hold it by clamps while turning off the outside, making at once a very simple and true way of doing it. Where a ring like that shown in Fig. 56 is used a small hole is drilled through the connecting ends and held together by a pin, but this way weakens the ends very much, and is not so quick as the method already explained. The packing shown in Fig. 51, or as is more commonly called the Dunbar packing, is made by the small ring first being turned on the blank, then cut off, the larger ring is then turned to a fit with the small ring, and the small ring driven on, and both rings finished together before cutting off. In fastening the piston onto the rod, the common way is to turn the rod up taper and grind it to a fit on the piston head, then forcing the rod into place in the head, bringing it firmly against the shoulder of the rod, and to be held there by a key driven through the head.

The piston rod, as shown in Fig. 49, is secured to the piston by means of a nut instead of a key. These pistons, instead of being driven on, are very often heated and shrunk on, but whenever a solid piston—that is, a piston as shown in Fig. 49, with a chamber in it, is to be shrunk on, never do it if it is an old piston without first drilling a hole into the chamber. This may appear odd, but if we will just look back, we have seen or read of pistons that burst while being heated, which is caused by a gas forming in this chamber from the oil used in the cylinder. It is a small precaution and should always be taken. Follower bolts, where they are screwed into the cast iron, very often corrode, and are twisted off in trying to remove them. To prevent this corrosion the holes are drilled large, tapped out, and brass bushings screwed in, which are in turn tapped and drilled to receive the follower bolts.

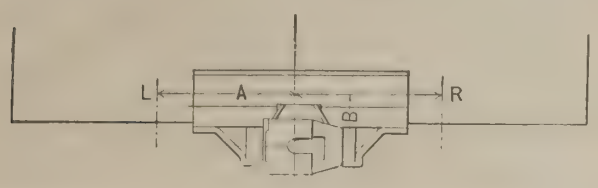
An iron valve weighing 6,500 pounds has been made at Troy, N. Y., for a Havana sugar mill. This is claimed to be the largest valve ever constructed.

Dr. T. L. Phipson, who has devoted a considerable amount of attention to problems concerning the constitution of the atmosphere, is led to the conclusion that the original atmosphere of the globe consisted of nitrogen alone, and that the oxygen now present is the product of vegetable life. In a paper in the "Chemical News" he states that the minute microscopic plants (Protococcus pluvialis and P. palustris) can be easily transformed into manufacturers of oxygen gas. As the result of experiments he concludes that plants absorb carbonic acid by the roots and secrete oxygen by the leaves, from which it is subsequently given off. Into the primitive atmosphere of nitrogen, the early vegetation would thus pour oxygen during countless years until its composition became practically what it now is.

Master Car Builders' Association Notices.

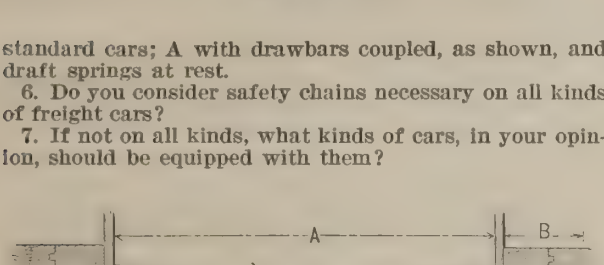
The Committee on Safety Chains has addressed the following circular to members of the Association:

1. Do you use safety chains on any of your freight cars?
2. If so, what kinds of freight cars have you equipped with them, and how many of each kind?
3. Referring to sketch, please give dimensions A and B, and state on which side hook is placed, viz.: whether at R or L.
4. Can you give detailed print of chain, also print showing the application to car?
5. Referring to sketch: Give distance A and B of your



standard cars; A with drawbars coupled, as shown, and draft springs at rest.

6. Do you consider safety chains necessary on all kinds of freight cars?
7. If not on all kinds, what kinds of cars, in your opinion, should be equipped with them?



Dimensions taken when Draft Springs are at rest.

8. State your reasons why you do or do not consider safety chains necessary.
9. How many freight cars have you in service?

The committee will be glad to receive any suggestions or information based upon your experience with safety chains.

Members are requested to reply before February 1, 1894, and address same to H. Coulter, General Car Inspector, P., W. & B. R. R., Broad Street Station, Philadelphia, Pa.

H. Coulter, W. H. Day, J. E. Simons, E. E. Carver, J. J. Casey, Committee.

Railway Statistics.

This topic is discussed at considerable length in the seventh annual report of the Interstate Commerce Commision, a synopsis of which has just been sent out by the Secretary of the Commission, Mr. Edward A. Moseley. The total railway mileage on June 30, 1892, was 171,563.52 miles, an increase of 3,160.78 miles; the total number of railway corporations was 1,822, being a net increase of 37 during the year; 899 maintained independent operating accounts and 712 were independent operating companies. Of the 761 subsidiary roads, 320 were leased for a fixed money rental and 186 for a contingent money rental; 9 roads were abandoned. There were 19 mergers, 17 reorganizations and 16 consolidations. The capitalization of roads reporting was $10,226,748,134. There were 560,958,211 passengers and 706,555,471 tons of freight reported as carried during the year ending June 30, 1892. The gross earnings reported were $1,171,407,343, and the operating expenses were $780,997,996, leaving net earnings of $390,409,347, to which add $141,960,782 an income to railways from investments. After payment of $416,404,938 as fixed charges, $97,614,745 was paid in dividends and $4,314,390 in other payments, leaving a surplus of $14,036,056. The passenger revenue for the year was $286,805,708; and freight revenue amounted to $799,316,042. There were 821,415 persons employed in railway service at the end of that year, of whom 2,554 were killed in accidents and 28,267 were injured. Three hundred and seventy-six passengers were killed and 3,227 were injured. These accident statistics are carried out with considerable detail. Earnest recommendation is made for an amendment providing a penalty for the failure of carriers to file their annual reports within a specified time. The form adopted for these reports is noted as being satisfactory to the carriers, and as having been put in use by 22 State commissions. A preliminary statistical report for 1893 will form a part of the appendix to this report.

It appears that the tunnel of the Baltimore Belt Line, under the streets of that city, which is to provide a connection between the Philadelphia Division and the main lines of the Baltimore & Ohio, will not be opened before next summer. It was announced in the newspapers recently that the tunnel proper was completed, but the construction of the approach at the north end has been much delayed by difficulties in securing the right of way.

Electric Lighting on the Paris, Lyons & Mediterranean Railway.

The electric light is becoming popular in Europe for train-lighting as much for its safety as for the better illumination afforded. The French railway companies have been experimenting with it for several years, and the Paris-Lyons-Mediterranean Company is now fitting up 50 first class carriages, each having four compartments. Accumulators fixed in each carriage and charged from a fixed station have been decided on after experiments extending over three years. These are of the Tommasi "multitubular" type; the electrodes are protected by a covering of perforated celluloid. The plates in each cell weigh 26½ lbs., and 12 cells, connected in series, are placed in each carriage. The cells are divided into four sets, each set being placed in a water-tight box with three compartments, which is itself inclosed in a wood-lined sheet iron box; these water-tight boxes are made interchangeable. The sheet iron receptacles are fixed two on each side of the carriage against the external side of the frame; they are provided with a hinged door, which lets down to admit the water-tight box, the cells in which are connected to contacts which press against springs inside the fixed box, thus automatically putting the battery in circuit. The wires connecting the four batteries in series are carried in iron pipes fixed to the frame of the carriage.

The lamps are of 10-candle power and take about 38 watts at 20 volts; two are placed in each compartment, but only one is used, the other being automatically switched in by means of an electromagnet if the first fails. They are fixed in such a manner as to be easily removed if it be desired to return to gas. A switch controlling all the lamps is placed in the same position that the main tap occupies when gas is used. The pressure of the battery when fully charged being more than is required by the lamps, a resistance is included in the circuit, and is cut out when the battery is half discharged. An hour-meter fixed in the place of the pressure gage in a gas lighted carriage shows the number of hours the battery has been at work, and hence its state as regards charge. The wires for the lamps are carried in an iron pipe on the roof.

The total weight of the battery and water-tight boxes is 501½ pounds, while that of the whole of the remaining plant, including the fixed receptacles, conductors, switch, resistance, hour-meter and lanterns, is 1,095½ pounds. The battery has a capacity of 5,600 watt-hours, and is sufficient to keep the lamps alight for about 36 hours for each charge.

Quebracho Wood.

Quebracho wood is of a blood-red color, very bright when freshly cut. It is found in great abundance in large forests in north Argentina. The wood so far has only been appreciated in Europe by tanners, as it contains a large proportion (said to vary from 15 to 20 per cent.) of its weight in tannin, to the presence of which has been ascribed its extraordinary durability. It is stated that when, for the purpose of extending railways in the province of Santa Fe, posts which had surrounded grazing inclosures were taken up, the wood, though having been for 150 years, and sometimes longer, in ground alternately parched by great heat or sodden by tropical rains, appeared to be in as good condition as though recently cut. The wood is specially suitable for railway ties, on account of its stability, durability and weight, and by its freedom from attack by insects. It weighs about 78 pounds per cubic foot, does not decay, and is not compressible, so that holes must be bored clear through the wood, and equal to the diameter of the bolts.

A Large Locomotive of New Design.

The "Railway Engineer" reports that Messrs. Dubs & Co. have in hand a monster locomotive, designed by Mr. Michael Reynolds, Standeford, near Wolverhampton, which is a complete departure from modern practice, and specially designed for fast express traffic. The engine is to be capable of developing 2,000 horse power, and on the level attaining a speed of 100 miles per hour. The driving wheels are to be 12 feet in diameter, the cylinder 40 inches, 28 inches, and 13 inches by 30-inch stroke; the boiler pressure 200 pounds per square inch. In front and rear of the large driving wheel there is to be a six-wheel bogie with 5-foot wheels. The boiler is to be on one side of the driving axle, and the engines on the other side, with a three-throw crank axle. There is to be no tender, the water being carried in a tank underneath the floor of the engine-room, and the coal in the rear of the firebox. The whole of the bearings are arranged inside the engine-room, and accessible when the engine is running at speed. The driver's footplate is to be in front, and will form a compartment by itself, containing regulator handle, brake and reversing levers, speed gage, etc. The distance from London to Edinburgh is 500 miles, and the time taken about 8¾ to 9 hours, which Mr. Reynolds' engine, it is said, will reduce to 6 hours, running through without a stop.

Serve Tubes.

Some details have been published of experiments made with serve tubes by the Paris, Lyons & Mediterranean Railroad. These tubes are smooth on the outer or water side, but formed with interior longitudinal webs projecting toward the center. Former tests have shown that if used to replace thin tubes of the same diameter, the volume of gas passing through would be reduced in consequence of the reduced sectional area, and the consumption of coal would be less. The locomotive would become more efficient but less powerful.

The later tests made were intended to study the best conditions of use for the webbed tubes. They took place in Paris with a special boiler which had previously served for testing plain tubes, and which consisted of a furnace and set of tubes similar to those of a passenger locomotive, but so arranged that the length of the tubes could be adjusted at about 6 feet 6 inches, 8 feet 6 inches, 10 feet, 11 feet 6 inches, 13 feet, 14 feet 6 inches, 16 feet 3 inches, 19 feet 6 inches and 23 feet.

With plain tubes the result had shown that using equal draft the quantity of water vaporized per pound of coal decreased slowly with the shortening from 23 feet to 19 feet 6 inches, and even to 16 feet 3 inches, but more quickly between 16 feet 3 inches and 14 feet 6 inches, and rapidly at 13 feet and under. The total quantity evaporated, however, increased with a shortening of the tubes from 23 feet, reaching a maximum between 14 feet 6 inches and 13 feet, and then diminishing with any further decrease in length. For plain tubes a length of between 13 feet and 14 feet 6 inches was considered the best, as giving good efficiency with maximum of power.

The webbed tubes tested were of 2 inches and 2½ inches in diameter, having eight webs projecting toward the centers. The lengths varied with the 2-inch tubes from 11 feet 6 inches to 6 feet 6 inches, and with the 2½-inch tubes from 13 feet to 8 feet.

The results of the tests show that the length giving the greatest total evaporization was between 8 feet and 6 feet 6 inches for 2-inch tubes, and exactly 10 feet for 2½-inch tubes. Longer tubes gave a greater efficiency, but the quantity of coal burned and total water evaporated were less. The length corresponding to maximum production was equal for all drafts.

The ultimate choice rested on 2½-inch tubes, the length selected being 10 feet, and, in order to obtain increased power, the diameter of the boiler was raised from 49 5-8 to 52 inches, allowing the number of tubes to be increased from 113 to 133.

The final result, as compared with plain tubes, showed an increase of 20 per cent. in power, and a decrease of 10 per cent. to 15 per cent. in the weight of the locomotive. The decreased weight was partially due to the construction of the furnace in steel. The steam pressure used is 220 pounds per square inch.

An Age of Copper.

M. Berthelot, the French technicist, in a recent communication to the Academie de Sciences, states his belief in the sometime existence of an age of copper in addition to the three recognized archaeological ages of stone, bronze (copper and tin) and iron. He bases his opinion chiefly upon an analysis of a piece of copper which had been found by M. de Sarzec, in the course of antiquarian investigation in Mesopotamia or Al Jezira, as the Arabs designate the famous stretch of country between the Euphrates and the Tigris. The fragment thus chemically determined proves to have neither tin nor zinc entering into its composition, there being simply traces of lead and arsenic. Water and the atmosphere had made ravages into the specimen which was practically a suboxide, or a compound of protoxide and metallic copper. As the ruins from which the piece of metal was taken are authoritatively considered to be more ancient than even those of Babylon, M. Berthelot does not hesitate to promulgate the theory that an age of copper preceded the bronze and iron periods, especially as the examination of the component parts of a portion of a metallic sceptre which, it is alleged, belonged to a Pharaoh who reigned in Egypt some 3,500 years before Christ showed no signs of the presence of tin.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Wilfred Lewis exhibited a section of a seven-inch steel stay-bolt from a hydraulic riveter, which had broken in the nut about 2½ inches from the end of the bolt. The static load on the bolt was 450,000 pounds, and at the time the actual load probably did not exceed 600 pounds. It has been found by experiment that when a nut is made to come at the end of a bolt, to obtain uniform stress throughout the bolt, it is not sufficient to make its thickness equal to half the diameter of the bolt, as is generally supposed. The thickness of the nut should be at least equal to the diameter of the bolt.

Fort Worth, Tex., will soon be in possession of a fine three-story stone passenger station, which is being erected by the Chicago, Rock Island & Pacific road.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

TYNDALL.

The death of Prof. John Tyndall, at his home in Halsnere, England, Dec. 4, at the age of 73, leaves a void n the scientific world that will long be felt with sorrow y all students and admirers of the beauties of natural hilosophy. For many years he was Professor of Natral Philosophy in the Royal Institution, and his inestigations and lectures there, and the many scientific ooks he wrote accomplished a great work in dissemiating useful information among the masses. He was orn at Leighlin Bridge, Ireland, Aug. 21, 1820. His arents were English, and poor, and he was given an rdinary school education. After leaving school he was rst employed on the Irish Ordnance Survey, being ater transferred to the English Survey, and finally acepting a position in the engineering department of an English railroad. He left this position to become instructor of physics in Queenswood College, Hampshire. His ability became so evident that he was selected to ucceed Thomas Young as Professor of Natural Philsophy at the Royal Institution, and finally succeeded araday as Superintendent of the Institution.

His most popular book was "Heat Considered as a lode of Motion." The beauty and grandeur, yet simlicity of his language, imparted an exquisite charm to is writings that gave them world-wide popularity. As n instance we quote as follows from his remarks on the mits of science as indicating man's power of thought:

In discussing the material combinations which result in he formation of the body and the brain of man, it is mpossible to avoid taking side glances at the phenomena f consciousness and thought. Science has asked daring uestions, and will, no doubt, continue to ask such. Probems will assuredly present themselves to men of a uture age, which, if enunciated now, would appear to ost people the direct offspring of insanity. Still, though he progress and development of science may seem to be nlimited, there is a region beyond her reach, a line with hich she does not even tend to osculate. Given the asses and distances of the planets, we can infer perturbaions consequent on their mutual attractions. Given the ature of a disturbance in water, air, or ether, we can nfer from the properties of the medium how its particles ill be affected. In all this we deal with physical laws, nd the mind runs freely along the line which connects the henomena from beginning to end. But when we endeavor o pass, by a similar process, from the region of physics to hat of thought, we meet a problem not only beyond our resent powers, but transcending any conceivable expanion of the powers we now possess. We may think over he subject again and again, but it eludes our intellectual resentation. The origin of the material universe is equally nscrutible. Thus, having exhausted science, and reached ts very rim, the real mystery of existence still looms around s, and thus it will ever loom—ever beyond the bourn of man's intellect—giving the poets of successive ages just ccasion to declare that

"We are such stuff
As dreams are made of, and our little life
Is rounded by a sleep."

A GOOD RULE.

The American Society of Mechanical Engineers has adopted a rule limiting the time for the presentation of papers at its meetings to five minutes, the intention being that the papers shall not be read in full at such meetings, but presented in abstract so that as much time as possible may be had for their discussion. The members are provided with printed copies of all papers to be presented, in advance of the meetings, and are expected to read the papers beforehand and prepare themselves to discuss the topics that interest them; and the members are expected to reduce their discussions to writing in advance for the sake of condensation and clearness, and to avoid stenographers' errors. This is a departure that promises very satisfactory results, and it seems that the rule would work equally well in other societies, such as the Master Mechanics' and Master Car Builders' associations. This might not be good for oratory, but it would certainly effect a reform in the discussion of subjects that would make them more valuable in many ways. It is likely that more points would be brought out in this way about any subject, the language would be better, and there would be less repetition and more accuracy—qualities that will enhance the value of any discussion and the interest of its report. It very frequently happens that those who rise in meeting to discuss a paper or a report forget the exact statements of the paper or the report, or forget one or more of the points they wish to speak on. In either case the value of the discussion suffers materially, and the chances of disseminating misconceptions are multiplied.

A PREDICTION FULFILLED.

In commenting in our last issue on the strike of the federated employees on the Lehigh Valley Railroad, we said, "It is probable that before our next issue the Lehigh Valley strike will be history," and it is. The strike was declared off Dec. 6, through the mediation of the State Boards of Arbitration of New York and New Jersey. These Boards rendered a valuable service to the strikers, the railroad and the community; not so much by changing the attitude of the railroad company, for this was not done, but because they succeeded in getting the strikers to correctly understand that attitude, which they evidently had not been able to do unassisted. When a correct understanding was arrived at the strike was immediately declared off. We do not mean to imply that railroad employees have not sense enough to understand the meaning of words, but what we do mean (and it is a frequently demonstrated fact) is that on occasions of excitement or in matters of great personal interest these men are apt to look at everything through blue glass, figuratively speaking, and persuade themselves that everything they see is blue. They will, perhaps unconsciously, twist the meaning of a sentence to suit their own ideas or imagination. Every railroad officer knows that this is true of every class of railroad men.

In abandoning the strike on the Lehigh Valley road, the men accepted the identical conditions that had been offered them by the president of the road weeks before. A couple of modifications, in fact, were made through the mediation of the Boards of Arbitration, but they were more of an explanatory character than in the nature of concessions. On the third day of the strike, Nov. 21, President Wilbur issued the following notice to all employees:

To correct any misapprehension regarding the position of the officers of this company, I would state that they are at all times ready and willing to give patient hearing to complaints on the part of its employees or any number of them in any department; if dissatisfied with the conclusions reached by the Division Superintendent or General Superintendent, the President will hear their cases and decide. But we decline to confer with organized committees composed of several branches of the service, for the reason that we cannot know that such committee fairly represents its employees. Engineers cannot, of course, fairly represent grievances of telegraph men, nor can firemen properly represent trainmen. The company maintains the right to employ men upon such terms as may be agreed upon, and settle all complaints only with its employees, and to discharge men for cause, with the right to appeal, but without reference to the judgment or action of any organization.

A week later the following announcement was made:

That the road agrees to take back as many of its old employees as it has places for, without any prejudice on account of the fact that they struck or that they are members of any labor organization; that when in the employ of the road, committees from the various classes of employees will be received as stated in the bulletin of Nov. 21, and their grievances considered and justly treated, and that, in employing men in the future, the company will give the preference to former employees when the strike is declared off.

Eight days more of striking followed, when, at the suggestion of the mediators before referred to, it was announced that in addition to the terms offered above:

That, in re-employing men formerly in its service, the available time shall be so divided among the men so re-employed that they may feel they are again in the service of the company, and self-supporting; that in making promotions hereafter the company will make no distinction between men now in its employ and those so re-employed on account of seniority in service or otherwise.

It was further announced that the rules agreed to by General Manager Voorhees on Aug. 7, while the Lehigh Valley was controlled by the Philadelphia & Reading, were and would continue in force. We were misinformed in regard to this point, and the editorial remarks in our last issue in reference to it were erroneous, as explained in the following, which is an abstract from a letter sent us by President Wilbur:

You will notice that the strike was not occasioned by any refusal of ours to recognize rules adopted by the Philadelphia & Reading Railroad Company at a time when the Lehigh Valley was under lease to that company, as those rules have never been in question, but have been enforced ever since the 8th of August, when our company again took possession of its property; have not been rescinded, and are to-day in full force.

The committee claimed that labor organizations had been recognized by Mr. Voorhees, and that therefore they were justified in demanding recognition by us. This, you will notice, I declined in my letter of Nov. 17. The issue, therefore, as was admitted by Chief Arthur in an interview which appeared in the Philadelphia morning papers, was for recognition of labor organizations.

It will thus be seen that the men finally accepted what had been offered to them early in the strike, and that their strike for the recognition of the federation of their unions was a complete failure, as they did not receive that recognition, and the railroad maintains its policy "to deal directly and only with its employees."

This strike and its failure constitute an important event in American railroad history, and the fact that a strike of the federated unions of engineers, conductors, firemen, brakemen and telegraph operators, failed of its purpose, shows that when put to the test these organizations have not the strength or power that they are generally credited with. It shows that the question of whether the managing officers or the employees shall manage a road, is largely one of backbone and firmness in the managing officers. Under the present conditions no strike can possibly succeed on any large road in this country, if the managing officers are capable of as much firmness and courageous adherence to principle as were displayed by the Lehigh Valley management during the "late unpleasantness" on that road.

We do not wish to be understood as having no sympathy for the men who engaged in this strike, or for the large and respectable body of railroad employees throughout the country who demand fair pay and just treatment. We do sympathize with these, and with those who struck and made their condition worse instead of better in these hard times; but we are convinced by our very intimate knowledge of the workings of railroad labor organizations, that it is best for the community that this strike failed as it did, and that similar strikes should fail in the future. It is not through the workings of a labor organization that any railroad man can best improve his condition in life and his treatment in service, but it is by intelligent work faithfully directed in the interests of the road that employs him that he can best advance his own interests in every legitimate way. What is true of the individual is true of any number of individuals, and we believe that the best way for railroad employees to better their condition is to quit their everlasting agitation of "grievances" and try working in harmony with those for whom they labor and those they labor with.

THE AIRBRAKE DECISION.

The decision rendered by Judge Townsend, of the United States Circuit Court of New York, in the suits for infringement of patents brought by the Westinghouse Air Brake Company against the New York Air Brake Company, has excited wide comment and universal interest.

The opinion of the court deals with the mechanical merits of the case in a very thorough and intelligent manner. There were three suits in equity; one for infringing patents on the quick action feature of the Westinghouse triple-valve, one for infringing patents on the Westinghouse engineer's brake valve, and one for infringing patents on the "emergency" feature of the Westinghouse apparatus. Briefly stated the defense offered in the several cases was, first, that the New York quick action triple-valve "is merely a combination of the invention described in the automatic relief valve of one patent not in suit, with the invention whereby reservoir pressure was utilized to operate an emergency valve, described in a certain other patent not in suit." Second, because of differences in construction and operation of engineer's valve there was no infringement. Third, infringement of the emergency feature patent was admitted, but the validity of the patent was disputed.

In all three suits judgment is rendered in favor of the Westinghouse company, and injunctions and accountings ordered against the New York company.

The decision relates the circumstances of the history and development of the airbrake as plain and automatic and of the fact being demonstrated at the Burlington brake tests of 1886 and 1887, of the need of an improvement that would enable brakes to be operated on 50-car freight trains without destructive shocks. Upon this George Westinghouse, Jr., began investigations that led to the invention, duly patented, of a quick-action auto-

matic brake capable of being successfully applied to a train of 50 freight cars, and operative under all conditions of practical railway service.

The New York company did not deny that George Westinghouse, Jr., was an original and meritorious inventor, the first inventor of the plain brake, the first to put an airbrake into successful use and the first to graduate air pressure in the brake cylinders; and it was admitted that the Westinghouse quick-action automatic brake was the first practical system on long trains. But it claimed that early and expired patents, not in suit, of the Westinghouse company, showed how practical airbrakes could be made and successfully operated. The New York company admitted that it had adopted these inventions, but denied infringement on the ground that these patents were not in suit. It further claimed that the patents in suit were for mere minor improvements upon and modifications of those inventions, which did not require any exercise of creative thought. The New York company claimed that it took its relief valve from a patent granted to the Westinghouse company in 1875. The subject of this invention was designed for use in connection with the plain apparatus, and was "to provide for the more immediate escape of the compressed air from the brake cylinders after it has done its work." It was a patent for an invention, not for applying brakes, but for quickening the releases of the brakes in the plain-brake system. In regard to this the New York company held that the first result in each case was to quicken the action of each succeeding automatic relief valve, and the difference in secondary results, that in one case it released, in the other applied, brakes, is immaterial.

In deciding this point Judge Townsend says:

The sole object of the invention was to quickly release brakes in the direct system. It was intended to obviate the difficulty arising from the fact that in the direct system the escaping air, being expelled simply by its own expansion, came out very slowly. It was not adapted to the application of brakes, or in any way to the automatic brake system, although that system had then been invented.

There is no suggestion in the patent in any way in which it could be adapted to the automatic system, nor, if so adapted, to apply the brakes, does it appear how it could then be operated to release them. No provision is made for graduation for ordinary service stops in any case.

The opinion of the court was that the position of the New York company in this matter was untenable.

In the suit for infringing the patent on the Westinghouse engineer's valve, the differences in the construction of the New York engineer's valve was depended on for immunity; but it was decided that while apparently in some respects a superior valve to the Westinghouse valve, yet the vital elements of its construction were the same in their operation, and in the objects they accomplished. Although the valve was different in its mechanism, it yet performed the same functions, in the same way, as the corresponding mechanism of the Westinghouse valve—and was therefore an infringement.

The third suit was based upon the infringement of a patent that had not been granted when the first two suits were begun. This was for the emergency feature of Westinghouse brake, described as an invention "to provide means for effecting the rapid admission of fluid under pressure to a desired delivery receptacle by means of and coincidently with a reduction of pressure in the receptacle of a fluid supply," and as a means by which this object was to be attained with or without a triple volve apparatus. All the drawings, except the first, show the appliance as connected in operative relation with such triple-valve apparatus. The New York company admitted the infringement, but maintained that the claims of the patent were invalid in view of former patents, not in suit, that they are merely a double use —a substitution, and not an invention. "The claims were designedly made far too broad, and must be construed to cover (*a*) the double use, and (*b*) a relief valve whether controlled by a piston or its equivalent, or controlled in any other way, known or unknown."

The distinct invention of this patent is the combination of the valve with the triple-valve mechanism under such relations that it does not need any movement on the part of the triple-vale mechanism in order to operate it. The decision of the court fully upheld the broad claims of the patent.

The net result of all this is that the Westinghouse Air Brake Company will enjoy a monopoly of the manufactuse of airbrakes in this country until the patents that have been granted it have expired, or some mechanical genius invents a means of operating as good a brake in a totally different way. While some are prone to bewail the loss of the stimulating and cheapening effects of competition as a result of this decision, it is perhaps a blessing in disguise. The company that has made the best and most reliable brake, having the best workmanship, and being now in use on 95 per cent. of airbraked rolling stock, will continue to supply the demand with brakes that can be depended on to be uniform in their operation and durable in service.

The series of articles on "Repairing Locomotives," contributed by Mr. J. T. Heffernan, is begun again in this issue of the National Car and Locomotive Builder, and if possible will be continued without interruption until the subjects which Mr. Heffernan discusses in such a plain and practical manner have all been treated. The author of the papers is a practical locomtive builder, and his writings are of special value to locomotive men because they deal little with theory and largely with every day practice.

During the dull season of the last few months the extra enginemen on the roads throughout the country have had but a poor chance to earn their salt, as their "brothers" having regular engines or runs have proved themselves to be quite as heartless monopolists as any whom labor agitators are wont to denounce, and have stuck to their engines most assiduously. On some of the roads this matter is being corrected by the officers requiring that these hoggishly inclined individuals practice the principle of "live and let live" by laying off one trip a week in order to give the extra men a chance. This is a good illustration of about how much brotherhood there is in the brotherhoods.

The "American Engineer and Railroad Journal" has for the last several months published a list of accidents happening to locomotive engineers and firemen throughout the country each month. The expressed object of doing this is to "indicate some of the causes of accidents of this kind" so that the proper remedies may be adopted. This list shows that, as is well known, collision is the chief cause of injury to enginemen; but it also shows that some of the minor causes of injury are more frequent and potent for evil than is generally considered. Falling from engines is one cause that claims many victims, and in seven months nine men have been injured by striking obstructions placed too near the track. The publishing of this list will serve a useful purpose by calling attention to these minor and supposed unimportant causes of accident, the first necessary step toward their prevention.

Literature.

An event in periodical literature, not without its significance to the general public as showing the growth of the reading classes, was the receipt by the "Cosmopolitan Magazine" of an order from the American News Company for 200,000 copies of its December issue. This is the largest order for copies of a magazine that has ever been issued, and shows how popular this excellent magazine is becoming.

The "Photographic Times," of 423 Broome Street, New York, has issued a notable Christmas number, containing an excellent photogravure picture prepared especially for the purpose and entitled "Santa Claus"; a splendid photograph by Stieglitz, printed in three colors; a gold medal prize photograph printed in steel blue. There are also 36 pages of original articles including editorials on matters of current interest.

Our Chicago contemporary, the "Railway Master Mechanic," has decided to change its name, and will hereafter be known as "Railway Engineering and Mechanics." The scope of the paper will be somewhat enlarged to correspond to the title, but its principal field will continue to embrace locomotives, cars, shops and the material, appliances and supplies pertaining to them. More space than heretofore will be given to signaling devices and systems, and the uses of electricity for shop, train and track.

"The Science of Mechanics": a critical and historical exposition of its principles, by Dr. Ernst Mach, professor of physics University of Prague. Second German edition, translated by Thomas J. McCormack. Chicago: The Open Court Publishing Company. 534 pages; price, $2.50.

This book is divided into five chapters, which treat respectively of the development of the principles of statics, of dynamics, the extended application of the principles of mechanics and the deductive development of the science, the formal development of mechanics, and the relation of the science to other departments of knowledge. The book is excellently translated, and forms a very complete history of the development of the divisions of the science of mechanics from man's first knowledge of them, through the experimental stage, to the deductions of general laws.

An Injunction Against Northern Pacific Employees.

As we go to press it is announced that trouble is brewing on the Northern Pacific, where it appears a federation of engineers, conductors, trainmen, firemen and telegraph operators, similar to the Lehigh Valley federation, has moved for an increase of wages and been refused. The receivers have sought the protection of the United States Circuit Court, at St. Paul, and on Dec. 26 Judge Caldwell, of that court, issued an injunction, the main points of which are as follows:

The officers, agents and employees of Thomas F. Oakes, Henry C. Paine and Henry C. Rouse, as Receivers of the Northern Pacific Company, and the engineers, firemen, trainmen, train dispatchers, telegraph operators, conductors, switchmen and all other employees of said Thomas F. Oakes, Henry C. Paine and Henry C. Rouse, as Receivers of the Northern Pacific Railroad, and each and every one of you, and all persons, associations and combinations, voluntary or otherwise, whether employees of said receivers or not, and all persons generally, and each and every one of you, in the penalty which may ensue, are hereby strictly charged and commanded that you, and each and every one of you, do absolutely desist and refrain from disabling or rendering in any wise unfit for convenient or immediate use any engines, cars or other property of Thomas F. Oakes, Henry C. Paine and Henry C. Rouse, as Receivers of the Northern Pacific Company, and from interfering in any manner with the possession of locomotives, cars, other property of the said receivers or in their custody, and from interfering in any manner, by force, threats or otherwise, with men who desire to continue in the service of said receivers, and from interfering in any manner, by force, threats or otherwise, with men employed by the said receivers to take the places of those who quit the service of said receivers, or from interfering with or obstructing in any wise the operation of the railroad, or any portion thereof, or the running of engines and trains thereon or thereover, and, as usual, from any interference with the telegraph lines of said receivers, or along the line of railways operated by said receivers, or the operating thereof, and generally from interfering with the officers and agents of said receivers or their employees in any manner by actual violence or by intimidation, threats or otherwise, in the full and complete possession and management of said railroad, and of all the property thereunto pertaining, and from interfering with any or all property in the custody of said receivers, whether belonging to the receivers or shippers, or other owners, from interfering, intimidating or otherwise injuring or inconveniencing or delaying the passengers being transported or about to be transported over the said railroad of said receivers or any portion thereof by said receivers, or by interfering in any manner by actual violence or threats, or otherwise preventing or endeavoring to prevent the shipment of freight, or the transportation of mails of the United States, over the road operated by said receivers, until the further order of this court.

The New York & New England Railroad was placed in the hands of a temporary receiver, Dec. 27. Mr. Thomas C. Platt was appointed Receiver.

Fall Meeting of the American Society of Mechanical Engineers.

The fall meeting of this society was held at its house at New York City, beginning Dec. 4, and lasting until Dec. 8. President Eckley B. Coxe presided, and the following papers were presented and discussed during the sessions:

"The Buckeye Engine Valve Gear," by A. K. Mansfield.

"The Maximum Contemporary Economy of High-pressure Triple-expansion Engines," by Prof. R. H. Thurston.

"Expansion Bearings for Bridge Superstructures," by George A. Morison.

"A Device for Drill-jigs," by Barton Cruikshank.

"A Curve Delineator," By Frederick A. Scheffler.

"Notes on Belting," by Fred. W. Taylor.

"Some Experiments on the Effects of Water Hammer," by R. C. Carpenter.

"Constants for Correcting Indicator Springs Which Have Been Calibrated Cold," by R. C. Carpenter.

"The Use of the Indicator in Dynamometric Testing," by W. S. Aldrich.

"A New Form of Prony Brake," by R. C. Carpenter.

"A Comparison of Mean Effective Pressures of Simultaneous Cards Taken by Different Indicators," by D. S. Jacobus.

"Recent Progress in the Manufacture of Steel Castings," by H. L. Gantt.

"Steam Piping and the Efficiency of Steam Plants," by Wm. A. Pike.

"A Method of Manufacture of Large Steam Pipes," by Charles H. Manning.

"Strength of Rim-joints in Fly-band Wheels," by James B. Stanwood.

"Experimental Determination of the Effect of Water in Steam on the Economy of the Steam Engine," by R. C. Carpenter.

"Test of a Boiler Using Grates with a Small Percentage of Openings," by F. A. Scheffler.

"The Cumulative Errors of a Graduated Scale," by Wm. A. Rogers.

"A Modern Disinfecting Plant," by Wm. H. Francis.

"Crucible Furnace Using Petroleum," by W. S. Crane,

"Theory of Direct-acting Steam Pumps," by David Guelbaum.

The officers elected for the ensuing year are as follows: President, Eckley B. Coxe, Drifton, Pa.; Vice-Presidents, C. E. Billings, Hartford, Conn.; Percival Roberts, Jr., Pencoyd, Pa., and H. J. Small, Sacramento, Cal.; Managers, John B. Herreshoff, Bristol, R. I.; L. B. Miller, Elizabeth, N. J., and W. S. Russell, Detroit, Mich.; Treasurer, William H. Wiley, New York; Secretary, F. R. Hutton; Assistant Secretary, Francis Hoadley.

Some Elegant Cars.

The following is a description of the interior arrangement and decoration of compartment cars on the Cincinnati, Hamilton & Dayton, furnished us by one of the officers of the road:

Not only are they architecturally ornate, but their general construction is such that the traveler enjoys the luxury of a parlor in the finest residence in the land. The cars are lighted with Pintsch gas, and there are 10 complete drawing-rooms to each sleeper. This compartment communicates, except when the traveler wishes to retire or enjoy pronounced privacy, when by closing the doors a private drawing-room is provided. The first room of the series is square, contains an upper and lower berth, a lavatory with white metal bowl, hot and cold water, and a good sized wicker chair, with upholstered cushions and trimmings. Despite the elaborate furnishings there is adequate room left for the occupants to move about. The exquisite coloring and decorative features are marvels of beauty. A mahogany wainscoting, reaching to the height of the window sills, is followed to the ceiling, including the upper berth front, by painted woodwork of pea-green striped with gold, broken by embossed and decorated plush panels to match, the latter being relieved by gold moldings. The seats of plain plush, the carpets as rich in quality as those of a Smyrna palace, and the highly embellished ceiling, in the center of which is a gas chandelier of deflecting mirrors, are each in harmony of color with the green and gold tints. Beveled glass mirrors incased in beautifully designed framework of green and gold supplant the plush panel in places convenient for the toilet—the largest mirror's handsome encasement forming a centerpiece of chaste beauty. In this and the adjoining stateroom, plate glass panels in the partition forming the aisles enable the traveler to view the scenery by pushing back the rich sash curtain drapery, which at other times secures an entire privacy of the rooms. The colors of the rooms are all different, one being of white mahogany, with plush upholstering and embossed and decorated plush panels; the tints being such as to blend in a harmonious whole into that delicate shade known as canary. That the splendid equipment is meeting with public favor is evidenced by the abnormal rush that is made daily to secure berths in them in the Windy and Queen cities.

The Atchison, Topeka & Santa Fe Railroad was placed in the hands of receivers Dec. 23, President Reinhart, John J. McCook and Joseph C. Wilson being appointed receivers.

The losses to the Lehigh Valley Railroad Company due to the strike are announced to be as follows: Damage to locomotives, $46,000; damage to cars, $19,000; damage to freight in wrecks, $9,450; damage to perishable freight by delay, $2,550; total, $77,000.

The Long Island Railroad has ordered 55 new passenger coaches of the Pullman Company. The coaches will be full size, with the improved automatic Westinghouse air brakes, Miller platforms and couplers, and all the latest improvement in trucks and running gear. The interior will be finished in light woods, with dark upholstery and brass finishing, large windows, and comfortable seats. The exterior is to be painted dark maroon, the standard color of the Long Island Railroad.

Personal.

Mr. George R. Cassie has been appointed Master Car Painter of the Lake Shore & Michigan Southern.

Mr. David B. Dewey, of Chicago, has been appointed receiver of the Minnesota & Wisconsin Road.

Mr. Willard Kells, son of the late Ross Kells, has been made General Foreman of the Erie shops at Meadville.

Mr. Frank Trumbull, of Denver, Colo., was on Dec. 11 appointed receiver of the Union Pacific, Denver & Gulf.

Mr. Samuel P. Wheeler, of Springfield, Ill., has been appointed receiver of the Jacksonville, Louisville & St. Louis.

Mr. Frank Carr has been appointed Master Car Builder of the United Counties Railway, with offices at St. Hyacinthe.

Mr. J. D. Campbell, Assistant Superintendent of Motive Power on the New York Central & Hudson River Road, has resigned.

Mr. Charles A. Scott at one time General Manager of the government railways in Nova Scotia, died at Quebec, Dec. 15.

Mr. George H. Babcock, President of the Babcock & Wilcox Boiler Co., died at his home at Plainfield, N. J., on Saturday night, Dec. 16.

Mr. John B. Connors, Superintendent of the Toledo, Ann Arbor & North Michigan, has tendered his resignation to take effect Jan. 1.

Mr. P. T. Lonergan has been appointed Master Mechanic of the Rome, Watertown & Ogdensburg Railroad, vice Mr. George H. Haselton.

Mr. W. E. Looney has been appointed Master Car Builder of the Louisville, Evansville & St. Louis Road, with headquarters at Princeton, Ind.

Mr. George P. Hamlin, who was Superintendent of Construction of the first railroad built in Russia, died at his home in Baltimore, Md., Nov. 12.

Mr. John J. Horner has resigned as President of the Arkansas Midland to take effect Jan. 1, and has been chosen Vice-President and General Manager.

Mr. A. L. Mohler has resigned his position as General Manager of the Great Northern and General Superintendent Case, of the same road, succeeds him. Mr. Mohler will proceed South for a vacation.

Mr. George H. Baker, Editor of the National Car and Locomotive Builder, has been elected an associate member of the American Society of Mechanical Engineers.

Mr. Isaac D. Barton, General Superintendent of the New York & New England road, has resigned. Vice-President Odell will assume the duties of the position temporarily.

Mr. J. E. Phelan, formerly Division Superintendent of the Dickinson Division, Northern Pacific, has been appointed Master Mechanic of the Dakota Division, with headquarters at Fargo.

Mr. James Buchanan has been appointed Assistant Superintendent of Motive Power in charge of divisions east of Syracuse on the New York Central & Hudson River Railroad.

Mr. Henry J. Small, Superintendent of Motive Power and Machinery of the Southern Pacific Railroad, has been elected a vice-president of the American Society of Mechanical Engineers.

Mr. E. M. Herr, Superintendent of the Grant Locomotive Works, has sailed for Europe on a combined business and pleasure trip that is expected to cover a period of several months.

Mr. George H. Haselton has been appointed Assistant Superintendent of Motive Power in charge of divisions west of Syracuse on the New York Central & Hudson River Railroad, vice Mr. J. D. Campbell, resigned.

Mr. George De B. Keim, formerly President of the Philadelphia & Reading Railroad, died Dec. 20 in Philadelphia from apoplexy. He was born in Reading, Pa., 1832, and was the son of the late General George M. Keim.

Mr. R. W. Bryan, Assistant General Superintendent of the Eastern Division of the Great Northern, has been appointed General Superintendent of the same road to succeed Mr. C. W. Case, appointed General Manager.

Mr. Robert Law has been appointed General Superintendent of the Burlington & Northwestern and the Burlington & Western Railroads, in Iowa, to succeed the late Mr. John T. Gerry. His office will be in Burlington, Ia.

Mr. C. M. Lawler, who was recently made General Superintendent of the Philadelphia, Reading & New England, has now been appointed General Manager of that road, dating from Dec. 9. His headquarters are at Hartford, Conn.

Mr. George J. Parkin has been appointed Master Mechanic of the Erie and Ashtabula division of the Pennsylvania Lines west of Pittsburgh, northwest system, vice Mr. J. A. Wood, transferred. Mr. Parkin's headquarters will be at Erie, Pa.

Mr. William C. Hudson, Secretary of the New York State Railroad Commission, has resigned. The new secretary is Mr. James D. McMahon, of Utica, Deputy Attorney General of New York. Mr. Hudson has been Secretary of the Commission for ten years.

Mr. W. G. Van Buskirk, Master Mechanic of the Peoria Division of the Terre Haute & Indianapolis road, died suddenly Nov. 29, while on a train, and in conversation with other officers of the road. Death was due to the rupture of a blood vessel in the brain.

Mr. George K. Lowell has been appointed General Superintendent of the Louisville, New Albany & Chicago, with headquarters at Chicago, to succeed Mr. S. J. Collins, resigned. Mr. Lowell has been Assistant Superintendent at Lafayette, Ind., for some time past.

The position of Superintendent of Motive Power on the Illinois Central has been abolished. Mr. William Renshaw has been appointed Superintendent of Machinery, with office at Chicago, and will have full charge of all matters pertaining to motive power and car equipment.

Mr. George R. Ott, Master Mechanic in charge of the Chicago Division of the Baltimore & Ohio, died at Garrett, Ind., Dec. 9, aged 45 years. Mr. Ott went from Baltimore to Garrett about five years ago. Before that he had been foreman of the pattern shops at Mt. Clare. He was in the service of the Baltimore & Ohio over 20 years.

Mr. A. S. Grant, of Palestine, Tex., has been appointed Master Mechanic of the Houston, East & West Texas Railroad, with headquarters at Houston. For many years he has been General Foreman of the International & Great Northern bridge and building department at Palestine.

Mr. Theodore Voorhees, who has been Acting General Manager of the Lehigh Valley Railroad since the lease of that road to the Philadelphia & Reading was abrogated in August, has been given the full title of General Manager.

Mr. Henry L. Leach, Division Master Mechanic of the Fitchburg Railroad, at Fitchburg, Mass., has resigned to devote his entire time to the commercial interests of his track sanding apparatus for locomotives, of which he is the inventor. His present address is North Cambridge, Mass.

Mr. Thomas K. Scott, who has been Acting General Manager of the Georgia Railroad, for several months past, has been appointed General Manager of that road, with headquarters at Augusta, Ga., to succeed Mr. John W. Greene, resigned. Mr. Scott was formerly Superintendent of the Alabama Mineral Division of the Louisville & Nashville.

Col. Alton R. Easton, one of the most prominent citizens of St. Louis in early days, died there Dec. 11, aged 86. He it was after whom Alton, Ill., was named. He was military Governor of Santa Fe during the Mexican War; Assistant United States Treasurer under Fillmore; Inspector-General of Missouri in 1862 to 1864. He was a close friend of General Grant.

Mr. J. N. Weaver, Division Master Mechanic of the Lehigh Valley Railroad, at Sayre, Pa., was made Assistant General Superintendent of the Northern Division of that road during the recent strike, the object being to have an officer of high authority at Sayre, where the principal shops are located. When the strike was ended Mr. Weaver returned to his position as Master Mechanic.

Mr. A. H. Watts, Master Mechanic of the Cincinnati, Jackson & Mackinaw road, was assaulted by a locomotive engineer in his employ, Dec. 14. The man had been reprimanded for damaging an engine. Becoming intoxicated he called at Mr. Watts' home late at night and attempted assassination, discharging a revolver at Mr. Watts, who, although not shot, was yet seriously injured before his would-be murderer was overpowered.

The following changes have been made on the Northern Pacific: Mr. F. W. Gilbert has been appointed Superintendent East Cascade Division, with office at Sprague, Wash., and Mr. Joseph McCabe, Superintendent West Cascade Division, with office at Tacoma, Wash., vice Mr. C. S. Prowell, heretofore Superintendent Cascade Division; Mr. John Dorsey has been appointed Superintendent Missouri Division, with office at Dickinson, N. D., vice Mr. J. E. Phelan.

Mr. Arthur B. Underhill, who has been Superintendent of Motive Power of the Boston & Albany Railroad for the last 13 years, has resigned that position, his resignation taking effect on Jan. 1. Mr. Underhill has been in poor health for several years, and his resignation is offered so that he may secure complete rest. He was for nearly 16 years Master Mechanic of the Boston & Worcester, and in 1880 succeeded the veteran Wilson Eddy. Mr. Underhill was one of the first to build engines with boilers carrying pressures of 160 lbs. and upward.

Mr. J. J. Casey, for several years Superintendent of Motive Power of Yazoo & Mississippi Valley Road, with headquarters at Vicksburg, has been made Assistant Superintendent of Motive Power of the Illinois Central system, with headquarters at Chicago. The Yazoo & Mississippi Valley will pass under the supervision of the general officers of the Illinois Central system. Mr. Charles Linstrum will become Master Mechanic in charge of the Vicksburg shops, which are the largest on the Illinois Central system south of Ohio. They were constructed under the supervision of Mr. Casey several years ago.

The Baltimore & Ohio Southwestern Railway makes the following announcement:

Mr. J. M. Sheer having resigned, the office of Master of Rolling Stock is abolished.

Mr. J. G. Neuffer is appointed General Master Mechanic with headquarters at Cincinnati.

Mr. T. G. Duncan is appointed Assistant Master Mechanic of the Ohio Division, with headquarters at Chillicothe, Ohio.

Mr. C. Skinner is appointed Assistant Master Mechanic of the Mississippi Division, with headquarters at Washington, Ind.

Mr. Henry Schlacks, who resigned from the service of the Illinois Central Railroad Company on Feb. 1, 1893, has been appointed Superintendent of Motive Power of the Denver & Rio Grande Railroad. Mr. Schlacks entered the service of the Illinois Central Railroad while a boy, and worked his way up to the position of Superintendent of Machinery, which he held for 10 years previous to his resignation. He relieves Mr. N. W. Sample of the superintendence of the motive power department of the Denver & Rio Grande. Mr. Sample was formerly Superintendent of Motive Power, but for the past two years has filled both this office and that of General Superintendent of the road.

Mr. Albert Benton Pullman died Dec. 18, at his home, "Ingleside," near Evanston. He had been confined to his bed for a week past, and while his illness was regarded as critical the end was not looked for so soon.

The deceased was born at Auburn, N. Y., Oct. 16, 1828, and was educated in the public schools of that place. Before he had reached manhood he removed to Albion, N. Y., where he engaged in the business of cabinetmaking. Here he married Miss Emily Bennett, in 1847, and in the following year went to Grand Rapids, Mich., and entered the furniture business. In 1859 he went to Chicago with his brother, George M. Pullman, and the two organized a firm and engaged in the business of raising buildings to the proper street levels. His first venture in sleeping car building was in 1860, and he continued in it for 27 years, filling for 25 years the position of second vice-president of Pullman's Palace Car Company. In 1887 he retired from active participation in the management of the company, and has passed the remainder of his life since in travel and at his beautiful home near Evanston. His wife died in 1890. Mr. Pullman was the mechanical genius of the family that have made their names so famous in the manufacture of sleeping cars. Understanding as he did every detail in the art of cabinetmaking he was able to superintend the details of the construction department of the vast Pullman industry. He leaves two daughters, Mrs. Graeme Stewart, and Miss Emma Pullman. In addition are four brothers, George M. Pullman, Rev. R. H. Pullman, of Baltimore; Rev. James M. Pullman, of Lynn, Mass., and Charles L. Pullman, of Chicago.

Chauncey M. Depew's Experience.

The best thing I remember connected with myself (said the gentleman whose name appears above) is, that when I graduated from Yale I thought I would lead a life of scholastic ease. I thought I would read and write a little, take it easy and have a good time. I had a hard-hearted old father of sturdy Holland Dutch ancestry. He had money enough to take care of me and I knew it, and when he discovered that I knew it and intended to act accordingly, it was a cold day for me, and he said to me: "You will never get a dollar from me except through my will. From this time forth you have got to make your own way." Well, I found I had a hard lot of it. Nobody had a harder one, and the old gentleman stood by and let me fight it out. I bless him to-night with all the heart and gratitude I have for that. If he had taken the other course, what would I have done? I would have been up in Peekskill to-night nursing a stove, cursing the men who had succeeded in the world, and wondering by what exceptional luck they had got on. But having to dig my way along I got beyond everything my father ever dreamed of; but it was done by 14 hours or 16 or 18 hours' work a day, if necessary. It is done by temperance, by economy, when you make a dollar spend 75 cents and put the other 25 by.

The General Superintendent Snowbound.

Mr. T. E. Calvert, General Superintendent of the Burlington & Missouri River Railroad, in Nebraska, came out from Lincoln the first of this week, says the "Pioneer Grip," of Alliance, Neb., to try one of the decapod engines on the Deadwood line. He started with Engine 275 Tuesday morning from Edgemont with 14 loads and a water car. They succeeded in making Argyle, 25 miles away by night, the last 16 miles being made in 17 hours. The engine drank up all the water and devoured all the coal in sight as far as they proceeded. Being out of water at Argyle, Mr. Calvert started out on foot for Pringle, a distance of seven miles to have train 204 to help them out. There being ten inches of new snow on the ground he found his task at pedestrianism rather severe. Finally coming up to a section man in an exhausted condition he called him under a bridge, the storm now being so severe on the track that they could not hear one another speak. He told the section man to go to Pringle and report the condition of things, and that he would remain under the bridge, as he was completely played out. The section man came on to Pringle and reported that a big fat brakeman came as far as a certain bridge two miles out, and was completely exhausted and lying under the bridge, and that he had sent him in to report that Engine 275 was at Argyle out of water and wanted assistance. Superintendent J. R. Phelan had been anxiously awaiting news from this train and two other extras that were behind this experimental train, and when informed by the section man of the state of affairs remarked "there's a dead brakeman," as a dreadful blizzard was raging in the hills. The first thing to do was to send an engine out after the exhausted brakeman, which was started at once, and when it returned it brought in Mr. Calvert, who represented the fat, frozen brakeman.

"This is the first time in the history of Mr. Calvert's life," says Superintendent Phelan, "that he ever went under the bridge and gave up."

The line was finally released and the decapod sent back to Edgemont. Mr. Calvert also returned to Edgemont and gave up the trial for the present. Later it is reported that Mr. Calvert has positively refused to enter the train service on the Black Hills line again.

Jacob Leese, the first white settler in California, has died at the age of 82 years. He went to California in 1833, and built the first house upon the spot where the city of San Francisco now stands.

Some Sheet Iron Work.

BY JAMES F. HOBART.

A shop which used to put an angle iron ring around the water opening in tender tank has recently changed the style, and now makes necks out of a single piece of steel, welded up and flanged. The welding was done with the old style of neck, so nothing will be said of that part of the work. The old-style neck looked something like a Fig. 1. It had a swing top, which was hinged to the shell, this in turn being riveted to the angle iron ring (c).

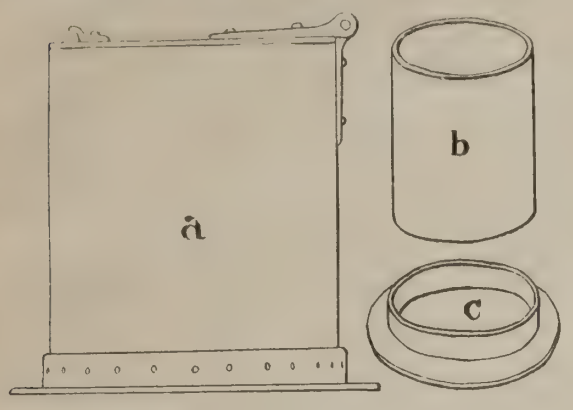


Fig. 1.—Angle Iron Flange for Tank.

As now made, the ring is discarded, and the shell b cut three inches longer than formerly. A soft yellow heat is taken at one side of one end, as at a Fig. 2, charcoal being used. The shell is steel. Then it is stood on end on the floor, held with a pair of tongs shaped like b, and the hot edge of the shell turned down with a common wooden mallet. A few blows of the mallet produces the effect shown at c. This is continued, one man holding the tongs, the other using the mallet until the shape d is obtained. Then another heat is taken, and another section of the flange driven down. After the shell has been heated and hammered all around, it looks like c. Then it is turned flange down on the solid, and trued up. A good man and his helper will flange one of these shells, taking five heats, in 20 to 25 minutes. It is a much better way than the ring method, costs less, and makes a better job all around.

It is a curious thing—but nevertheless a very true

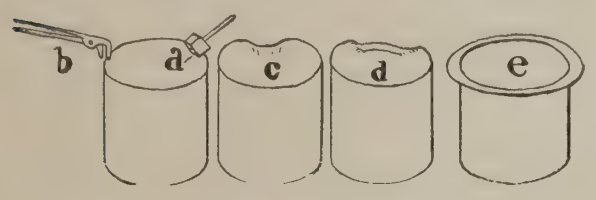


Fig. 2.—Flanging Tank Nozzle.

one—that in almost every railroad shop some job is done which costs one and a half or two times as much as the same work would cost outside the shop. Take, for instance, the matter of hammers. They are made in the shop at a cost of $1.25 each, while the same tool bought outright would cost 65 cents. One shop made a dozen ratchet drill stocks. They cost $9.85 each, complete. I can buy a better stock in the open market for $3.25. Where is the economy in this operation? There isn't any. The master mechanic knew it, and so did everybody except the directors of the road who had forced him to doing such a foolish thing. That master mechanic knew from experience that there would be a big "kick" over an item of "one dozen ratchet-drill stocks, $3.25—$39. And he also knew that there would not be such a growl over shop expenses, for they were to be expected. And the directors couldn't read "between the lines" and see that invisible item of

"1 doz. ratchet drill stocks, $9.85—$118.20."

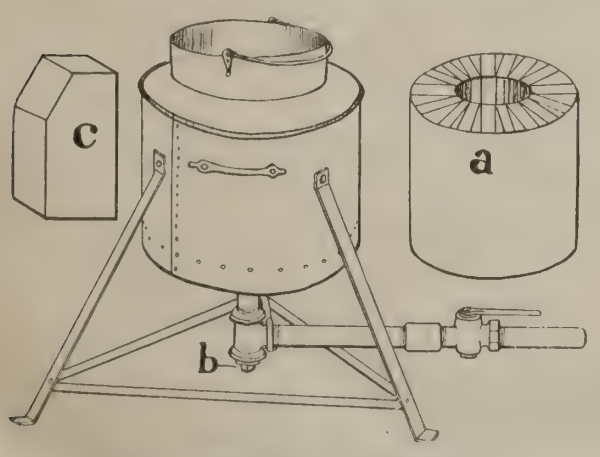


Fig. 3.—Babbitt Pot and Rivet Heater.

And so it goes. Suppose the directors come to life once in awhile, and realize a little of the true inwardness of such matters. At any rate, that is the only reason I could ever think of for their forcing the master mechanic to reduce expenses by cutting down the force of shop help, or by going on to short time, or both, at a time when everybody knew that the necessary repairs required every man, and more too.

That is what I thought the other day when I came across a rig for melting babbitt metal for lining driving boxes. The concern looked something like Fig. 3. It was made of 3-16 tank steel, and similar devices, though smaller, were in common use for rivet forges around the shop boiler house. Little description is needed. The legs being made of ⅜ by 1¾ flat bar iron, and a ring of half-round ⅞-inch iron being riveted on to stiffen the top of the heater. The inside was lined with firebrick, as seen at a, each brick being tapered at the top (c) so the kettle could have a better bearing.

But the kettle itself was a curiosity, and must have cost the company considerable money. It is a mighty good kettle, as may be seen by looking at Fig. 4. But this fine kettle is flanged up from the flat piece of steel (b). One side at a time is malleted down around a

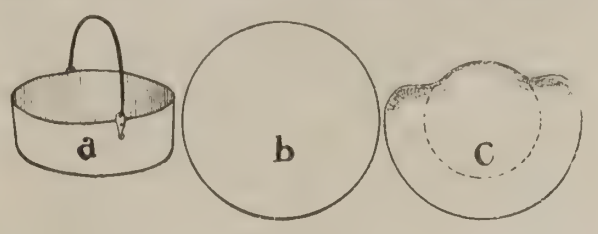


Fig. 4.—Flanging Up a "Babbitt Kettle."

form until it looks like c. Then another side is heated and forced into shape.

Both the rivet heaters and the babbitt kettle had fixed tuyeres, the dirt that got down through them being removed by taking out the plug b, Fig. 3. A tee is put on to the air pipe at this point, instead of the usual elbow, and for cocks to control the blast old blow-off valves are utilized. This makes the use of an extra coupling necessary, as locomotive blow-off cocks are hermaphrodite concerns anyway, one end being tapped, the other end threaded.

Some steel rivets had been bought and put into the shop. Nobody knew that the rivets were steel, but they gave so much trouble by breaking and cracking during and after riveting that the foreman mistrusted that they were steel, and were being heated too hot.

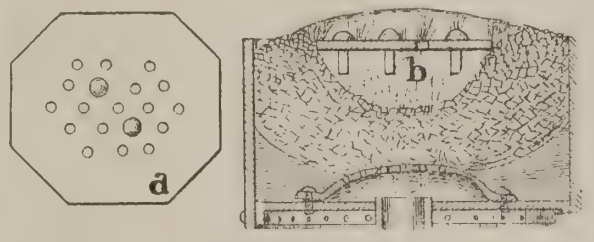


Fig. 5.—Rivet Heating Rig.

A piece of ¼-inch iron was fixed up, as shown in Fig. 5. This was laid on top of the fire and the rivets put through the holes while heating. The result was that most of the heat was put at the end of rivet where it was needed, and that the heads were kept quite cool. There was not any loss from some of the rivets getting lost in the fire and being burned up.

The position of the plate on top of the fire is shown at b. Pea coal is used, and the plate enables the fire to be kept in its best shape without having to tear it to pieces every time a rivet is fished out.

Abolishing the Belt.

A new Belgian factory, according to a correspondent in that country, uses electricity to transmit its power instead of belting, and we think that a brief description of this device may prove of interest to our readers. The dynamo is 600 horse power, and forms the flywheel of the compound Corliss engine. The shop is supplied with 16 motors, and among them ten 16 horse power, one 21 horse power, and one 37 horse power motors. Their average efficiency is 87.2 per cent. On some of these motors the load is very valuable, and several are exposed to dust and dirt, so that with 90 per cent. efficiency of the dynamos, 98 per cent. of the conductors, 87 per cent. of the motors, the net result is 77.6 per cent. power delivered. As the lost work in belt-driving is practically a constant quantity for all loads, or, at least, is usually considered to be, the power required to turn the shafting, pulleys, etc., when no work is being done on the machines, it follows that taking 79.4 per cent. as the final output in two cases, one of electrical and the other of mechanical transmission, we find that at a load of 20 per cent. the electrical system would still give 47.2 per cent. useful effect, and the mechanical nothing at all. From careful experiments which have been made in actual practice, we learn from this same source, it has been clearly proved that to drive all the idle machines requires more power than to drive the shops in ordinary course of work; whereas, 11 electrical horse power is required when driving all the idle tools, only about seven electrical horse power is needed in ordinary work, of which four electrical horse power is used to drive the shafts, belts, etc., alone; this clearly shows how small a part of the power produced by the engine is actually used in useful work at the tools. Such satisfactory results of the application of electricity to factory driving must attract attention, and will doubtless lead to great changes in transmission. Whether in the case of large machine tools it would not be better to discard shafting and belts altogether, and supply a special motor to each tool, is a question which must be settled for each individual case which may arise; the current would be switched on or off just as easily as the belt is now thrown from the loose to the fast pulley, and vice versa.—"Machinery."

Economies Effected on the M., K. & T. R. R.

The following paragraph appears in the annual report of the Missouri, Kansas & Texas Ry. Co. for the year ending June 30, 1893, and indicates what can be done in the direction of economizing on a large railroad:

The cost to the company for live stock killed and other loss and damage, and injury claims, decreased over the previous year $100,000. A change in the method of the purchase of coal in Missouri and Kansas resulted in a further saving of $38,000. The purchase of ties in the open market, instead of through a general contractor, also caused a saving of $40,000. The construction of water-works effected a saving of about $13,000. The saving by construction of additional ice storage capacity was about $20,000. Other economies were introduced in the departments of the General Superintendent and Purchasing Agent, which are estimated to amount to $150,000.

The Chicago, Burlington & Quincy Railroad has but two of the class M engines in service. One of these was illustrated and described in The National Car and Locomotive Builder for October. It has been understood that the engine of this class exhibited at the Fair by the Rogers Locomotive Co. would be purchased by the C., B. & Q. road. This will add another to the two mentioned above. The Grant Locomotive Works had an order to build 30 of these engines, but when this concern failed the order was withdrawn, and has not yet been placed with any other builders.

Standard time, according to the Executive Committee of the American Railway Association, is being adopted throughout the world. The value of the system has been proved by the 10 years of its use in this country. Greenwich time is used by the railways of Great Britain, Belgium and Holland, and it is the legal time for all purposes in Great Britain and Belgium. Middle European time, one hour faster than Greenwich time, is used by the railways in Sweden, Germany, Hungary, Servia and the westward part of Turkey. It is the legal time for all purposes in Sweden and the German Empire, and is likely to be adopted at an early date by the railways of Italy and Switzerland. Eastern European time, two hours faster than Greenwich time, is used by the railways of eastern Turkey, Bulgaria and Roumania. The time of the 135th degree of east longitude, nine hours faster than Greenwich time, is used for all purposes in Japan.

For some forms of belts, it is said, paper is likely to take the place of leather. According to the Boston "Commercial Gazette," a belt made of paper is found superior to those of usual materials for some purposes, as it becomes covered with a hard shining surface in working, which makes the belt durable.

A robber met a coal dealer on a lonely road and stopped him.

"Your money or your life," said the robber.

"Who are you?" asked the coal dealer.

"I'm a highwayman."

"Good enough," continued the coal dealer. "I'm a low weighman. Shake."

The statement of the Michigan Peninsular Car Company for the year ended Aug. 31, 1893, shows net earnings of $866,690, which, after paying fixed charges, including a dividend of eight per cent. on the preferred stock, leaves something more than 18 per cent. profit. Eight per cent. was paid on the common stock, and a little over 10 per cent. carried to the surplus fund. The cash assets of the company amount to over $3,000,000, and the fixed assets to over $7,000,000.

According to a Dutch Government report just issued, the labor question is practically unknown in the Netherlands. Dutch workmen like long hours and are content to live on 40 cents a day. The reason why they prefer long hours to short is because they can thus work in the slow and leisurely manner that suits them best, and can indulge their national conscience in the matter of thoroughness; and they are content with low wages because they know how to make them go a long way. The Dutchman is not fond of striking and gets on well with his employers, resenting state interference in his relations with them as calculated to imperil that freedom and independence for which his ancestors fought so nobly. The only thing that in any way resembles a labor question in Holland is connected with the introduction of machinery, which puts the true Dutchman out of gear altogether, forces him to work briskly and even makes him discover that old-fashioned wages are not quite up to new-fashioned ideas.

New York Railroad Club.

The annual meeting of this club was held in New York City on the evening of Nov. 23. Mr. D. L. Barnes' paper on "The Construction and Inspection of Locomotive Boilers to Prevent Explosion" was discussed at considerable length and adversely criticised in many particulars.

Mr. E. A. Mitchell (Erie): While I cannot agree in all particulars with Mr. Barnes' paper, I think it is a very valuable one. A few points, however, I will endeavor to bring out. On page 8, Mr. Barnes makes a statement which I would interpret to mean that the stays in the crownsheet should not be headed over—in other words, that the stiffness of the crownsheet should depend entirely on the strength of the threads. He gives as a reason for that that less explosions occur than would otherwise if heads were used. I am inclined to think that in the center rows of crownsheet stays they should have heads, in order to help stiffen the crownsheet at that point, and again, as crownsheets are only about ¾ thick, we have a stronger resistance from the head of the bolt than we would from the thread, especially if the riveting-over at the bottom is not done in a perfect manner.

On page 11, Mr. Barnes makes a statement as follows: "But few, if any, of the rules for inspection give a clue to what is wanted from an examination, and only in rare cases are any definite instructions given about how to conduct the details of an inspection." I claim that the printed and verbal rules issued to our inspectors, and the experience gained by inspectors in the constant inspection of boilers make them, as a rule, thoroughly competent to care for such boilers. It is impossible to print rules entering into all details of inspection. The education of inspectors depends more on their experience.

He says on the top of page 12: "Generally, the inspectors are left to their own judgment, and being men with a limited knowledge of boiler design," etc. I would say that, as a rule, and we know that there are exceptions to all rules, inspectors are not men of limited knowledge, but men of experience in that special line of business. He says in the paragraph following: "By good inspection and proper construction, all danger of boiler explosions can be avoided." He does not bring in any statement there about careless men. Careless men anywhere will produce disastrous results.

On page 14, about the middle of the page, he makes the statement that stays are put in cold and frequently too slack to be of any real use until the crownsheet has deflected more than it is safe to permit. I find in talking with men, that stays, as a rule, are placed in under light tension, and I know of only one or two shops where stays are put in loosely. At the bottom of the same page, he says: "To put in this large number of stays so that they will draw properly is impossible" in a crownbar boiler. I have never found any difficulty in having stays applied properly in crownbar boilers. I think if the work is done by a careful man that it can be done as well there as in a screw-stayed boiler.

Then he says, on page 17, that it is possible with right and left take-ups to adjust all the stays in the boiler so that they will draw evenly. I do not see how they can do that. On page 18, he states that the only safe method of determining whether there are sufficient stays in a boiler is to make an accurate calculation on the plan followed by all of the best boiler builders. He does not state who the best boiler builders are, and it is hard to decide which is the best without a careful examination of the finished product. It seems to me he should have stated what factor of safety to use and let each one then make his own calculations.

On page 21, last paragraph, he says: "Staybolts should be put in so that the threads in the sheet do not indent the bolt. This is done by removing the top of the threads in the sheet. Preferably the bottoms of the threads of the staybolts should be round and not sharp." That differs entirely from the results reached by the Southern & Southwestern Railroad Club, in which, after a series of experiments, they demonstrated that the United States standard thread was the best form of tap to be used in cutting thes threads ,and so far as my experience goes, I think that the United States standard tap is all right for staybolt taps.

On the 22d page, he makes the statement: "If the stays were larger in diameter, there would be fewer broken ones." Probably the introduction of 1¼-inch screwstays would remove almost completely the prevailing troubles with screwstays. The Southern & Southwestern Railroad Club decided that a ¾ or ⅞ stay was better and would stand more vibrations than a 1¼ stay.

On page 33, he states that the largest percentage of breakages occur on the back head and throat sheet. That is contrary to my experience.

On page 34, he gives some statements made by various inspectors. For instance, he says that one man states: "I am an inspector, but my instructions are so blind that I don't know where or when my duty is done, and when or for what I am responsible." It seems to me that inspector ought to be discharged.

On page 37, he throws all crownbar boilers into the second class. Now, it seems to me, that crownbar boilers can be built so that they can go into the first class. In other words, nearly all the locomotives of this country, according to this paper, have second-class boilers.

At paragraph d, page 38, I would infer that he throws all boilers without lining on the back head into the third class. It seems to me that is improper. He also says: "Staying generally inaccessible for quick and intelligent examination by an inspector with lamp and long-handle hammer." In old boilers there are more or less stays so located that you cannot get an examination of same by lamp and long-handle hammer, especially those stays that are near the back boiler head, when they must be inspected from the dome. It seems to me that a great many stays in first-class boilers are inaccessible.

Boilers over ten years old, he says in paragraph 8, should go into the third class. We all have boilers over ten years old that are, in my judgment, as good as when first built, especially the boilers running in good water districts, where boilers will run for three months without washing, and then only show very little impurities. Such boilers should not be thrown into the third class until they are much older than ten years.

At page 39, he states, under head of inspection of first class: "Once every six months remove dome-cap, throttle and dry pipe, and examine all stays that are above tube and crownsheets by tapping and shaking them to see if loose or broken." I think we would have to purchase a good many more locomotives than we have to-day if we are going to remove the dome-cap and dry pipe once in six months. I do not believe it is necessary in good water districts to remove a dry pipe any oftener than when engines go into the shops for general repairs. In bad water districts, generally the flues have to come out in six or eight months, and at that the dry pipe can be removed.

At page 40, he says: "It is not necessary to remove other staybolts around a broken one if the bolts are put in as called for in the requirements of a boiler of the first class." I would like to know why. It seems to me if we had a broken staybolt I would want to remove those around it to be sure that none of them were cracked or unduly strained.

On page 42, he says: "All new locomotive boilers must be tested with hot water at the pressure of 25 pounds above the working pressure. He gives this as opinions compiled from a mass of valuable correspondence. It appearing in the paper indicates that he approves of it. Otherwise he would have objected to it. Yet, in another part of this same paper he states that it is not necessary and should not be done—to place a hydraulic pressure above the working pressure, as it would overstrain the boiler.

He says: "(6) Special examinations of the staybolts of locomotives in service must be made once every week." That would require a large number of additional engines, and where careful inspections have been made continuously of certain types of boilers and broken stays found so seldom, I cannot see the necessity of testing those boilers once every week. It is not our practice. We test whenever we wash out, and that is every 15 to 30 days.

In paragraph 8, he speaks about the method of making the tests and then states that braces must be examined after each test. That means that the dome-cap must be removed, which would cause the test to be much longer than it would otherwise be.

In paragraph 10, he gives as the practice of various roads, and he evidently concurs in it, that "In replacing a broken staybolt, the next staybolt in front and back in the same horizontal row, and the one directly above and below the broken bolt, must also be replaced." In a previous paragraph, on page 40, he said it was not necessary.

He says, in paragraph 15: "Dome-caps must be removed every three months and a careful examination made of the interior of the boiler, so far as practicable, without removing the tubes. In another place he states that braces must be examined after each test, and that must be once a week."

Again, paragraph 24: "All boilers, whether stationary or locomotive, shall have two fusible plugs located at the danger line for low water." That is practiced a great deal and there is a great deal of difference of opinion on the point whether it is necessary or not.

Mr. Dixon (Rogers Locomotive Company): As to telltale holes in the staybolts, I think the assertion that no solid screw staybolt should be put in a boiler without the telltale hole is going too far. There are some cases where a telltale hole, though an excellent thing in its way, is an element of danger. Suppose a staybolt, where the water is bad, starts to break; incrustation will fill it up and the hole will be so effectively plugged that nothing will come out of it. Then again, he says that it is quite necessary to send a trained inspector to the works when an engine is building. If a trained inspector, on behalf of the railroad company, is sent to a shop while the work is in progress, he is evidently sent there for one of two reasons: Either to instruct them how to build the boiler, or else to keep a watch on them for fear that they should be dishonest and put in bad work. If he is sent there for the first reason, it seems to me that the railroad company is taking a good deal on itself to say that the inspector knows more about boiler construction that the builder. The builder has been building boilers for a large number of roads, and knows the experience of probably 100 different master mechanics. It seems to me they should know infinitely more about boiler construction and design than the inspector. On the other hand, if he is sent to keep a watch on them, if the builder starts out to be dishonest, you may have a dozen inspectors there and he will get the best of you. In fact, the worst piece of work I ever knew to be done was done right under the nose of a trained inspector. Then, if a trained inspector should be sent—how about the small roads, ordering only two or three engines at a time, who cannot afford to send an inspector? I do not suppose Mr. Barnes means to say that those small roads have bad boilers palmed off on them because they cannot send inspectors to look after the thing.

Mr. West (N. Y., O. & W.): I have had some experience with the fusible plugs, and I think they are a detriment and dangerous to the crownsheet. On account of them engineers are often accused of having low water when they have plenty of water.

The President: That is our experience.

Mr. West: I think the New York Railroad Club ought to put itself on record as being opposed to this system of inspection that Mr. Barnes has outlined. I think it is entirely impracticable. I do not think there is a road in the country that can stand it. We have quite a number of hollow staybolts, and we have yet to find the first broken one.

Mr. Lewis (D., L. & W.): As to the inspection, I do not see how any railroad can comply with the recommendations in Mr. Barnes' paper. There are some very good things here and a good deal of instruction, but as for the examination recommended, we haven't enough locomotives to do it, and I do not know of anybody else who has at the present day.

Mr. Worthington (Byer, Peacock & Co., Manchester, Eng.): I have been very much interested in the remarks that have been made this evening. Not having had the opportunity of studying the paper, I do not feel quite able to criticise the opinions of Mr. Barnes in the way that some members have been doing. But there are one or two points which are of special interest to all locomotive engineers, whether in this country or in England. All our fireboxes in England are made of copper, whereas all yours are of much stronger, and, perhaps, less durable material—steel. But from what I have seen in the last few weeks in this country, I think that we shall have to come toward your practice rather than that you should go toward copper practice for fireboxes. I have been astonished to hear of the length of time that steel fireboxes last. I have been specially looking out for the way you stay your steel fireboxes. It seems to me that with the very high pressures we are getting in locomotives now, up to 200 pounds, as I have heard, that the pitch of the firebox stays will have to be reduced; that the stays will have to be placed nearer to one another. Our practice, in the copper boxes, is to place them four inches apart. I have not found in the fireboxes in this country, so far as my small observation has gone, any stays pitched nearer than four inches, and yet your firebox sides are a quarter of an inch thick. It seems to me, if we are going to those higher pressures, there is likely to be some little difficulty in the thin boxes when they get a little eroded or a little thinner, that the plates will begin to bulge. Of course, I do not speak from experience in this matter, but I was wondering if any difficulty of that kind had occurred.

Again, as to whether the thread which only goes through a quarter of an inch of thickness is sufficient to hold the firebox. We, with copper fireboxes, have a great deal of trouble with the upper rows on the sides where the stays so frequently break, due, probably, as we think, to the expansion of the copper firebox being greater than the expansion of the shell, and we sometimes place the stays a little nearer together there, and I have been rather pleased to notice that on some of the roads here the pitch of the stays in the upper shorter rods at the sides has been reduced, in fact, it has been reduced so much that, instead of four spots there are five spots; if you will understand what I mean by that—between every four stays there has been a "fifth spot" put in. That, it seems to me, has been increasing too much. But there is a tendency to place the stays nearer together, especially in the upper part of the box where the greatest difficulty no doubt occurs, as it does with us.

With regard to the drilling of stays, it is not a universal practice, but it is an increasing practice in England. It is curious to notice in some parts of Europe, where the drilling of stays has been carried to an extreme. There was a case in which one of the French railroads got out a specification and asked for tenders for locomotives. I dare say you are aware that in England we are not often able to make locomotives for France. But they were very anxious to get these locomotives made in England, and a certain firm of locomotive builders in England got the contract to build them. But there is one little thing they did not like about it. These staybolts—it was a Belpaire firebox, by the way—these staybolts were marked to be drilled from end to end. The makers thought it would be all right just to drill them a little way in. But when it came to carry it out, these staybolts, three or four feet long, had to be drilled all the way through. The French inspectors were obdurate. They would not allow them to drill simply six inches at each end, but they must have them drilled right through, and the difference between making that a paying and making it a losing job lay just there, and this poor firm had to drill every long stay in this Belpaire firebox from end to end. (Laughter.) That, no doubt, was very unnecessary. They had to be made just like a rifle barrel. There is one little point brought up about pitting. I thought, perhaps, our experience on some of the larger English roads might bear somewhat on the subject here. It had been tried on some of the roads using steel boilers and copper fireboxes where pitting was found a good deal. They place a block of zinc in the boiler. This pitting was reduced, and for many years done away with. This lump of zinc, weighing, perhaps, 10 or 15 pounds, is placed in the barrel of the boiler, and in the course of 12 months or so actually wastes away. It seems to indicate that the action is something of a galvanic nature, and the waste, instead of taking place galvanically upon the boiler, is transferred to the lump of zinc. That has been found to reduce the pitting in some cases. Whether it be the water or whether it be something in the steel is a matter for the chemist to find out. But I fancy from what one hears of the chemical analysis of different parts of ingots, that if there is a difference of many hundredths of a per cent. of some of the ingredients in the steel ingot, the same difference may take place in the different parts of the plate, and if there are bits of pure iron in the plate and the rest of it is well carbonized or is good steel, then, probably, the pure iron might be attacked by anything of an acid nature more readily than the steel itself. I think the tendency being to make so many compound engines, and to carry 200 pounds pressure instead of 120 or 140, it will become very necessary to look after the safety of our locomotive boilers.

Mr. Joggins (Norfolk & Southern): Mr. President, I think that Mr. Barnes has given us a paper about which we can do a great deal of talking, anyway. He, however, has put the matter before us in a way which makes the defects and weakness of boilers very prominent, indeed, and has, I am sure, given occasion to a great many people to think about matters about which they had not thought before, in connection with boilers. One of the very important things which deteriorate a boiler has been mentioned by Mr Worthington. Boilers deteriorate in two ways, sometimes very rapidly: one way is by grooving, which we are acquainted with, although it is very difficult to follow up the cause of every groove. Some water will pit a boiler very badly. Other waters will not treat that same boiler in that way. Some waters will treat some of a set of boilers very badly by producing pitting, and would allow the other boilers of the same set, perhaps, to get along all right. The method of using zinc is, of course, a very old one. I think steamboat engineers have used it for a great many years. I have had some experience with its use, and I think it is a very good thing indeed to put in boilers. A short time before I went to the railway on which I am now, they had a new engine, bought about three years previously, and they used it entirely in yard work, so that it had to use one sort of water and that water was brackish—very slightly, indeed: and the consequence was that they had to renew the firebox in the boiler in about two and a half years. When I was told of that difficulty, I immediately tried zinc in the boiler, and I find now that it has been running for about five years with very slight deterioartion, using, so far as we know, the very same water. It is nearly two years ago that we put into service some pump house boilers, and in one place the water is a little brackish. We were warned of that, but we did not take any steps to help ourselves. In the beginning of last winter we attached a large steam heating plant to the boiler, and during the whole winter, which was a very severe one up to about February, we had trouble with that boiler. Every week or so a telegram would come saying that another tube had burst in the boiler, which was really only ten months old, and a man would have to hurry down and put in another tube as quick as he could. When a tube was taken out, it was found that there was a single hole eaten through the tube. That was all. The rest of the tube was as sound as when put in. After that had occurred a few times I had some zinc put in that boiler. They had one tube break out a week afterward, and although the boiler has been in steam night and day ever since, not another tube has given out. We keep it well supplied with zinc. I can only attribute our immunity from trouble to the presence of that zinc.

We all know that every metal has a certain place in the galvanic scale. Of course, we know that zinc will eat away in the presence of copper very rapidly, indeed, if there is an electric current used from each metal, and it seems to me that a great many steels and irons have little defects which are inappreciable to the chemist, or to the manufacturer, but, nevertheless, are there. There are also plates which are more or less positive or negative in their galvanic action compared with other plates, and those plates which are lower in the scale are certain to be eaten away, it seems to me, and if there are small spots of pure iron around they are certain to be first attacked. Last year I saw a firebox taken out of a locomotive boiler, and on the outside sheet, on the water side, there was a regular comb of metal dug away, as it were. The staybolt itself was not touched, but the iron was scooped out so that the remaining piece was only about 1-16 of an inch thick. I could only attribute that to what I tried to explain now—that that sheet of iron was slightly different in quality to the staybolt, and that the salt water attacked the plate just as zinc is attacked in the galvanic battery. Most of us know that the government requirements are that the hydraulic test shall be placed on the steamboat boilers once every year, and that the hydraulic test shall be 50 per cent. above the working steam pressure. I think they are very wise in requiring that test in that way. While it is very true that a hydraulic test does not tell you whether a boiler is really weak or not, yet it is a certain safeguard to a man who has seen a boiler tested 250 or 260 pounds. He cannot have the same fear of that boiler that he would have if he had not seen it tested at all, supposing he has to use it at 180 pounds pressure.

So far as the rules laid down for inspecting boilers are concerned, I do not at all agree with them. Some of those rules laid down for the second class of boilers are very good, because they are the experience of men who have been testing boilers for years. But the rules laid down for the inspection of a first-class boiler are, I think, very faulty, indeed, from beginning to end, and it would be impossible to carry them out on the majority of our railroads.

Mr. Forney: It may be interesting to call attention to a theory that was developed some years ago, with reference to the causes for the apparently capricious corrosion that takes place in boilers. Some one here mentioned a boiler that ran under conditions the same as another, and one corroded and the other did not. The water was the same and the construction of the boiler was the same. Some years ago attention was called to the fact that if a piece of iron or a piece of metal was subjected to tension and then exposed to a corrosive agent, that the corrosion would occur more rapidly than if the metal was not under a

state of tension. This is verified, I think, by the rapid corrosion that sometimes takes place in the stays of boilers. Another circumstance is the corrosion of steam chests. You will find that that occurs in the corner of the steam chest where the steam pressure exerts an undue strain on the metal at that point, and the acid in the oil will attack the iron just in that particular place. I think that in some cases, perhaps, this corrosion in boilers could be accounted for by the fact that the metal where it occurs is in a state of tension and that there is some corrosive substance in that water.

Mr. Sinclair: I have always noticed that there is liable to be more corrosion in places where there is any movement of metal exposed to heat than elsewhere. Mr. Joggins mentioned corrosion around the staybolts where the sheets were very badly eaten out, and no other part of the boiler was touched. It seems to me that was a case where the staybolt was strong enough to move the sheet, and corrosion acted where the movement was going on. You will always notice on a boiler sheet that has lap joints if there is very much pressure and there are corrosive agents at work in the boiler, that there will be corrosion under the lap at the place where the movement is constantly going on, by the pressure inside, through the tendency of the pressure inside to make the boiler cylindrical and the tendency of the seam to make it flat at that point. It seems that the movement makes the molecules of the metal very liable to be attacked with the corrosive agents.

Most of the practical men who have been at all responsible for the safety of boilers are liable to be thoroughly at odds with Mr. Barnes on the principal points that he takes there. I have a note on fusible plugs. I had a great deal of experience with fusible plugs. And it seems to me that 95 per cent. of the engineers of the country do not want them for locomotive boilers. The trouble with a fusible plug is, that where impure water is used it seldom makes a hole till after the sheet is red hot. At other times it is given to melting, and indicating hot plates where there has never been low water.

Mr. Rogers: I do not believe a hydraulic test is worth a hill of beans unless there is a hammer test with it. Mr. Joggins made one remark to the effect that he would like to know why Mr. Barnes did not say something as to why boilers exploded. I do not believe there is a man on earth who knows why boilers explode. I have been associated with four boiler explosions, two locomotives and two stationaries. Two of them had plenty of water in when they went up and two had not.

Mr. Montgomery: Practical men generally consider that boiler explosions are due to several causes. First, insufficiency of strength in the shell; next, defective bracing or broken braces; again, from internal grooving; again, from heated crownsheets; again, from excessive pressure; again, from reckless management. This morning we had the flues out of an engine more than 20 years old; we took the standpipe out and got a boy in the boiler to examine it. The boiler, so far as we were able to see, was in perfect condition. The Superintendent of Locomotives of the Pennsylvania Railroad said recently, in a published interview, that in 20 years they had only had two explosions, and I think the number of locomotives east of Pittsburgh is something like 2,000. That shows that the design and construction of their boilers is about as perfect as it is possible to make them. Explosions are not confined to one particular locality of the country. The percentage of boilers that explode is about the same in all parts of the country; it shows that the inspection is thorough and the design of the boilers is generally good. Mr. Barnes, in his paper, has fixed the life of a boiler at about 18 or 20 years. That would be a very short limit. Mr. Barnes recommends heavy staybolts. On a locomotive that was assigned to the division with which I am connected, we had occasion to put in some new staybolts, and we found a staybolt 1⅜ inches in diameter that was broken. That being the case, it would be of very little use to make the staybolts large, and I think that the strength in the sheet would not be sufficient to hold such heavy staybolts. The result would be that you would have continual bending and working that would destroy your sheets. When we had the old wood-burning engines they were hot and cold all the time, and we ran them for years and you hardly ever heard of a broken staybolt. But to-day we are finding them all the time, and I do not quite understand it. In regard to holding the bolt in the crownsheet, I should prefer to screw in the bolt and rivet it over. I think there is not sufficient strength there for a bolt not riveted to hold. There is more strain on the crownsheet than any other part of the firebox.

Mr. Sinclair: Mr. Rogers' talk was to the effect that the explosion of boilers was a mystery that no one could understand. There is one thing about that mystery—that it very rarely occurs where there is thoroughly good inspection, and it occurs very frequently where there is poor inspection. I think I am right in saying that under the inspection of the English Board of Trade no marine boiler has ever yet exploded, and a marine boiler is the very worst form of boiler to withstand pressure.

At the conclusion of the discussion of Mr. Barnes' paper, a handsome gold-headed umbrella, appropriately inscribed, was presented by the members to Mr. Calvin A. Smith, who has been Treasurer of the club since 1871.

The election of officers resulted as follows:

President—R. C. Blackall, Superintendent of Motive Power and Machinery, Delaware & Hudson Railroad.

First Vice-President—George W. West, Superintendent of Motive Power, New York, Ontario & Western Railway.

Second Vice-President—A. E. Mitchell, Superintendent of Motive Power and Machinery, New York, Lake Erie & Western Railway.

Third Vice-President—W. H. Lewis, Master Mechanic, Delaware, Lackawanna & Western Railway.

Secretary—John A. Hill, Editor "Locomotive Engineering."

Treasurer—C. A. Smith, Superintendent Union Tank Line.

It is well known that the bronze made of nine parts of copper and one of aluminum is of the color of gold and will not tarnish. It is of a tensile strength equal to steel. At this time this metal can be produced in castings for about the same price that crucible steel costs, and the castings can be made very true to pattern. Why do we not use it and save the expense of working forgings to shape? And why do we not use it for the improved artistic effect its color will give?—"Engineering Magazine."

While describing some interesting experiments in shop lighting at a recent meeting of English mechanical engineers, Mr. B. A. Dobson said that the more diffused light of gas was preferable to the strongly defined shadows of arc lamps. He proposed a system used on the continent, where arc lamps are used, but they are placed in an inverted position to that which is usual, the negative carbon being above and the positive carbon below. This throws the greater part of the light rays upward, as most of the illuminating power proceeds from the crater of the positive carbon. The ceiling and sides should be kept well whitewashed, so that the light thrown up will be again reflected downward. The result is that, without any definite source of illumination being observable, the whole room is flooded with a well diffused light.

New England Railroad Club.

The December meeting of this club was held at the United States Hotel, Boston, on the evening of Dec. 13. President Chamberlain occupied the chair. It was announced that the January meeting of the club would be held in Wesleyan Hall, No. 36 Broomfield Street, and that the subject for discussion would be "Railroad Building, with Reference to Economy in Operating," the subject to be opened by a paper by Prof. C. Frank Allen, of the Institute of Technology. It was also announced that Professor Swaine, of the same Institute, would contribute a paper to the proceedings of the April meeting of the club. It was decided to publish reports of the proceedings of the club in pamphlet form of standard size, and to exchange these with other railroad clubs, the idea being to furnish each member of each club a copy. It was also decided to adopt the feature of a light lunch after meeting, that has become popular with several other clubs and mechanical societies. The President announced as the subject for discussion for the evening: "Locomotive Boilers and Their Attachments," to be opened by Mr. Orlando Stewart.

Locomotive Boilers and Their Attachments.

Mr. Stewart: The attachments are limited only by the size of the boiler butt on which to place them. We all realize the fact that with the increase of these attachments to the boiler the factor of danger is largely increased to the men on the footboard, in case of accident of a serious nature, such as a head collision or derailment which causes the engine to tip over. Should either of these things occur one or more of them are sure to be broken off, thereby allowing the steam and hot water to escape from the boiler. To have these attachments as safe as possible is the object of every locomotive builder and master mechanic. The manner of fastening them to the boiler does not differ materially on any of the roads in this country. My practice for years has been, for check valves to rivet a composition flange 1¼ inch thick and 7 inches diameter onto the side of the boiler, through which I drill a tap hole large enough for the required size of check. For injector throttles I use a composition stand with a flange on the lower end, bolted to the top of the boiler with four ¾-inch bolts. Two sides of this are utilized for injector throttles, two sides for air-brake and blower throttles, and the top for steam gage. Other small attachments are screwed into the boiler in the most convenient place. Thus, I make a 1⅜-inch hole in the boiler supply steam for both injectors, air pump, blower and steam gage.

The item of fuel is the largest single item of expense that a railroad has to contend with, and every efficient master mechanic is constantly studying ways and means to reduce expenses in this direction. How many devices have been tried with this one object in view. Some of these have been tried with very good results, but not one or all combined has brought the locomotive boiler up to the efficiency of the stationary boiler.

The reason for this is patent to the mind of every mechanic in the room. The locomotive boiler is of necessity limited to a certain amount of grate area. The frames or driving wheels, between which the firebox must go limit it in one direction. There is a limit beyond which it is not safe to go with wheel centers, and this limits it in the other direction. So we have all the grate area that it is possible to obtain, and we must be satisfied. But how unsatisfactory are the results obtained. There is a reason, and let us see if we cannot find it. I will ask you to go back with me 30 years. It was a very large engine that weighed 25 tons at that time. The boilers were 38 inches in diameter; firebox 34 to 36; 125 flues; frames the same width as now. There was no overhang to the boiler; it was straight from the mud ring to above the top of the crown bars, the firebox straight from the mud ring to the crownsheet; water space 1½ inch. The fuel was wood. These engines when in service always had plenty of steam. About that time we began to increase the size of the locomotive boilers and cylinders, the frames remaining the same. Where the idea originated that it was necessary to increase the water space as the boilers were increased, I do not know; I suppose it was from the locomotive builders. But this practice continues to the present day, and now we have a water space in some of our largest engines of 3½ inches sides and back, and 4½ inches front; this is below the frames. When you come to the overhang of the boiler above the frames, there is no pretense of making the firebox conform to the shape of the boiler, and I have seen boilers where the six or seven top rows of staybolts were eight to ten inches long. Can any boiler make steam freely with such a body of water around the firebox? I say no. And may it not be possible that this wide and uneven water space is the cause of the vast number of broken staybolts in our boilers at the present time?

I believe in large engines. We have in this country the largest and finest engines in the world. What we want is to make them more economical in the use of fuel. This, I believe, can be done by reducing the water space to 1½ inch on the sides and back, and 2½ inches on the front; and then putting in a circulating pipe to take the cooler water from the front of the boiler and deliver it close down to the mud ring, thereby avoiding the downward current which the water has under ordinary circumstances to reach this place.

It may be said that by reducing the water space to 1½ inch, we will not have sufficient water around the firebox to withstand the intense heat inside. This may have been the reason why the water space was made wider when the change in fuel was made from wood to coal. If so, the reason is not valid. The action of the heat upon the water does not have the effect of lifting the water; it simply changes it into steam; and the hotter the fire the more rapidly this change takes place, and the smaller the quantity the quicker it is done. To illustrate this—do we ever have a hotter fire in a locomotive boiler than they do in a steam fire engine? They use cannel coal, which makes a much hotter fire than any coal that is furnished us to use; yet, with the intense heat which that coal produces, the water space in those boilers is but five-eighths of an inch. The engineer of one of those engines that I measured a short time since told me that the boiler carried but 24 gallons of water when in working order.

Discussion.

Mr. Lauder: I am sorry to say that I shall be obliged to differ with the gentleman who has just read his able paper, in every proposition that he has made. I differ with him thoroughly in the position he has taken with regard to water space. If it were possible to get a wider water space without restricting the grate area I should rather put in a four-inch water space than three, and I would not dare, w.— the high steam pressure we carry now, and with the long furnace we have, to attempt to run a locomotive with a 1½-inch water space. I think it very doubtful if water could be kept round our long, deep furnaces with that water space. I have very little faith in water circulators or devices for producing artificial circulation of water. I have never felt their necessity. I believe a boiler will steam better with a liberal water space than with a restricted one. An engine with a large amount of water surrounding the furnace will always steam more regularly than one carrying a small body of water. I think the only reason why a steam fire engine should carry a small amount of water is that it enables it to get up steam quickly. Besides that, the larger the water space the heavier the machine would be, and lightness is one of its chief requisites. I believe if we should put a four-inch water space around our furnaces, with five or six inches at the front, we should get very much better steaming locomotives than we do to-day, were it not for the fact that to that extent our grate area would be restricted; and large grate area a locomotive must have to enable it to burn the quantities of coal required to meet the exigencies of modern railroading.

As to the question of staybolts, my experience of many years leads me to believe that the shorter the staybolts the more broken ones, in all kinds of locomotive boilers. That has led me to narrow the top of the furnace, so as to get a longer staybolt near the top, where breakages usually occur. One of the serious questions we have to deal with to-day is to get staybolts that will stand a reasonable time without breaking. I believe the design of the boiler has more to do with that matter than any other thing. I have a large number of engines under my care at the present time that were built by the Rhode Island Locomotive Works. Their water space on the sides is three inches all the way from the mud ring to the top of the crownsheets, and we have had more trouble to maintain the staybolts in those engines than in engines of any other design. I find that narrowing the furnace at the top, and thereby increasing the width of the water space, very materially decreases the breaking of the stays at that point. I have always assumed it was due to two causes. One is, the longer the staybolt the less movement there is of the bolt when there are differences of temperature between the inside and outside plate; and with less movement the staybolt will stand more and have a much longer life than if made short. The other cause is, that by having a large water space the temperature of the two sheets is kept more alike than it could be with a restricted water space. With a heavy body of water there you get better results from your fuel, extract more heat from it than with a restricted water space and poor circulation resulting therefrom. With the high pressures we are carrying the question of staybolts is a vital one. I will make a statement which can easily be verified; that in the last ten years there have been built boilers under my supervision and of my own design, not less than 75, and in that 75 we have had just seven broken staybolts. They have been running all the way from two months to eight years. The first boiler we built to carry a pressure of 175 to 180 pounds, and in that boiler we have had up to this time three broken staybolts. This statement can be verified from the records in my office. If that result can be attained with one road, it can be done with all. If a staybolt is nearly broken, the hammer test will fail to detect it so long as any part remains sound. Where it is completely broken off a competent inspector ought to find it by the hammer test. I have not for ten years put in a staybolt less than an inch in diameter, and to that fact, I believe, is largely due my success with staybolts—their freedom from fracture. The result of my experience is that I believe the design of the boiler has more to do with this question of broken staybolts than all other causes combined. For the eight years since we have commenced to build high pressure boilers, $100 at the outside would cover the entire expense of the maintenance of 75 boilers, all in service from periods of two months to eight years, making an average of four or five years' service.

Mr. Twombly: What Mr. Lauder has said as to the boilers of his own construction is absolutely true..

Mr. Butler: I witnessed an experiment some time since, to show the motion of the firebox in the operation of getting up steam. At a pressure of 100 pounds the crownsheet rose 5-16 of an inch; above 100 pounds it began to go back again, as the boiler began to be heated alike, and at 160 pounds, it went back to its original position, within 1-16 of an inch. That would show what the conditions are to break staybolts. When they break it is near the outside shell, and it would certainly seem that a long staybolt would stand more of that expansion and construction up and down than a short one, because it would be more elastic. I don't think the water space should be less than three inches, nor as large as Mr. Lauder indicates. I think in the construction of boilers the hammering in of staybolts is wrong. I believe the staybolt can be screwed to its place without a hammer blow being struck, and it is not necessary to wrench them in with a long wrench; they can be set in with a 16-inch wrench.

The Rome Locomotive and Machine Works were destroyed by fire recently. The total loss was $500,000 and the insurance but $300,000.

Messrs. Valentine & Co., manufacturers of the well known Valentine varnishes and colors, have issued a very attractive and useful memorandum book with a calendar for 1894 embodied. The official ribbon granted this company at the Columbian Exposition is reproduced on the cover of the book.

Stanley G. Flagg & Co., of Philadelphia, Pa., manufacturers of steel airbrake fittings, Keystone soft metal and Vulcabeston unions, are busy in all their departments; the Keystone unions, requiring no washers, have been adopted by a large number of locomotive builders and superintendents of motive power as their standard.

The Midvale Steel Company has just received a report from the West Shore Railroad giving the mileage made by a set of Midvale tires on engine No. 47. This engine is of the four-wheel type, weighing 94,500 pounds, with weight on drivers of 62,500 pounds. Size of wheels, 68 inches diameter. New tires, 3 5-16 inches thick, were applied to this engine April 15, 1890, and after turning, in November, 1893, were 2⅝ inches thick, showing a net reduction of 11-16 inch, which included natural wear, brake wear and loss of metal in turning. Total mileage made to first turning, 261,733 miles; equivalent to 23,794 miles to 1-16 inch loss of metal.

The Thomson Meter Company, of 79-83 Washington Street, Brooklyn, N. Y., has issued a pamphlet describing and illustrating the "Bee" water meter of its manufacture, and giving much information about water meters that is interesting and useful to know.

This meter was invented by Frank Lambert, of Brooklyn, more than six years ago; was first manufactured in 1887, and in 1890 but 5,000 of them were in use. To-day there are 40,000 in operation, an increase which shows that Mr. Lambert and his associates are rapidly coming into their reward for their patience. The present officers of the Thomson Meter Company are: Frank Lambert, President; Geo. T. Montgomery, Vice-President; Joseph W. Kay, Treasurer; and Henry C. Folger, Secretary.

By the old way of making tin rollers a cord or wire is required to hold the shade in the groove, and to most people this is a source of great annoyance. The Stewart Hartshorn Company has perfected, and is now putting on the market, one of the greatest improvements ever made in the shade roller line. It is a new groove tin roller, that it has been furnishing for more than a year to a limited number of customers so that it might be given a thorough test before offering it to the trade in general. The trial has proved entirely satisfactory, and from the words of praise bestowed upon the new groove by those who have used it, it will probably soon come into quite general use. The shade is attached to the new groove with patent fasteners (which come packed in extension piece of each roller with directions for use), that do away with all trouble, and make it a pleasure to mount a shade on a tin roller when formerly it was hard work.

The Central Railway Club.

At the November meeting of this club it was resolved on motion of Mr. Rogers to continue the practice of holding a banquet in connection with the annual meeting, the ladies to be included among the guests and the committee of arrangements to be the same as last year. It was also decided to have the banquet in the evening.

Airbrakes and Brake Rigging.

The committee on this subject, in consequence of its members having been very much occupied with official business, was unable to present a report, but the club was favored with a valuable paper by James Howard, relating chiefly t othe matter of brake rigging of airbrakes. Mr. Howard said that so long as so many imperfect rigs remain in daily use, the hackneyed expression was likely to be heard, "the airbrakes failed to work," when in fact it is the brake rigging or foundation brake that is at fault. Of late the question of the automatic adjustment of the brake has been pushing itself to the front. The master car builders have shown a disposition to consider some such device as necessary to the further perfect action of the airbrake. Mr. Howard described at length some of the conditions that must exist in the brake rigging before any reliable adjusting device can be made. No slack adjusting device can be made to discriminate between slack that is caused by the wear of brakeshoes and slack that is thrown into the brake rigging by loose and ill-fitting pins, worn boxes, and pedestals, springing brakebeams, inefficient hand brakes, etc. When such faults exist there is apt to be with any adjuster the unpleasant experience of holding up the brakes, but it is folly to condemn the adjuster in such a case. To operate any adjuster there must be two positive motions —that is, a forward and back motion. There appears to be only one place in which this motion is constant and invariable, and that is in direct connection with the piston of the brake cylinder.

The desirability of an adjuster upon freight cars seems more obvious than that there should be one upon passenger cars as the latter comes often under direct inspection, while a freight car travels all over the country, and is far more liable to have its air equipment rendered inoperative by want of the adjustment of its foundation brake. It is possible to make an adjuster work with a spring, but there is a well grounded objection to the introduction of springs. The cause of the difficulty is the separation of the piston head from its rod. When the brakes are applied the rod is pushed out of the cylinder by the piston head. Upon the release of the brakes the rod is supposed to return into the cylinder, but if, from any cause, such as undue friction or cramping of the rigging, the rod is impeded in its return, a space is left between the rod and piston head. Upon the next application of the brakes, especially if it should be an emergency application, the piston head is driven violently against the end of the rod and a hole is punched through the head. This is no more than might be expected of such an arrangement of piston and piston rod. This is a question that deserves attention. It amounts to a defect in air-brakes. If the piston rod is not absolutely certain to follow up the piston head in its return upon the release, then this same thing may occur upon the next application of the brakes.

There was no discussion.

The Committee on Airbrakes was continued.

Driving Boxes and Eccentrics.

Mr. Lavery, from the special committee on causes and prevention of the heating of driving boxes and eccentrics, presented the following report:

Driving boxes and eccentrics heating can be traced to many direct and indirect causes that would require pages of reports to cover were it necessary. We are of the opinion if these parts are properly designed, carefully constructed, of good material, and proper lubricants used, the causes for heating have been covered. And if proper care is taken by those having our locomotive in charge, the prevention also is given. Driving boxes and eccentrics well designed should have strength without unnecessary weight, filled with oil cellars or recesses for the lubrication of the wearing parts. Constructed true and square in order that the surface may have easy contact with one another without pinching or binding. The material should be well considered, being strong and tough to carry the weights, as well as to resist the strains to which they are submitted.

The lubricant should be of the best grade of oils sufficiently light in body to penetrate to the surfaces, and yet not run off quickly after being applied. Presuming our locomotives are equipped as herein noted, we may reasonably expect good service if attended with care by those having them in charge, and in our judgment the heating of driving boxes and eccentrics will to a very large extent at least be prevented.

In the discussion that followed, the opinion prevailed that the report had covered the subject so thoroughly that it left little to be said.

Friction of Bearing Metals.

Recently a series of tests of the working of several anti-friction-bearing metals were made at the works of one of the leading firms of marine engineers in the north of England. Among the metals tested were Parson's white brass, Stone's navy white bronze tandem metal, the government mixture, and magnolia metal.

Stone's navy white bronze and magnolia much surpassed the other metals, and a final test of the two was made, which showed the great superiority of the latter. The machines were identical in each case, and consisted of a 3-inch shaft, running in bushes 4½ inches long, centers 16¼ inches, and the weight was applied by a lever and tested spring. The weight was 3 cwt., and the leverage 9 to 1; area of bearing, 3 inches by 2 3-16 inches equals 6.56 in each case, and pressure per square inch, 495.12 pounds.

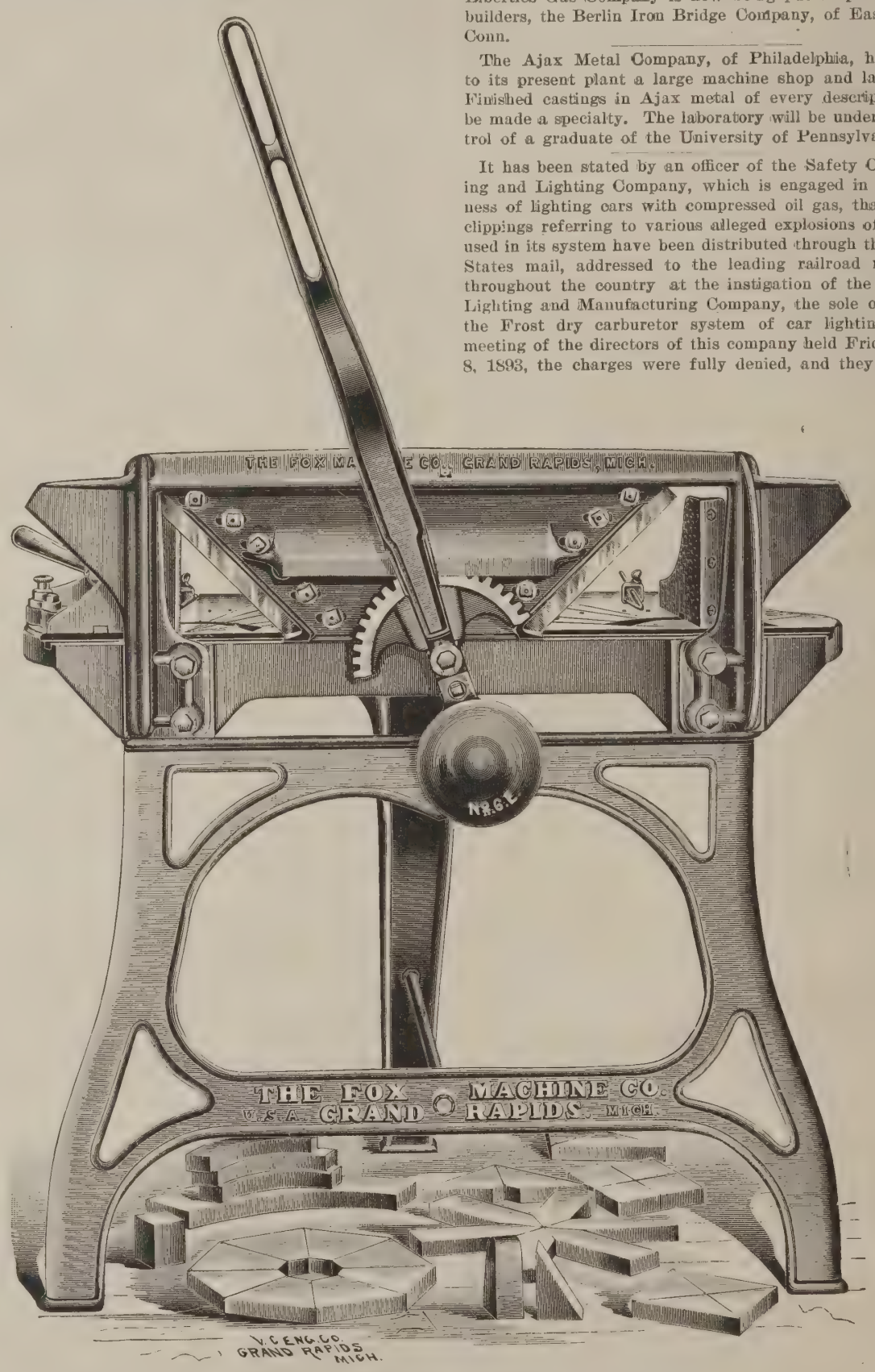
The bearings were each lubricated with 47 drops of oil per minute for the first ten minutes, and then the supply of oil was entirely cut off. The white bronze bearing fused at a temperature of 293 deg. Fahr., in three hours and ten minutes from starting; while the magnolia bearings were in perfect condition four hours and ten minutes after starting, the temperature being 129 deg. Fahr., and the bearing had actually cooled down from a maximum of 145 deg. Fahr.

In explanation of the decrease in temperature of magnolia metal during the last portion of the run, it should be stated that this bearing was cast on a mandrel and put in place rough, so that it had comparatively little bearing surface at first, and when examined at the end of the test was found not to have a full bearing even then; but, of course, as the total pressure remained the same throughout the test, viz.: 3,024 pounds, as the bearing surface increased the pressure per square inch was correspondingly reduced; hence the decrease in temperature.

An Improved Universal Trimmer.

The machine we illustrate herewith is made by the Fox Machine Company, Grand Rapids, Mich. It is an improved universal trimmer, the gage of which has an angular movement of 105 degrees. The machine is portable, yet stands firmly on any floor.

The gage is pivoted on the underside of the bed directly under the line of the knife, always keeping the shearing edge close to the knife, and always in the same position.



IMPROVED UNIVERSAL TRIMMER, FRONT VIEW.

The taper pin stop locates the gage quickly and accurately at any of the angles, effecting a large saving of time.

The eccentric lever clamps the gage at any angle. The E trimmer has a large bed; stands on its own feet; is a very heavy machine, yet is easy to handle, as the adjustments are convenient and quickly made. The cut is made quick, as one-half revolution of the lever gives a full stroke of the carriage.

This machine has given very good satisfaction wherever used, and has come to be considered as a standard tool in a great many pattern shops.

The Jones & Lamson Machine Company, of Springfield, Vt., has issued a neat pamphlet describing and illustrating the "2 by 24 Flat Turret Lathe," which is manufactured exclusively by it, and which has been doing successful work in a number of railroad, locomotive and other shops. Some improvements that have been made in this lathe are also illustrated and described.

The State Street Horse Railway Company, at New Haven, Conn., has placed the contract for the roof on its new power house with the Berlin Iron Bridge Company, of East Berlin, Conn. The building will be 84 feet wide and 250 feet long, the roof trusses being of iron, covered with slate.

The Frost Veneer Seating Company, of New York City, has been awarded medals for its exhibits in the Transportation, Manufacturers and Fine Arts departments of the Columbian Exposition.

The Ensign Manufacturing Company, of Huntington, W. Va., is building Russell snow plows for the Rome, Watertown & Ogdensburg, and the Western Maryland, and the New York, Susquehanna & Western railroads.

The Phosphor-Bronze Smelting Company, of Philadelphia, has removed its offices to 2200 Washington Avenue, that city. It has erected a new foundry and smelting works at that location, and largely increased its facilities for the manufacture of its "Elephant Brand" phosphor-bronze, ingots, castings, wire, sheet, rods, etc.

The roof for the new purifier house of the Northern Liberties Gas Company is now being put in place by the builders, the Berlin Iron Bridge Company, of East Berlin, Conn.

The Ajax Metal Company, of Philadelphia, has added to its present plant a large machine shop and laboratory. Finished castings in Ajax metal of every description will be made a specialty. The laboratory will be under the control of a graduate of the University of Pennsylvania.

It has been stated by an officer of the Safety Car Heating and Lighting Company, which is engaged in the business of lighting cars with compressed oil gas, that certain clippings referring to various alleged explosions of the gas used in its system have been distributed through the United States mail, addressed to the leading railroad managers throughout the country at the instigation of the Railroad Lighting and Manufacturing Company, the sole owners of the Frost dry carburetor system of car lighting. At a meeting of the directors of this company held Friday, Dec. 8, 1893, the charges were fully denied, and they declared they had no knowledge whatever of the person or persons who have caused such clippings to be sent out, and that they deprecate the malicious spreading of the intelligence of such alleged disasters.

The Huyett & Smith Manufacturing Company, of Detroit, Mich., are installing two very large plants; one for the Intercolonial Railway of Canada, at Moncton, N. B., consisting of two of the largest sizes of the Smith hot blast apparatus, and one for the Kansas City, Ft. Scott & Memphis Railroad, at Springfield, Mo., which also takes two large apparatuses. The contracts for these heating systems were awarded to the Huyett & Smith Manufacturing Company, after the above companies had made a thorough examination of the heating plants of other railroad companies, which were furnished by this company and had been in operation for some time. This company report their sales to be good considering the times, and especially is this so of their foreign trade, having recently sold and shipped eight hot blast apparatuses to England, three to Canada and one to Germany. This concern also manufacture the celebrated Smith steel disc ventilating fans, exhaust fans, dust separators, steel plate steam fans, forge and pressure blowers, etc.

The "Crown" Oil Cup.

The following engraving represents the "Crown" index, sight-feed glass oil-cup.

This cup is provided with an "index" device for regulating the flow of oil, and an indicator arm turning on the lid to mark the notch giving the desired feed. When desired the feed can be instantly turned off, and on again, by replacing the index lever in the notch of the indicator arm. When the index arm is closed the lever can be left

The Crown Oil Cup.

to stand up out of the notch, thus acting as an indicator to show from a distance that the feed is shut off.

These cups are all made of cast brass, handsomely finished, and are heavy and durable. The oil will not leak out between the brass and the glass parts, as is the case with ordinary spun brass cups. Wherever used they are giving good satisfaction. They are made in eight sizes, holding all the way from ⅝ of an ounce to 18 ounces of oil.

Besides the "Crown," this company makes seven other styles for various purposes, all of which are fully described and illustrated in a catalogue, which will be mailed to any address upon request. These goods are manufactured by the Lunkenheimer Company, of Cincinnati, O.

Riehle Brothers Testing Machine Company, Philadelphia, report indications of an improvement in business, and among recent orders the following: 20,000-pound horizontal testing machine, 10,000-pound vertical screw power testing machine, canvas testing machine for the United States Government, warehouse and railroad trucks for export,

Cory's Force Feed Lubricator.

At the present time of very fast trains, making long runs between stops, the question of facilities for thorough and positive lubrication of all journals, eccentrics and links of the fast-moving engine, becomes very important. The introduction of the device herewith illustrated and described marks a distinct advancement in securing the highly desirable means of oiling all important bearings of the locomotive, while it is running at full speed, and this is fully accomplished direct from the cab, from whence it is possible to oil each bearing successively or any particular bearing repeatedly that may be giving temporary trouble by heating.

The lubricator is placed conveniently of access in the cab, and consists of an "oil supply reservoir" of one gallon capacity. At the lower part of this reservoir is seated a hollow conical valve A; the cavity in this conical valve will hold about one-seventieth of a gallon. This space inside of conical valve is termed the "oil discharge reservoir," and connects to oil supply reservoir by small valve B, seated in upper part of hollow valve. The side of hollow valve is perforated by a hole E, one-eighth of an inch in diameter, that can be brought to coincide with any one of the 16 outlet holes at base of oil supply reservoir, each of which connects with a line of pipe to a given bearing.

There are 16 notches on the upper rim of lubricator, and when the lever is brought to engage with any one of these notches, the hole in the side conical valve then coincides with a given hole in the base, leading to outlet pipe.

When the lever is thus placed for any bearing which it is desired to supply with oil, the valve shown attached to base (and connected to either steam or air pressure) is opened, and pressure enters through the small valve C, into oil discharge reservoir, closing valves B and D, and forcing contents of oil discharge reservoir through hole E, and through line of pipe connecting with bearing that it is desired to oil.

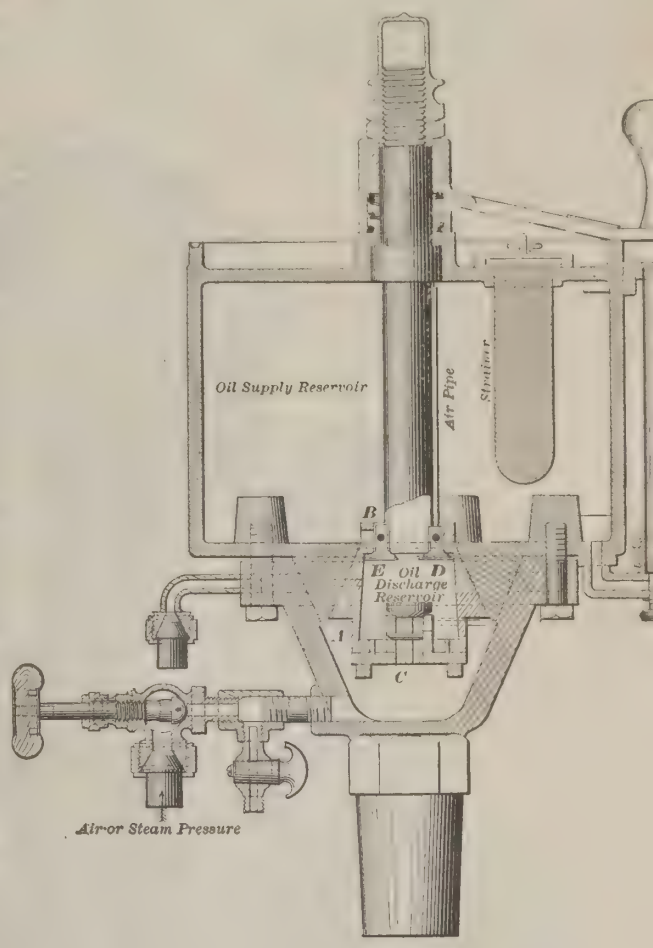
This requires but a moment, when pressure should be shut off, and lever placed midway between any two notches, when in about five seconds the discharge reservoir will again be filled and ready for discharging to any other desired bearing when lever is placed in notch corresponding to it and pressure again turned on. For all main journals, three-way tips are furnished for ends of pipe, thus the wedges and jaws are oiled as well as the journal.

Thus the engineer has at his command a positive means of oiling all parts of his engine however fast the engine may be running and however long distances he is obliged to run without stops, and preventing any dangerous and destructive heating and cutting of bearings, delays of trains and possible accidents that might occur.

The use of this device is not intended to release the engineer from the responsibility of adjusting his present oil-cups, and inspecting and oiling by hand when first taking the engine from terminal station, the same as if engine was not equipped with the force feed lubricator. There is simply placed at the disposal of the engineer a gallon of oil that can be forced from the cab to any desired bearing as occasion requires.

There are now a number of locomotives running, equipped with these lubricators, some having been in service for two years and have never failed to perfectly perform their work, and none have required repairs of any kind to lubricator or any piping. The piping can either be one-eighth-inch wrought iron or copper pipe. This device is being placed upon the market by Mr. M. C. Hammett, of Troy, N. Y.

Messrs. Manning, Marwell & Moore, dealers in railway and machinists' tools and supply, of Nos. 111-13 Liberty Street, New York City, have issued a magnificant catalogue of the tools and appliances they handle, illustrating and describing the same, and in most cases naming the price. All kinds of modern tools useful in shop practice, and all kinds of supplies used on railroads, that can properly



Cory's Force Feed Lubricator.

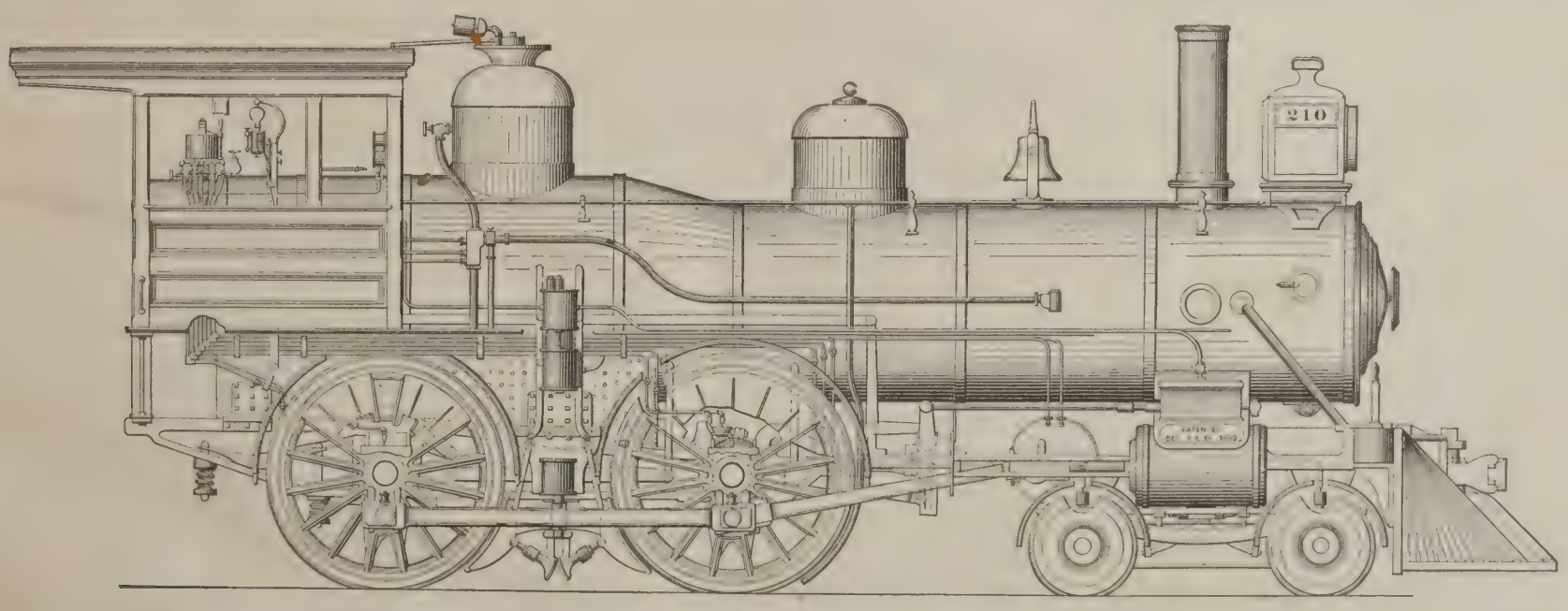
range and character the catalogue meets the needs of railroad mechanical officers and purchasing agents, as well as manufacturers and the users of large and small tools of every description.

The firm announces that it is prepared to furnish specifications, plans and estimates of cost for the erection and fitting out of all kinds of shops using iron, steel or woodworking machinery.

Mr. J. T. Connelly, manufacturer of improved mechanical devices, Milton, Pa., has issued a catalogue which illustrates and describes in detail devices for tapping staybolt holes in locomotive boilers which are behind the frames, drivers or other parts; also devices for drilling out or removing old or broken staybolts from the fireboxes of locomotives without displacing any of the intervening parts of the engine. Radial devices especially adapted for tapping staybolt holes in long distances are also illustrated and described, as well as is a new design of locomotive boiler, and an improved lubricator for car axles, crankpins, etc.

The Reading Traction Company, of Reading, Pa., has placed an order for its new car house with the Berlin Iron Bridge Company, of East Berlin, Conn. The side walls will be of brick, the roof of iron. The building will be 85 feet in width and 180 feet in length. The width is divided into two parts of 42½ feet each, a row of columns supporting trusses at the center.

The car heating decision in the Searles interference case reported by dispatches from Washington dated Nov. 22



LOCOMOTIVE EQUIPPED WITH CORY'S FORCE FEED LUBRICATOR.

3,000-pound transverse testing machine, 1,000-pound cement testing machine with worm gear, "Star" cement testing machine, 40,000-pound screw power testing machine, two 1,000-pound cement testing machines, 100,000-pound testing machine, six 20-ton Riehle-Robie protected ball-bearing screwjacks.

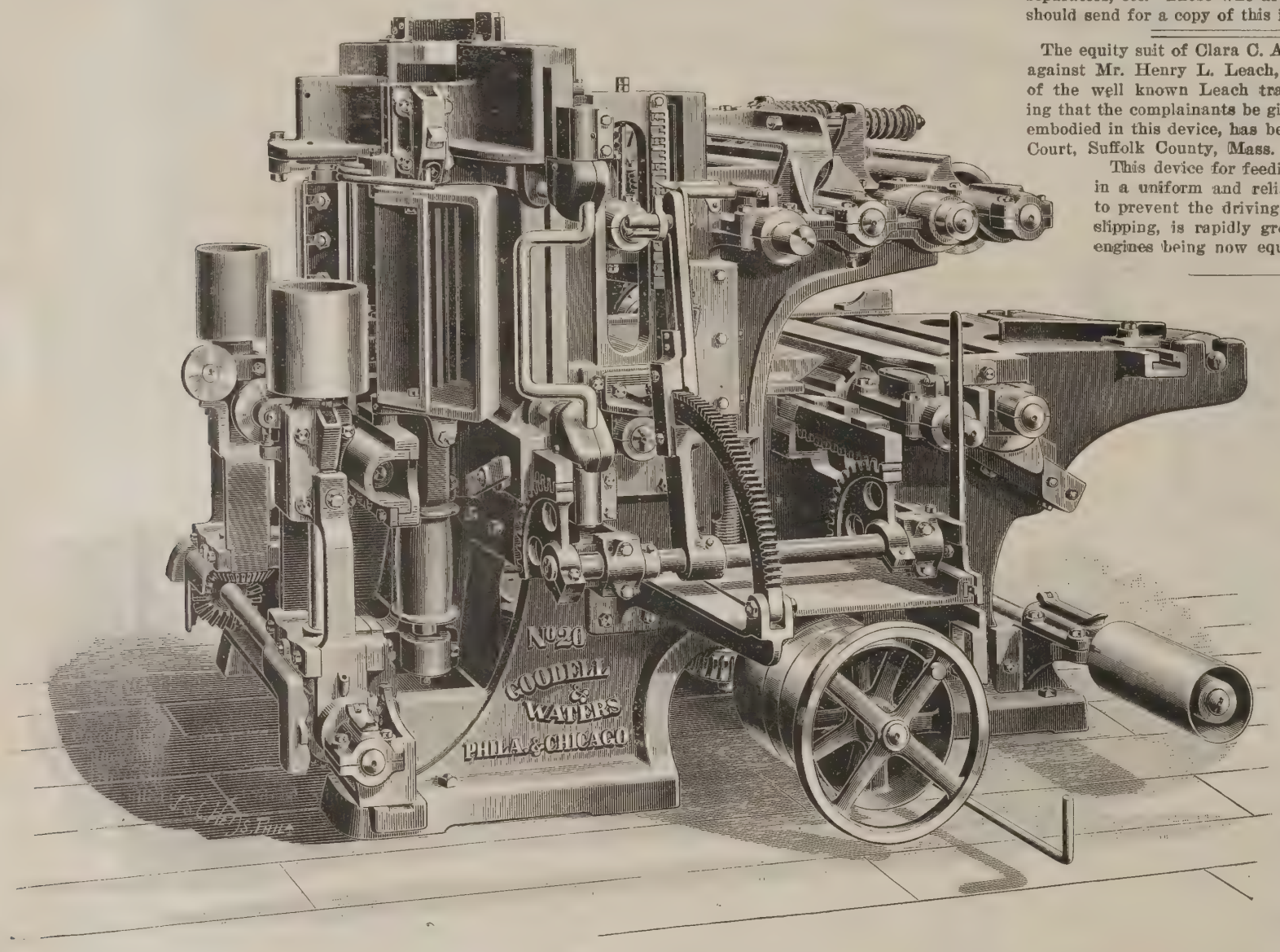
come within the scope of a catalogue, are named, described and illustrated in this one. It contains over 1,100 pages and nearly 6,000 illustrations, and the paper, printing and binding are of excellent quality, and in keeping with such a complete and expensive work. The index is complete and well arranged, and covers 12½ pages. In its

was in favor of the Consolidated Car Heating Company, of Albany, and the New York Safety Company, who were both represented in the argument by the Hon Don M. Dickinson, of Detroit. The decision was against Searles and not against the Consolidated Car Heating Company, as reported in some papers.

Special Quick Change Dimension Planer. (No. 20).

The accompanying illustration represents something that may properly be called an entirely new and novel machine. It is built by Messrs. Goodell & Waters, of Philadelphia. It is a heavy dimension planer especially intended to meet the requirements of car shops and bridge works, and all establishments using large timbers. It weighs 11,500 pounds.

The prominent feature of this machine, and to which the makers invite special attention, is the quick method of making changes. In all large machines there is generally much time lost in changing from one size to another, and Messrs. Goodell & Waters, quick to recognize the value of a dimension planer that could be readily changed for different sizes, have introduced their No. 20 which embodies this important feature. This machine may be adjusted to any variation in less than a minute. The under head performs the work first. Its depth of cut may be changed instantly. The driving belts and all feed appliances



QUICK CHANGE DIMENSION PLANER.

are on the right hand side of the machine. All operating levers and adjusting devices are on the left hand side, near the operator.

This machine is built to plane on four sides, 20 inches wide and 14 inches thick, and will vary in size from its full capacity to 2½ inches wide by ¾ inch thick. There are in all seven feed rolls, five horizontal and two vertical. The two vertical rolls are placed at the rear beyond the side heads. The journal boxes for the rolls are in halves.

The top feed rolls, cutter head and pressure arrangements are all combined, supported on two vertical screws, and operated by power hoist to change rapidly to any thickness. The right hand side head combined with vertical delivery roll and fence are moved in one operation by means of a hand lever to variations of ¼ inch up to 12 inches in width. The left hand side head and roll move by means of double screws to any fractional part of an inch, to the amount of eight inches, giving a total width of 20 inches. An indicator, at a convenient point of view, enables the operator to measure the distances between the heads. This machine is as convenient to change in width as an ordinary gang ripper.

All heads are solid forgings, and slotted on four sides. The top and under heads swing in a seven-inch circle. The journals are 2⅜ inches diameter, 11½ inches long. The side heads are placed at the rear end of the machine, and are more easy of access than when in the center. The delivery feed rolls move in combination with these heads. The machine is driven from the rear end. The counter frame forms a delivery table. The fast and loose pulleys are 16 inches diameter, eight inches face, and should run 900 revolutions per minute.

For further details we would refer our readers to the manufacturers, Messrs. Goodell & Waters, 3003 Chestnut Street, Philadelphia.

The Allen Electric and Supply Company, No. 232 Carter Street, Philadelphia, Pa., will handle the Graham trucks in all the States lying between the Hudson River on the East and the Mississippi River on the West. The increased orders taken for the truck recently and the great number of inquiries in the Middle States section, made it imperative to have a competent agency in this territory.

A Great Varnish and Color House.

Messrs. Valentine & Co. were most fortunate in the selection of the site of their varnish and color works. They have a large block of land in the Eastern District of Brooklyn, affording ample facilities for handling their extensive trade. Brick and iron only were used in constructing the buildings, as it was necessary to satisfy the insurance companies as well as themselves. The insurance inspectors at first were inclined to be incredulous at Valentine & Co.'s claim that their factory was fireproof and really a high-class risk, despite the inflammable materials required in the manufacture of varnish. Early this year it became necessary to increase their storage capacity for varnish, and the alterations have just been completed, and now the largest of their several tankrooms has a capacity of 145,000 gallons. Two other tankrooms have a capacity of 74,000 gallons, giving a total for these three rooms alone of 219,000 gallons; and this is exclusive of the varnish in the factory proper and stocks carried at their warehouses in Chicago, Boston and Paris, and in the hands of their regular agents. The company is thus enabled to hold larger stocks of varnish (for the purpose of ripening or maturing) than heretofore.

A Modern Method of Heating Buildings.

There are but few mechanics that have not a vivid recollection of stoves, charcoal furnaces and various other contrivances used to heat the workshops in which they spent the days of their apprenticeship.

The machinist stood at his lathe with a scorching hot stove at his back, and his hands and feet like chunks of ice. Even his tools had so much frost in them that they would stick to his hands "like a brother."

Time brought a change in this method of heating shops and steam coils, strung around the building, were introduced. Here was supposed to be the acme of shop heating. It was a great improvement, so far as the heating itself went, but it had many serious drawbacks.

The first cost was a "staggerer" for the owner; then after the plant had been installed some careless employee forgot to look after the heating apparatus and let it freeze up. The next morning there was no heat, as almost half the pipes were split wide open. Then again some so-called engineer, whose lack of knowledge of steam heating would fill volumes, got some cranky idea in his head and put it into execution, with the result that there was so much water hammer in the coils that several return bends and elbows were broken, and the whole heating plant had to be overhauled at great expense.

These were minor considerations when compared to the continual running expense. The proprietor endeavored to use the exhaust steam from his engine for heating, which resulted in so much back pressure that his coal bill was nearly doubled.

Something that would heat a shop evenly in all kinds of weather, the necessity of having fresh air for the employees, something in the shape of a heating plant that would not freeze up and burst, but that could practically take care of itself, caused the invention of the hot blast system. By this system fresh warm air is forced into every quarter of the building by a fan propelled by a small engine, or run from the line shaft. The exhaust from the main engine is turned into a bank of steam coils that are incased by a steel jacket. In front of these coils is a fan which forces an enormous volume of cold air over the coils. After passing over these the warmed air is conveyed to the points desired in galvanized iron conduits or brick ducts and flues. Because the great amount of air thrown in contact with the coils is one of the secrets of the success of this system, as the coils often act as a condenser and instead of creating a back pressure on the engine, often reduces the natural back pressure below the atmosphere.

The Huyett & Smith Manufacturing Company, of Detroit, Mich., one of the oldest concerns in the business, has recently issued a new catalogue which clearly sets forth this particular system and contains besides many things that are new to the heating and ventilating world. The catalogue also shows that this company are manufacturers of a very extensive line of blowers, exhaust fans, ventilating fans, engines, marine water tube boilers, steam traps, dust separators, etc. Those who are interested in these matters should send for a copy of this interesting catalogue.

The equity suit of Clara C. Austin Leach and A. E. Leon against Mr. Henry L. Leach, inventor and manufacturer of the well known Leach track-sanding apparatus, praying that the complainants be given control of the inventions embodied in this device, has been dismissed in the Superior Court, Suffolk County, Mass.

This device for feeding a small quantity of sand in a uniform and reliable manner upon the rails, to prevent the driving wheels of locomotives from slipping, is rapidly growing in favor, about 1,500 engines being now equipped with the apparatus.

Mr. W. S. Rogers, of Troy, N. Y., has begun the manufacture of two improved forms of torches for use on locomotives, and by car and locomotive inspectors at terminal points.

The Cincinnati Milling Machine Company, of Cincinnati, O., has issued a neat pamphlet descriptive and illustrative of its universal cutter and grinder. This machine is provided with all adjustment necessary to grind between centers work to eight inches in diameter, but straight face cutters, metal slitting saws, inserted tooth mils, etc., can be ground to 14 inches in diameter. It is also arranged for grinding cylindrical, conical and flat surfaces, such as hardened spindles, arbors, bushings, cam rollers, concave sides of cutters and saws, and the face of punching dies, hardened gages and templates. A great variety of small machine parts can also be finished to an advantage by grinding on this machine.

Our Directory.

Lehigh Valley.—Theodore Voorhees is appointed Genera Manager.

Fitchburg.—Henry L. Leach, Division Master Mechanic, has resigned.

Cleveland, Akron & Columbus.—W. J. Vance is appointed Master Mechanic.

Union Pacific, Denver & Gulf.—Frank Trumbull is appointed Receiver.

Jacksonville, Louisville & St. Louis.—S. P. Wheeler is appointed Receiver.

Philadelphia, Reading & New England.—C. M. Lawler is appointed General Manager.

Louisville, Evansville & St. Louis.—W. E. Looney is appointed Master Car Builder.

Rome, Watertown & Ogdensburg.—P. T. Lonergan is appointed Master Mechanic.

Toledo, Ann Arbor & North Michigan.—John B. Connors, Superintendent, has resigned.

Denver & Rio Grande.—Henry Schlacks is appointed Superintendent of Motive Power.

Boston & Albany.—Arthur B. Underhill has resigned as Superintendent of Motive Power.

Louisville, New Albany & Chicago.—George K. Lowell is appointed General Superintendent.

Arkansas Midland.—John J. Horner has resigned as President, and is made General Manager.

Western New York & Pennsylvania.—C. H. Newman, Master Mechanic at Oil City, Pa., has resigned.

Illinois Central.—J. J. Casey is appointed Assistant Superintendent of Machinery, with office at Chicago.

Pennsylvania.—Geo. J. Parkin is appointed Master Mechanic at Erie, Pa., vice J. A. Wood, transferred.

Great Northern.—R. W. Bryan is appointed General Superintendent, and C. W. Case is mad General Manager.

New York Central.—Geo. H. Haselton and Jas. Buchanan are appointed Assistant Superintendents of Motive Power, in charge of the divisions east and west of Syracuse, respectively.

Baltimore, Ohio & Southwestern.—J. G. Neuffer is appointed General Master Mechanic, with office at Cincinnati. J. M. Sheer has resigned as Master of Rolling Stock, and the office is abolished.

Northern Pacific.—F. W. Gilbert is appointed Superintendent East Cascade Division, with office at Sprague, Wash. Joseph McCabe Superintendent West Cascade Division, with office at Tacoma, Wash. John Dorsey Superintendent Missouri Division, with office at Dickinson, No. Dak.

NATIONAL CAR AND LOCOMOTIVE BUILDER

FEBRUARY, 1894.

CONTENTS.

The Fitchburg Railroad has ordered 600 cars.

The Atlantic Coast Line is in the market for four passenger engines.

The Baltimore & Ohio Southwestern is in the market for 1,000 new cars.

The Columbus, Hocking Valley & Toledo road intends to build 1,500 coal cars.

The Cumberland Valley is building 40 box cars in its shops at Chambersburg, Pa.

The Cold Blast Refrigerator Co., of Kansas City, is about to order 200 refrigerator cars.

The Jacob Dold Packing Company, of Kansas City, is in the market for fifty refrigerator cars.

The Chesapeake & Ohio is expected to soon become a large buyer of cattle, refrigerator and grain cars.

The car shops of the New York, New Haven & Hartford, at New Haven, are now running on full time.

The new shops of the Southern Pacific, at Ogden, Utah, are completed and have been put in operation.

The Kansas City Smelting and Refining Company is reported to be about to purchase a number of cars.

The Michigan Central contemplates equipping all its passenger cars entering Detroit with Pintsch gas.

The Standard Steel Works, of Philadelphia, have resumed operations at their works at Burnham, Pa.

The Missouri, Kansas & Texas contemplates the erection of repair shops and a roundhouse at Hilisboro, Tex.

The Cleveland, Chicago, Cincinnati & St. Louis road is in the market for 100 stock and 100 refrigerator cars.

The Burlington, Cedar Rapids & Northern has ordered 100 stock cars of the Barney & Smith Car Company.

Several departments of the Otis Steel Works have resumed operations, giving employment to about 300 men.

The New York, Ontario & Western has ordered 500 coal cars of the Michigan-Peninsular Car Company of Detroit

The Lake Shore & Michigan Southern has ordered 200 cars from the Michigan-Peninsular Car Company, of Detroit.

The South Baltimore Car Works have orders on hand for over 500 cars, and the shops are now running on full time.

The Richmond & Danville is about to order eight 10-wheel passenger engines for service on the new line to Florida.

The old New York & Northern Railroad Company has been reorganized as the New York & Putnam Railroad Company.

A contract for 200 refrigerator cars for the Armour Packing Company has been given to the Wells-French company, of Chicago.

The Produce Dealers' Dispatch Line, with offices in the Royal Insurance Building, Chicago, is in the market for 50 refrigerator cars.

The Delaware, Susquehanna & Schuylkill road is in the market for 500 gondola cars, to be built on Pennsylvania R. R. specifications.

The Barney & Smith Car Co., at Dayton, O., have an order from the Baltimore & Ohio Southwestern road for 100 special dump cars.

Pullman's Palace Car Company has decided not to send the train it exhibited at the Columbian Exposition to the Fair at San Francisco.

The Pennsylvania Railroad Company burns over 12,000 tons of coal a day between Pittsburg and Jersey City at a cost of considerably over $40,000.

After an idleness of several weeks the National Tube Works of McKeesport, Pa., resumed operations Jan. 24, giving employment to about 2,000 men.

The Peoria, Decatur & Evansville was placed in the hands of receivers, Jan. 10. Mr. E. O. Hopkins and Mr. Perry Huston were appointed Receivers.

The Schenectady Locomotive Works have orders to build three switch engines for the New York Central & Hudson River road and two for a Vermont road.

Messrs. Thomas C. Platt, of New York, and Marsden J. Perry, of Providence, have been appointed permanent Receivers of the New York & New England R. R.

The boiler of a mogul locomotive on the C., C., C. & St. L. railway exploded on Jan. 15 near Muncie, Ind., killing the fireman and injuring the engineer and brakeman.

The "Monon" will shortly begin the erection of new repair shops at Lafayette, Ind., the town having voted $100,000 to secure the renewal of the railroad plant.

General Manager Bradbury, of the New York, Lake Erie & Western, states that the gross earnings of the road will not show a decrease of more than $60,000 below those of 1892.

The Ensign Manufacturing Company, of Huntington, W. Va., has resumed operations. The company finds that the demand for new cars is confined almost exclusively to special kinds.

The Chicago & Grand Trunk Railway is having some coaches built by the Ohio Falls Car Manufacturing Company, of Jeffersonville, Ind. They are to be equipped with the Barr vestibule.

The Chicago, Milwaukee & St. Paul road has ordered two Baker fireproof heaters for use in compartment sleeping cars. The Pullman company has also ordered 12 of the same style of heater.

The directors of the Louisville & Nashville Railroad have passed their dividend, and issued a circular to the effect that the money would be reserved for emergencies and expended in equipment.

The engineers are paying an assessment of $7 apiece for the late lamented Lehigh unpleasantness. It's pretty hard to get the life whipped out of you and then have to settle the bill.—*The Railway Times.*

A bridge on the North Pacific Coast R. R., near Duncan's Mills, Cal., gave way as an engine with six men was crossing, Jan. 14. The engine fell 40 feet into the swollen stream and five of the men were drowned.

Fast time is being made by freight these days as well as by passengers. A carload of buggies was shipped from Buffalo, N. Y., recently for Los Angeles, Cal., and made the run in 8 days, 7 hours, 10 minutes.

The car shops of the Jackson & Woodin Mfg. Co., at Berwick, Pa., have resumed operations with nearly its usual force. The firm has a contract for 200 gondola cars for the Buffalo, Rochester & Pittsburgh.

It is reported that the Baltimore & Ohio has decided to erect divisional machine shops at Benwood Junction, W. Va. A roundhouse was erected at this point last year, but the building of the shops was postponed.

The fastest trip on record between New Orleans & Chicago was recently made over the Illinois Central by a special train of two cars. The run of 915 miles was made in 25½ hours, an average speed of 35.9 miles per hour.

The wages of all employés of the Chicago & West Michigan, and the Detroit, Lansing & Northern railroads have been restored to the figures prevailing before the general cut in August last, making an average increase of 10 per cent.

The Mount Vernon Car Manufacturing Company, of Mount Vernon, Ill., is building a number of ventilated fruit cars of 60,000 pounds capacity for the Florida Central & Peninsular. They are to be equipped with Westinghouse brakes.

Beginning Jan. 10, through sleeping car service was established between Philadelphia, Baltimore and San Francisco over the Baltimore & Ohio, Rock Island, Denver & Rio Grande, Rio Grande Western and Southern Pacific railroads.

The compound engine "Director General," built by the Baldwin Locomotive Works, and exhibited at the World's Fair, where it was much admired as a part of the Baltimore & Ohio Railroad's display, was recently put in service on that company's Royal Blue Line trains.

The Iron Car Company, a new organization which supplants the Iron Car Equipment Company, announces that its works in Huntingdon, Pa., will resume at an early date. This will give employment to several hundred men now out of work.

The Brooks Locomotive Works have an order from the Lake Shore & Michigan Southern for three six-wheel 18 by 24 switch engines and four ten-wheel 17 by 24 freight engines. These works also have orders for engines from the Buffalo, Rochester & Pittsburgh and from the Buffalo & Susquehanna roads.

A bad accident occurred on the Timina-Matanzas Railroad, eight miles from Cumanayagua, in the Province of Matanzas, Cuba, Jan. 15. A passenger train ran over a cow, and the engine was thrown from the rails and several of the cars piled upon each other. Sixteen persons were taken out of the wreck dead, and nine others were badly injured.

All the Pullman limited trains on the Pennsylvania Railroad are being equipped as rapidly as possible with the wide vestibule, introduced by the Pullman company, and being applied by them to all new cars. The Pullman company, it is understood, will equip all new cars built before the adoption of the wide vestibule with the improvement.

Improvements costing about $50,000 have been made to the East Buffalo plant of the Wagner Palace Car Company in the last few months. A new office has been put up, an iron shed 50 feet by 150 feet, and a storage shed built 800 feet long and covering four tracks. These shops now employ nearly 1,000 men on repair work, principally in putting on vestibules to all cars not fitted with them.

Some interesting experiments have been conducted within the last 12 years regarding the durability of Indian timber. The tests were made by the Forest School of Dehra, and out of 40 different specimens of the trunks fixed in the ground as posts, only three have survived the attack of rot and white ants. These were the Himalayan cypress, teak and anjan, which have been exposed for 10, 9 and 7 years respectively.

In a lecture recently delivered before a German engineering society, Mr. G. Lentz said that while formerly Russia used wood almost exclusively, the now prevailing fuel is English and South Russian anthracite and naphtha. Wood is largely used in South America, while in Belgium dust coal is extensively employed, notably on the State railroads. Bituminous coal is the prevailing fuel of Australian locomotives, and in Australia native anthracite deposits are in successful competition with English coals.

In reference to the receivership of the Atchison, Topeka & Santa Fe, General Manager Frey recently said: "The receivers will undoubtedly improve the physical condition of the road, although its present condition is good—much better than it has been for several years. New depots and sidetracks will probably be built, station facilities improved, and equipment added to by the purchase of new cars and locomotives. Probably some additions to the shops, in the way of extensions and additional machinery, will be made."

The Baldwin Locomotive Works have received from the Norfolk & Western an order for nine four-cylinder compound consolidation freight locomotives, duplicates of No. 330, which was exhibited at the World's Fair. The general dimensions are as follows: Cylinders, 14 by 24 by 24; driving wheels, 56 inches diameter; weight in working order, 135,800 pounds; weight on driving wheels, 120,600 pounds; boiler, Belpaire pattern, 60 inches diameter; total wheel base, 22 feet 9 inches; driving wheel base, 14 feet 10 inches; tank capacity, 4,000 gallons.

Statistics received from the manufacturers by the American Iron and Steel Association show a decrease in the production of pig iron in 1893 as compared with 1892 of more than 22 per cent. Fewer furnaces were in blast on Dec. 31, 1893, than at the close of any year within the knowledge of the association. In Bessemer steel ingots there was a decrease of more than 25 per cent. as compared with 1892, and the production of Bessemer steel rails fell off almost 29 per cent. This record for steel rails shows a smaller number of tons manufactured during 1893 than in any year since 1885.

Ground has been broken for the erection of the buildings of the Litchfield Car Works, at Memphis, Tenn. The work is prosecuted under the care of Superintendent J. M. Maris. One of the officers of the company says they will erect a great deal of new machinery at Memphis. Besides using the material that has done service in the shops at Litchfield, the plant will be improved by the use of machinery of the latest patterns. This machinery has been purchased and is awaiting orders to ship to Memphis. He also says that within four months the company will be manufacturing cars in Memphis. The new plant will be called the Memphis Car and Foundry Works. The shops will have a capacity of not less than 20 cars a day. The entire capital stock of the new company has been subscribed for.

Passenger Car Construction.

BY ERNEST MERRICK.

In the January number of this publication appeared an article under the same heading as above. It was not the expectation of the writer, however, that his name would appear at the head thereof, as I desired the article to carry the full weight of the prestige and conservatism of this journal. But at the last moment, surmising that the signature would be given, I rushed to the sanctum only to learn that everything was in press and that my name was in full type at the head of the article. The editor looked at me with that quizzical smile which made me conscious that I was "in for it," and that what little knowledge I may have of car building would now be put to a test.

However, things are as they are. The disintegration of materials and the action of forces will operate under nature's laws whether I proclaim them or not. And these illustrations should be received more as the recordings of an investigator rather than as of consequence from definite and positive assertions, such as are quite frequently dealt in by some car builders.

First of all, is there need of a better construction in our passenger cars? Are any of the 600 passengers that our railroads kill every year (the average for the last ten years) losing their lives through faulty construction of our cars? If you do not agree with me that the platforms, as now constructed, are a menace to safe traveling, we

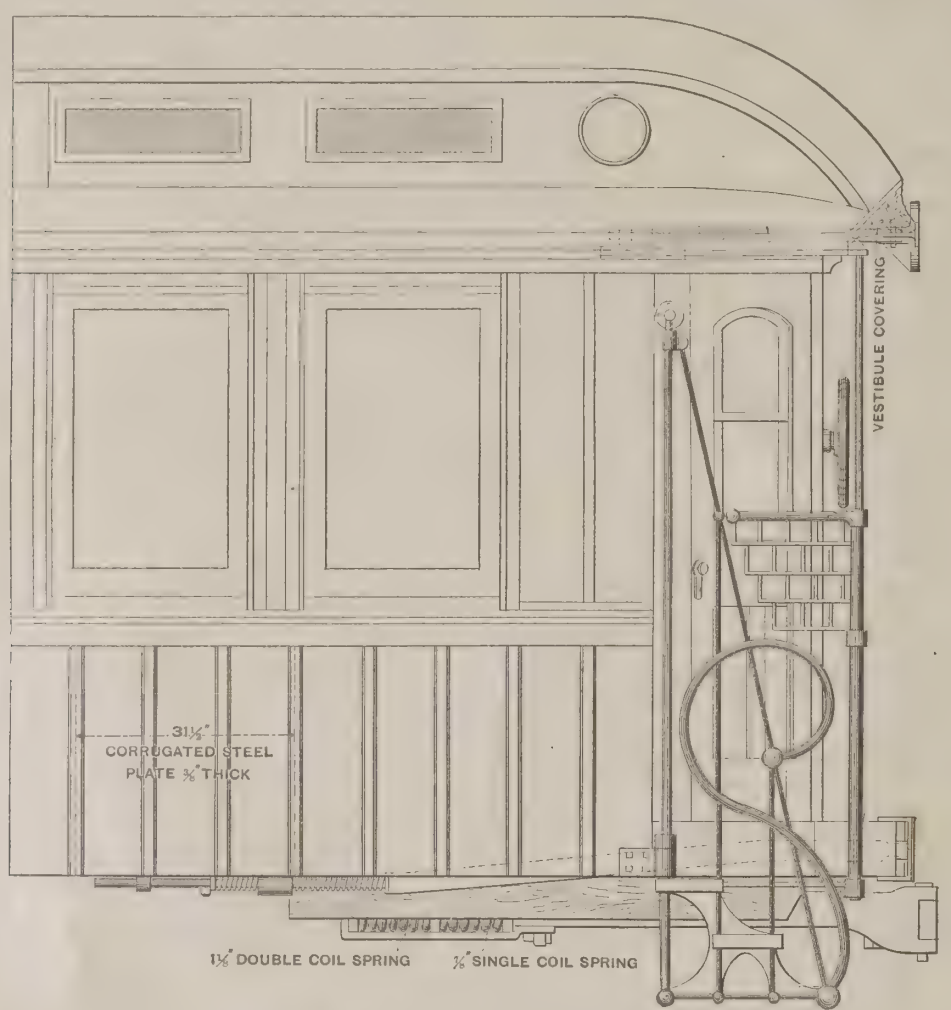


FIG. 2. SIDE VIEW OF END OF CAR.

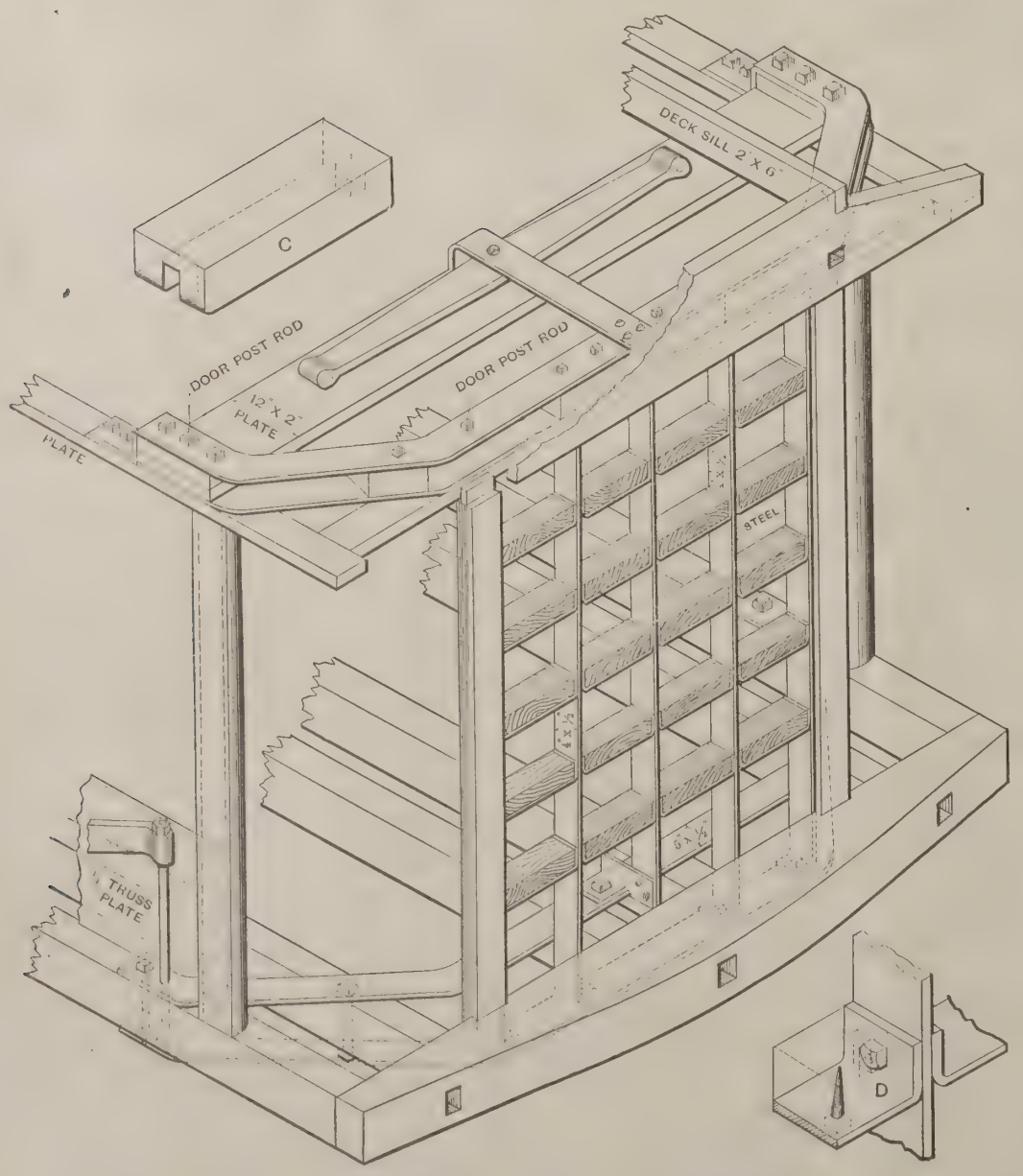


FIG. 3.—ISOMETRICAL VIEW OF END FRAMING.

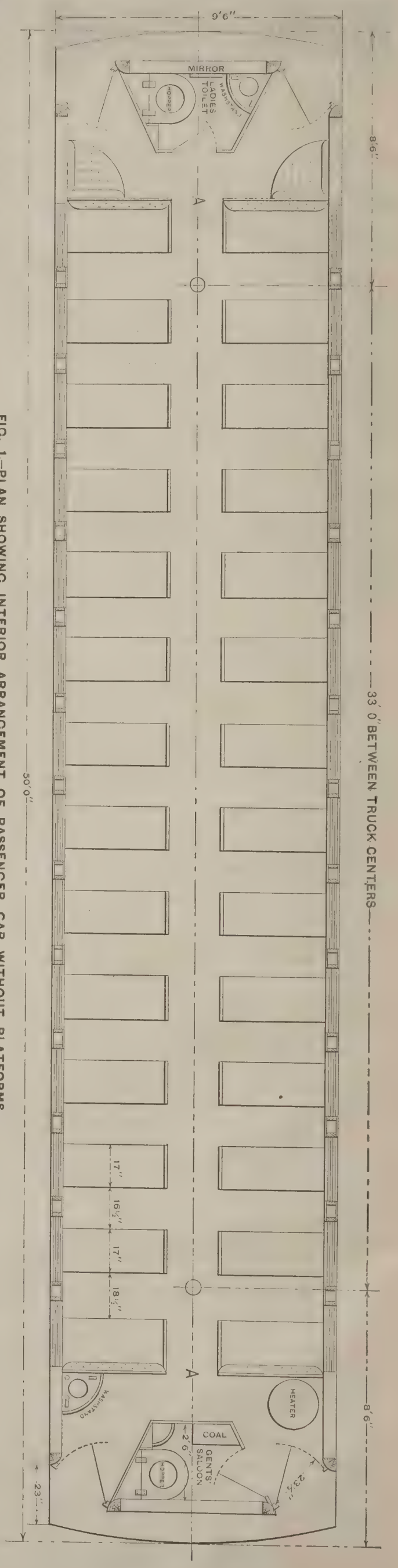


FIG. 1.—PLAN SHOWING INTERIOR ARRANGEMENT OF PASSENGER CAR WITHOUT PLATFORMS.

are at least united on the fact that the present car is inadequate, lacking in both strength and design, to meet the needs of the present extensive American travel.

We must either go back to the old car, with sills 5 × 9, corner and door posts 6 × 6 and window posts 2 × 4, or else we must advance on the composite principles of wood and iron put together on the very best knowledge of safe construction, which in passenger car work is essentially peculiar and different from all other structures. The recorded strength of materials in technical books does not help us much. It is the constant jarring, twisting and rubbing that we have to contend with, and our deductions are arrived at alone from the lessons of severe experience.

Four years ago, when with Pullman's Palace Car Company as assistant engineer at the Pullman Works, I made the assertion that platforms were of no use on passenger cars. I am now not only convinced that they are of no use, but are an absolute detriment; and the accompanying design is proposed as a possible improvement.

To make it quite plain that there is need of an improvement, especially in the end construction, I have only to cite a few recorded facts. The platforms of a car are drooped a little when first constructed in the shop, by virture of being on the line of camber or crown of the car; consequently the successive concussions they receive are out of a straight line, and soon they are jarred loose. Cars have been sent in for repairs with an entire platform hanging on with but a single bolt. What resistance would such a thing as this offer in case of a collision? On the other hand, some car builders have gone to the other extreme in plating the timbers with steel plates, and bolting them to the car very securely, in addition to truss rods. This car gets into a collision, mounts the adjacent platform, and goes plowing through the wreck. Cars have been telescoped with the platforms almost intact. Now what is the sensible thing to do, to maintain a medium and have it half strong and half weak, or to simply do away with it entirely? Of what paramount importance is a platform to be continually taking our time and money for repairs?—quite aside from the fact of its being potentially destructive.

A few words in regard to our frail end structures: Turn to the paragraph on End Frames, in "Railway Car Construction," by William Voss (page 107), the most authentic work on this subject we have to-day, and see how our passenger end frames are built up. Then refer to Fig. 9 on the following page (reproduced from the book mentioned), and observe the construction there illustrated: An end plate placed the wrong way for strength, two quarter round corner posts each made in two pieces, the larger half being poplar and simply screwed to the sills, two quarter round door posts, eight small studding, 1¼ inches × 4 inches, two short belt rails with some small strips nailed below, together with the end sill, and you have it all. There are a few small tie rods, but they are put in simply to hold the joints together. It is an astonishingly weak structure, and looks more like a gateway on the back porch of a good farmhouse than it does to do service in our American railway traffic, where the end of a car is liable at any moment to be forced to withstand a blow of many thousand pounds.

Again, I contend that we are building our passenger cars too long; splicing the sills and carrying the construction to such an extent that the whole may be regarded as a long tubular shell, very heavy along the bottom side, but with comparatively light walls and exceedingly weak, frail ends. Thus considered it is not at all difficult to account for telescoping. Nothing else could well take place. The destructive force of a collision has to be expended in some way, and by far the easiest course is first to crush in these frail ends and then split open the car.

Certainly no serious investigator can look over the long list of passengers mangled and killed in collisions during the past year without this fact being brought home to him with tremendous significance. I will not hazard the assertion that these lives would have been saved had the cars been built differently; but when one considers the present end construction, with a large door cut in the centre, and in many cars two end windows—robbing it of all considerable strength—also that nine-tenths of the platforms now used are in a loose and sagged condition, to be easily mounted or crumbled, there is indeed very good grounds for saying that many lives could have been saved, had the ends of the cars been so strongly constructed as to withstand crumbling, and thus carried the force of the concussion from car to car so as to produce a buckling or bulging of the cars from the track.

No thoughtful car builder will question the assertion that in the recent horrible collision on the D., L. & W. (9 killed outright, 44 wounded by telescoped cars), where one of the coaches was lifted from the trucks before it was crushed, that had this car been of a short substantial design, with a steel frame, this lifting would have continued until the whole car would have been forced up and off to one side. I have no hesitation in saying that had those cars been of such a design, some of the above-mentioned dead people would have been living to-day.

We cannot suppress energy, but we can direct it. I do not believe that we can build a car that will withstand the shock of collision, and simply rebound and remain on the track. We may do it for the majority of cases, but the inertia of a train rushing along at the rate of 50 or 60 miles an hour will crush almost a solid structure if held in line.

Why is it that freight cars are not telescoped? Certainly they are not telescoped in the sense that passenger cars

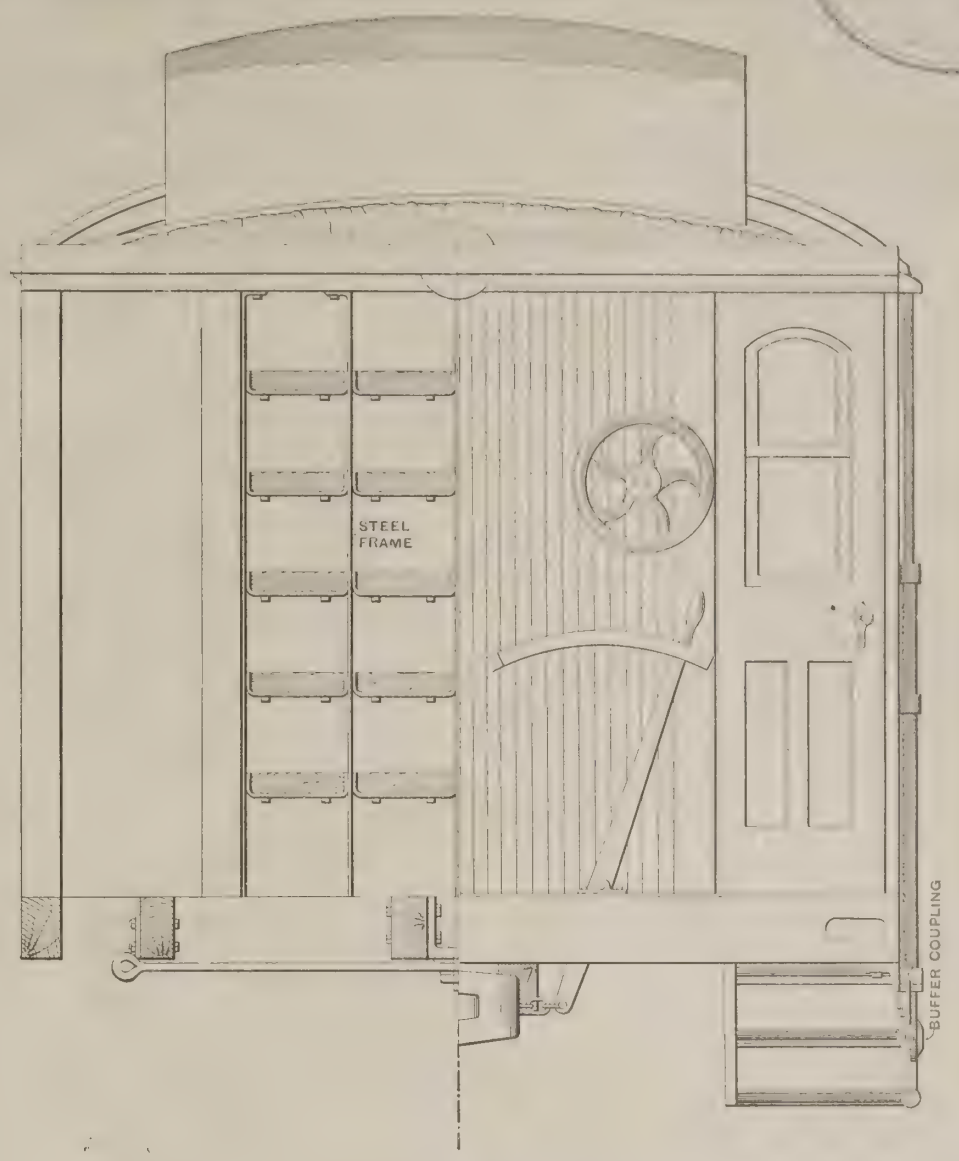


FIG. 4.—END VIEW.

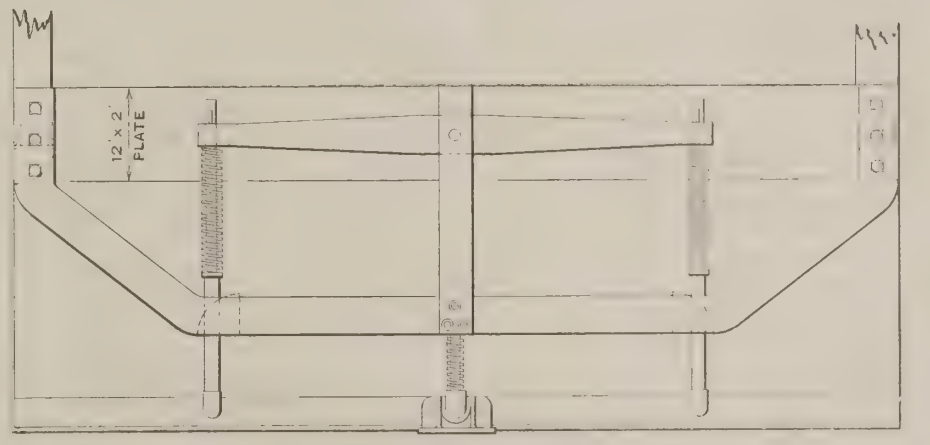


FIG. 5.—OVERHEAD BUFFER ARRANGEMENT.

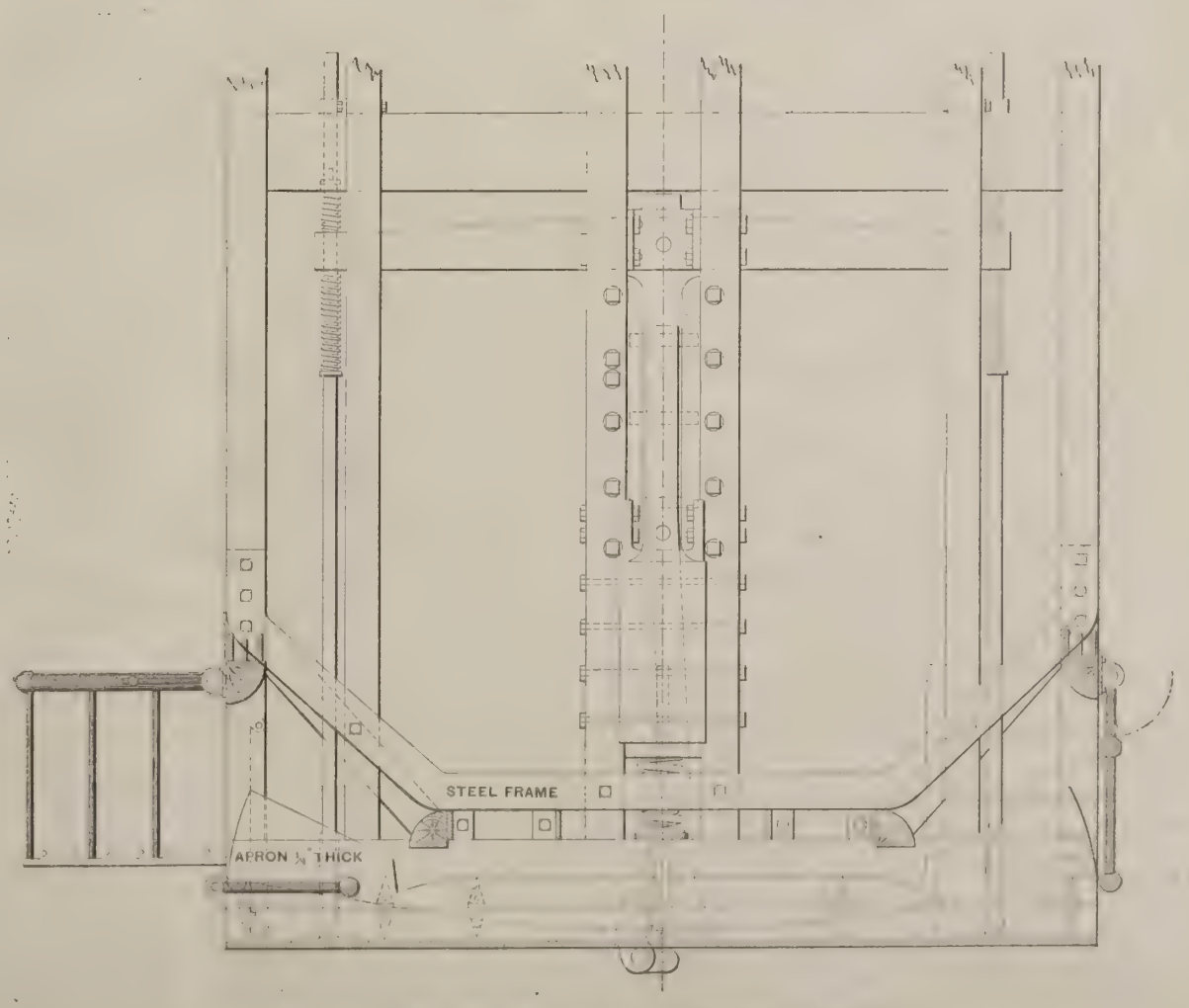


FIG. 6.—PLAN OF END WITH FLOORING REMOVED.

are, for when a collision occurs they are either pushed up into the air on top of each other or crowded off the track at either side. I recollect very well of seeing the wreck of a coal train on the Norfolk & Western, caused by a rear-end collision, in which the first car struck was completely demolished by the immediate impact, but the balance of the cars were bulged up and off the track, and lay strewn in a half zigzag, lapped condition against an embankment. They were more or less broken up, but the outlines of each car were plainly discernible. Another case in point, equally convincing, is that of the curious accident on the Pittsburgh, Fort Wayne & Chicago last October, in which it is reported "that a freight train in ascending a grade broke in two, and the two foremost cars in the rear portion of the train were derailed, probably by a drawbar which had fallen upon the track. *These two cars were pushed to one side* and the rest of the rear portion of the train passed on, and afterward ran into the forward portion, doing considerable damage."

The reason that freight cars act thus is, I think, that they are short and chunky, and as a general rule have large strong end sills, which, when in a train, are always in close proximity.

Our passenger cars are too long and too heavy. They are in fact monstrous tubes, and with thick, heavy undersides, are in just the condition for telescoping. Strangely enough, too, the drift of many articles in our railway journals is to show how better to splice sills, build a stronger

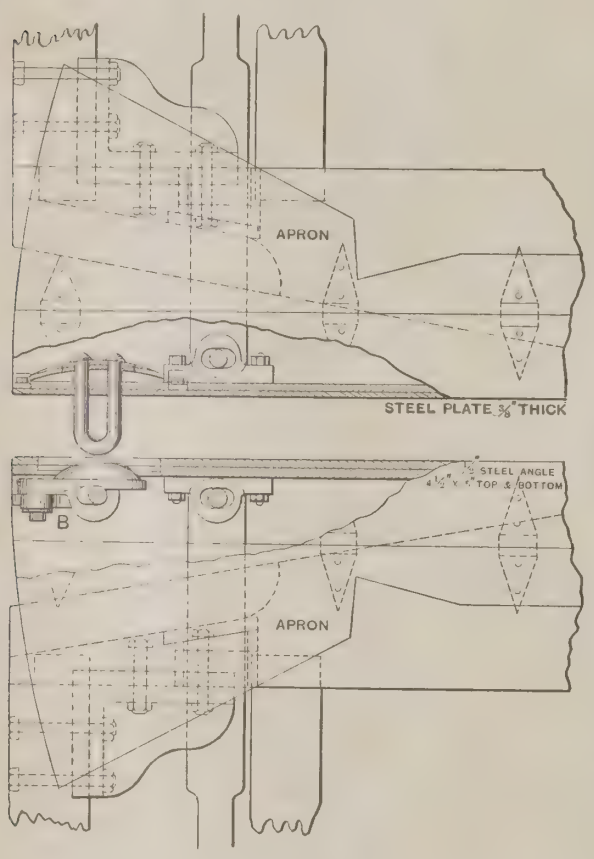
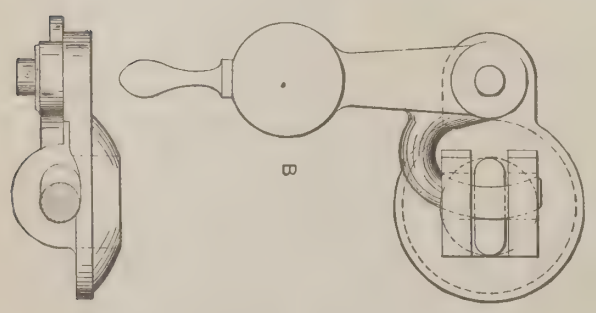


Fig. 7.—Extension of Buffers, Showing Manner of Coupling.



Buffer Coupling and Safety Chain Hook.

floor frame and better truss the sides of these long cars. A recent instance is that of two pages or more in one of our best publications, being devoted to the strength of long floor frames, and making no mention whatever of the end frames.

I do not doubt the need of stronger floor frames and stronger sides, but to run such in a long car with the present weak ends is absolutely dangerous. Think, for instance, of a telescoping car with the challender side truss, and the floor frame a solid work of sills. The wicked work of such a plate of steel, and the destruction of life would be something frightful. It is folly to suppose that the thin sides of a shell like a car will remain in alignment when but eight inches or so will pass one frame within the other, which, by the very fact of its strength and weight, will tear open everything in its path.

The challender truss, however, is a most excellent side truss, when properly protected at the ends. Its service has proved its worth as a truss. But I say it is dangerous to run such in a car with simply wooden end frames. In the composite wood and iron end frames, as here proposed, the challender truss would, I believe, attain its greatest usefulness. If need be, it could be further strengthened by iron struts riveted to the outside along the compression lines of the cantilever truss, which latter is a very advantageous truss in a car with heavy ends projecting a considerable distance from the truck center. Such a truss is shown at Fig. 8.

With these plates of steel firmly secured to the side of a short car, backed up with the iron skeleton isometrically shown at Fig. 3 for an end framing, buckling would be by far the easiest and in all probability the only road for the great force of a collision to travel.

DESCRIPTION OF PLAN.

Fig. 1 shows a plan of a car without platforms, and with four corner doors placed at such an angle as to facilitate ingress and egress and also be convenient in going from one car to another. The entire length is 50 feet over the end sills, which is also in this instance the length over the buffer beams. The distance between truck centers is 33 feet, which leaves the overhang of the car at each end 8 feet 6 inches. The distance, it must be remembered, is to be

The composite framing of wood and iron is here adopted for the general strength of the ends. My investigations thus far have not led to a conclusion as to the advisability of an entire steel frame for car construction. I am inclined to think, however, that if the riveting could be replaced by short bolts, with square heads and nuts, and these latter surrounded by hard wood as nut locks, a most excellent result could be obtained. It would largely facilitate repairs; then, again, wood has a certain deadening effect on vibrations, which latter, in metal framing, acts seriously at the joints and connections. I have held to this idea in this construction, as will be seen by the isometrical drawing of the block C.

It must be admitted, however, that much of the old prejudice against metal structures is melting away, and that steel framing is gradually gaining recognition, especially in the use of I beams for sills in freight cars. Two

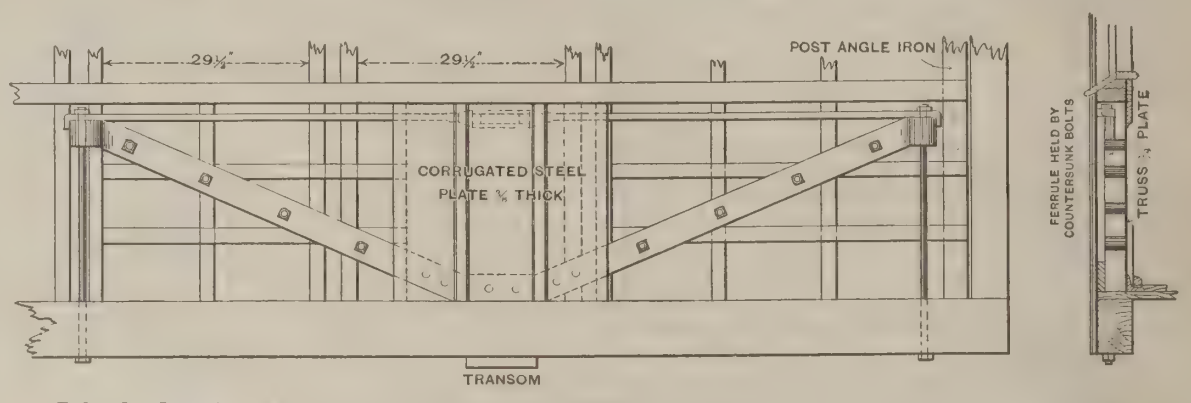


FIG. 8.—CANTILEVER SIDE TRUSS IN CONNECTION WITH THE CHALLENDER TRUSS.

compared with the length of platform cars, from the center of the truck to the face of the buffer beam, which, on most cars, is not less than 10 feet; that of the Pennsylvania short coaches, however, being 9 feet 9 inches. Consequently it will be seen that the side movement of the buffer plates and the strain on the couplers, which are augmented thereby, are materially reduced in a car of the above design. The distance of 8 feet 6 inches is, however, the minimum, being determined by the movement of the steps.

END FRAME.

The general contour of the ends, with a door at each corner, is more or less octagonal or near to a circle, which will help the "buckling" of the train that it is believed will take place in case of a collision.

It may occur to some that in this arrangement there is little or no advantage over the central opening as far as strength is concerned. But upon an inspection of the isometrical drawing, it will be observed that there are four steel plates, ½ by 5 inches, placed edgewise on a sweep from side to side, two at the sills and two at the plates. And that the center of the end, instead of being cut away by a door opening, is here protected by a close framework of steel rigidly fixed to the above named plates, both above and below. The center of the end is the place a locomotive will first strike a car, and if such is not protected, splitting will surely and quickly take place. In fact, the splitting open of a car in any case is due, I think, to this central opening.

12 inch I beams as the center sills of this passenger car would be a good construction.

Attention is called to the manner of framing the door-posts against the end sill. This is intended to prevent the rotting of post ends and tenons that now takes place under the door from the moisture retained by the platforms.

STEPS.

Knowing that the steps would either have to be of the extension type or swing out from under the car, I was at first not a little concerned about being able to get a design simple and strong and also one to be operated quickly and easily. But the problem has been worked out satisfactorily, being nothing more than three treads fastened to a skeleton frame, and all rigidly fixed at right angles to a long triangular safety gate, which latter is of such design that, when swung open, it affords a very convenient hand-rail. This triangular safety gate, however, is incomplete as a platform gate without an adjoining part, which is anchored to a corner vertical post-rod extending to the hood of the car. This part of the gate revolves on the post-rod, and has an inward swing, at the same time the steps have an outward swing, the connection below being simply that of two short cranks and a connecting-rod, all as shown in Figs. 2 and 6. The steps, when swung into position, rest in a clutch at the under corner of the end sill, which acts as a support.

It will thus be seen that the gates, and consequently the steps, can be operated in a simple quarter turn by any trainman either on the car or on the ground; and, further-

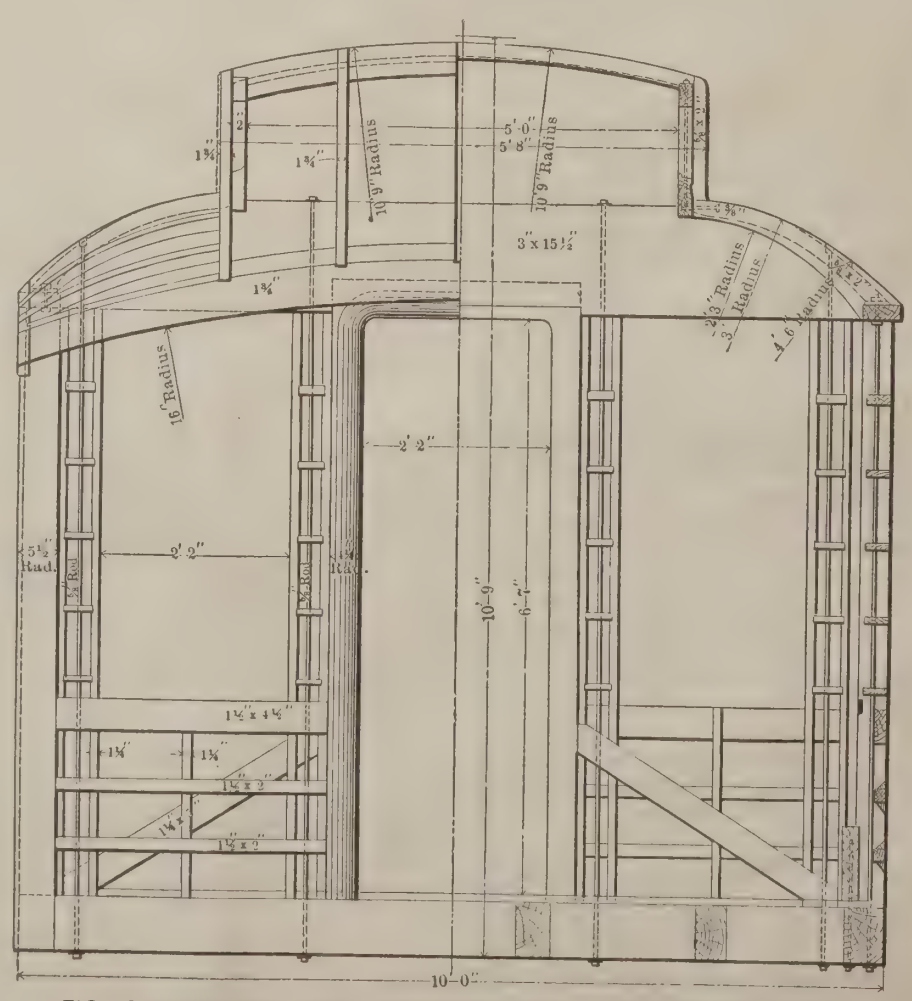


FIG. 9.—ORDINARY END CONSTRUCTION OF PASSENGER CARS.

more, that they cannot be opened by any one leaning on the gates when the car is in motion.

The criticism may be advanced that this arrangement will require one trainman to every car to operate these gates. This is not absolutely necessary, but it is of course desirable, and no doubt would be required on all trains carrying many passengers and making short stops.

In city and suburban service, where crowds have to be dealt with, time can be saved by a corner entrance and by the steps being swung back when the train starts; possibly the lives of some persons can be saved who are now in the habit of running after trains. Furthermore, it will be observed that this arrangement will prohibit passengers from crossing the track and entering the train from the off side, a thing that is now done with much annoyance and great danger at some stations.

BUFFERS.

There are two long buffers at each end of the car, one above the door on a line with the side plates, and one in the usual position at the sills. Both work on the parallelogram system with side stems, springs and long equalizing levers for easy adjustment in rounding curves. The sill buffer plate is of extraordinary dimensions. Extending the full width of the car, it is designed for strength and is similar in form to a deep heavy channel iron, the two flanges of which lip over the end sill both above and below. It is made of a steel face plate ⅝ by 9 inches, backed or re-enforced by 4½ by 5 inch angle irons securely riveted to the plate with counter sunk rivets. The end sill is of oak 8 by 12 inches. The side stems are of bar iron 2 by 3 inches, and the long equalizing bar is carried some distance back from the end sill to relieve as much as possible the offset in the stems (shown by dotted lines in the side view) made necessary by the location of the equalizer at the bottom of sills so as to be accessible in case of repairs. The center stem is a short, thick plunger, around which is a very heavy three-coil spring, graduated to receive buffing shocks of various intensity. This spring is backed by an oak block 2 feet long placed endwise, and let it into the center sills. It is further reinforced by a strong casting, which, as well as the block, is rigidly bolted to the sills. All can be removed in case of repairs. A wide iron plate ¼ inch thick, in the form of an apron, is hinged to the top flange of the buffer and plays readily over the short floor space, affording at all times a continuous passage between the doors of the adjacent cars.

In Fig. 7 is illustrated an entirely new departure: that of coupling together the buffer plates. The usual objection to a car as short as the one here shown, and to short cars in general, is that they oscillate easily, and are subject to oscillation by every depression and imperfection in the track. I have endeavored to obviate this by coupling the ends of these strong buffer plates by a simple contrivance, requiring but very little more time to couple than to hook up the present safety chains. In fact, they are intended to take the place of safety chains, for should the draft gear become disabled the car can be drawn by these couplings, which would throw all the draft on the springs around the stems at the back of the equalizing bar. These springs, it should be noted, have the same play as the draft spring.

It will be observed that by coupling the buffer plates, it is not intended to rely wholly upon the compression of springs to keep them always together, but to reserve the spring force for concussions. This coupling, very plainly illustrated in the drawing, holds the buffer plates practically rigid so far as a verticle motion is concerned, but allows a lateral play of 6 inches. The lever hangs vertical when coupled and is kept there by gravity. It will furthermore be observed that this long buffer channel, surrounding the large end sill as it does, will, in the case of a collision, offer all the resistance that is now claimed for the large wide iron plate bolted back of the end sill, and curiously named by some car builders an "anti-telescoping device."

DRAFT GEAR.

The draft rigging is entirely separate and distinct from the buffing arrangement, each being designed for its respective duty, one to take the concussions and one to take the draft. I have always believed in this principle, and I think it is one we can profitably copy from the English cars, even if it is a little "English." We are to-day using the knuckle construction of our couplers to take all the blows, with the result of sometimes breaking off a head, which, falling to the track, causes accident, possibly the derailment of a car. It is astonishing to note the size and weight of some of the vertical plane couplers used on our passenger cars. They are, in fact, great beetle-headed looking structures, and could be materially reduced if they had but to perform their right function, that of drawing the car, such as the name "drawbar" implies.

The drawbar here used is the simple design of the long shank, with the Miller side springs, thereby easing the movement of the knuckle in the opposing coupler on sharp curves. There are three follower plates at the draft springs; the center one being stationary affords a good stop for the double coil draft spring in the rear, and also a stop for the light single coil spring in front which recedes easily in buffing.

INTERCHANGEABILITY.

This is a problem that augments in some way objection to every proposed improvement in the end construction of cars, and in many cases constitutes the principal and only objection. It may seem so in an improvement so radical in design as this. I can imagine a conservative car builder saying that to remove all the platforms on the cars he has, simply to couple on to this car would entail an unbearable expense; and throwing away doors, panneling up door spaces, and cutting off the corners of old cars would be folly. This is true; but there will be no necessity of removing old platforms, panneling up door spaces, or anything of the kind. All that is required is simply to hinge a trap door to the end sill, arranged to swing down and fit over the steps; and in addition, equip the platform with safety gates, which latter are very desirable adjuncts to cars themselves. This will allow a passageway from the corner doors to the platform and the problem is solved.

VESTIBULE.

It is admitted that a vestibule, or some form of a covered or continuous passageway from one car to another is an improvement that has come to stay. Whether passengers fully appreciate the safety features of the present vestibule or not, they do value its convenience and the protection it affords in inclement weather.

In the design here proposed, the ends of the cars are very close together, consequently very little vestibuling is necessary. The apron plates at the buffers afford a continuous floor, and the overhead buffers, with the canvas or rubber covering as shown, afford a continuous roof. As for the sides, a curtain made either of heavy canvas or of rubber of the small accordion pattern, is pulled from the corner posts across the face of the gates and connected at the center. This makes a complete inclosure, dust and rainproof. Furthermore, any atmospheric resistance to fast running is here reduced to a minimum as this inclosure is made in a direct line with the sides of the car.

INTERIOR.

Referring to the plan shown in Fig. 1 it will be seen that the car really seats 58 passengers, as there are two single corner seats at one end. But, strictly speaking, these are for temporary use, as it is intended to keep the passengers away from the ends as much as possible in traveling.

The ventilation feature of a train with these cars should not be lost sight of, as with all the vestibule curtains drawn and the doors open an *indirect* draft can be had from one end of the train to the other. In the winter time two interior doors should be swung at *A*, which will greatly facilitate heating the car, and the seated passengers will not be treated to a cold air bath every time any one enters the car from the outside. Another advantage of this interior arrangement is that the ends of the car are further strengthened by the partitions of the saloons located as shown. Again, the words "Ladies' Toilet," embossed on the glass panel of the saloon door, can at once be seen from any part of the aisle of the car, thus avoiding a certain timidity now frequently noticed among women, who are not certain which is the ladies' end of the car.

GENERAL DESIGN.

The brake wheel is located sufficiently near to the side of the car to enable the brakeman a clear view in doing yard service.

The cantilever iron side truss shown at Fig. 8 should have the strut extending toward the center of the car much longer than that of the counter strut, so as to more evenly balance the extra weight of the coupler and buffers. The drawing does not show this feature, but indicates the manner of construction. The struts are firmly riveted to a square steel plate, placed over the bolster on the outside, and corrugated to harmonize with the paneling or sheathing of the car. The truss is prevented from buckling by counter-sunk bolts which extend through to the Challender truss on the inside, iron ferrules being placed between to take up the post space, all as shown. Attention is invited to the simplicity in the design of the entire car, and also to the accessibility of all parts in case of needed repairs. The equalizing lever and two stems of the overhead buffers are easily approached, being placed on a flat, wide end plate, extending across the cars over the saloons. Any part of the steel end frame can be easily removed, as the joints are all bolted and locked, as shown at *D*, Fig. 3.

In regard to the safe construction of the car, it may be said that we have to-day, in the use of the heavy iron vestibules on our best cars in trains like the Keystone Express or the New York Central "Exposition Flyer," all the safety that can possibly be had in car designing. But this is obtained in a car costing not less than $10,000, and in many instances much more. People who do not travel on these trains and who ride in the day coaches, deserve some consideration, especially when it is from this class of traffic that dividends are obtained.

Many car builders hold to platform construction, because passenger cars frequently get such concussions as to simply damage the platforms, and can be easily removed or repaired at slight cost. But the fact is that to save the body a little we are using an arrangement that takes up valuable space and accomplishes but little in this direction, to say nothing of its danger in collisions.

[*The writer of this article has applied for a patent on the proposed plan of car construction illustrated.*]

A suggestion for boilermaker's dictionary: "Please send me a Price list of your different sizes of Traction Engen Boiler Flues. "I have a Boiler that kneeds flowing."—The Boiler Maker.

Decrease of Locomotive Building in Great Britain.

It is not only in the United States that the locomotive building industry has suffered in the past year. The hard times that have been experienced here have also been felt in other countries. The following returns of the men employed at the end of September by the chief locomotive builders of Great Britain is given in the Glasgow *Herald* as a fair indication of the state of trade at that date, as compared with the same date in 1892.

	1890.	1892.	1893.
Neilson & Co.	2,505	2,307	1,896
Dubbs & Co.	1,960	1,697	1,775
Beyer, Peacock & Co., Limited	2,159	1,292	1,359
Sharp, Stewart & Co., Limited	1,336	1,507	1,246
Kitson & Co.	1,255	1,268	1,079
Vulcan Foundry Company, Limited	679	561	486
R. Stephenson & Co., Limited	530	455	344
Nasmyth, Wilson & Co.	474	377	320
Manning, Wardle & Co.	493	267	293
Hunslet Engine Company	262	240	245
	11,654	9,971	9,043

Commenting on this, *Engineering*, of London, says: Unfortunately, in formulating deductions, it must be taken into account that matters have been becoming steadily worse since the date under notice. The falling-off in numbers of men employed—928—would probably have to be doubled if statistics were available for Dec. 31 current, and the first pay day in January, 1894, would show a still larger falling away. If the above number of men employed this year—viz., 9,043, be compared with the total of 11,654 men employed in 1890, a more approximate idea will be obtained of the present condition of the locomotive industry. The amount of work put into the public market during the last year only about equaled one-third of the capacity of production, and it will be safe to state that the total amount of orders booked, publicly or privately, does not exceed one-half of the powers of production.

First Wire Rope.

The first wire rope in this country was made by John A. Roebling in 1840 at the village of Saxonburg, in Butler County, Pa. The rope was ⅝-inch in diameter and perhaps 500 feet long, and was used on a subsidiary plane at Johnstown in the same State. It was made of parallel laid wire, and served on the outside with annealed wire. This style of rope did not prove a success, because the rope went to pieces as soon as the serving wore out.

The next rope was made for one of the inclined planes of the old Portage Railroad across the Alleghany Mountains. The length of this rope was about 1,500 feet, and its diameter 1¼ inches. It was constructed on correct principles, substantially in the same way that wire rope is made at the present day. It lasted a long time and gave good satisfaction. Its success was the means of introducing wire ropes on the remaining nine places of the Portage road.

The Official Sympathized.

When Brakeman Thompson opened a switch at Kingsbury, Ind., and sent a Wabash passenger train headlong against a solid line of loaded freight cars, a few months ago, the indignant public suggested all sorts of punishment for him. Practical railroad men were not so bitter Thompson had been one of the most intelligent, competent and careful men in the employ of the Wabash road. A prominent railroad official in Chicago, who is familiar with the facts of the case, said, in a recent interview:

"He has suffered his full penalty already. I know what it is to live a year in two seconds. When I was a mere boy, crazy for railroading, I went out as a freight brakeman. One day our train was on a siding, waiting for an express to go by. I went ahead to the switch. Now, I wasn't thinking of switches, trains, or anything in the world except a certain person whom I was expecting to meet at the other end of the run. I went to that switch whistling and thinking of this something else. I unlocked the switch, threw it open, truned my back to it and watched the express grow larger as it swung down the long grade toward me. I saw it, but I wasn't thinking of it until, when it was almost upon me, I noticed the engineer jump from his place in the window. The whistle for brakes helped to arouse me. I turned to the switch, and then it dawned upon me that the switch was open and that the express train was headed for the siding. I jumped against the upright and the train went by on the main track. The engineer's face was white through the coal dust. I had no time to lock the switch; I simply lay against it until the last car had passed, and then I dropped in a faint.

"That engineer knew me and never reported it; if he had I wouldn't be in the railroad business to-day. Since then I have some pity and sympathy for men who make what seem to be criminal blunders. You can't tell why they do certain things at the wrong times; they can't tell themselves."

An arrangement of pipes to heat the air and consume the smoke of locomotives has been patented by Master Mechanic E. T. White, of the Baltimore & Ohio Railroad. We take the following description from a local paper:

The air is drawn from the air-brake cylinder on the outside of the locomotive. It next passes through a coil of pipes in the boiler, in order that the air may be heated, after which it is distributed among many parallel pipes in the firebox. The pipes are perforated to allow the escape of the air, which gives a greatly increased draft in the firebox. It is expected that the new device will better consume the coal and not allow so much unconsumed material to escape through the stack.

From a "scientific toy" the telephone has become one of the greatest business implements of the age. The annual report of the American Bell Telephone Company shows that that corporation rented last year 522,720 telephones, an increase of over 40,000 in one year. The company has 812 exchanges and a mileage of wire of 307,791, of which 90,216 miles are operated under ground.

Best Method of Securing Cylinders, Smokeboxes and Frames.

The following very interesting report on "The best methods of securing cylinders, smokeboxes and frames, together with regard to avoiding trouble from loose cylinders," was presented at the meeting of the Southern & Southwestern Railway Club, Jan. 18th. The report is an exhaustive treatment of the subject, and gives the results of very complete and extensive inquiry as to the current practice of the leading railroads and locomotive works of the United States. The committee considered improved and modern methods exclusively, and did not include in its investigation the details of engines with less than 18-inch cylinders.

In presenting its report the committee has treated the subject under the following heads:

First—The fastening of the cylinder saddles to the smokeboxes.

Second—The fastening of the cylinder saddles together at the center.

Third—Fastening of single bar frames to cylinders.

Fourth—Fastening of double bar frames to cylinders.

Fifth—The design of single bar frame from the main pedestal to the bumper beam.

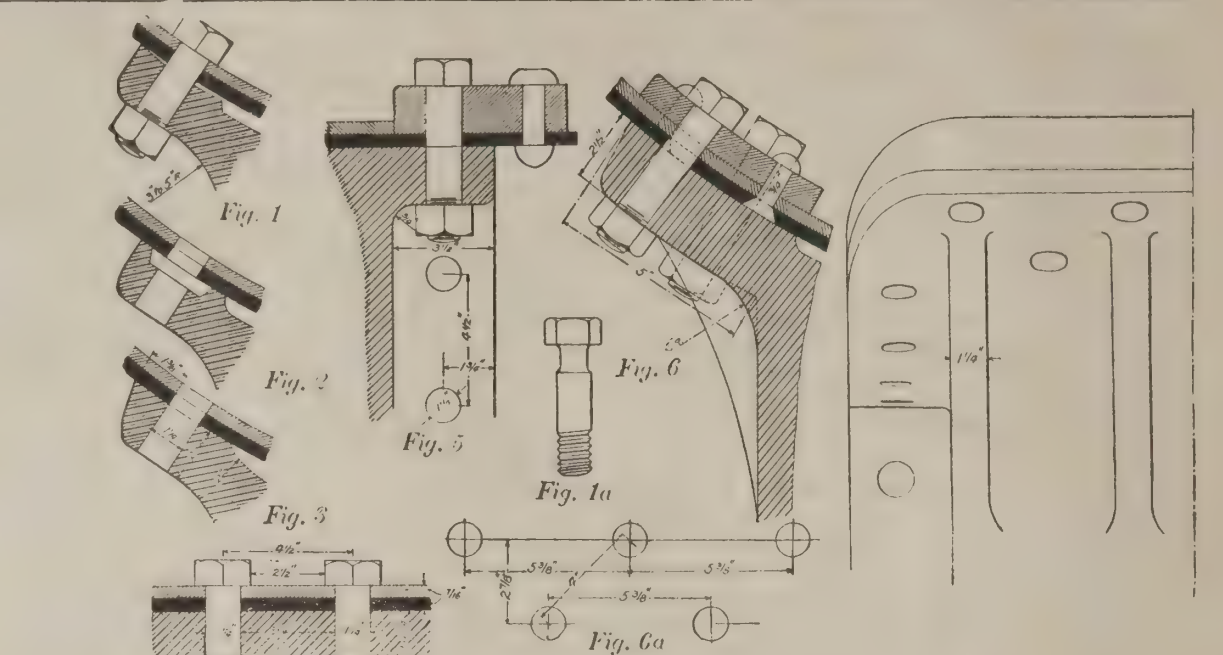
Sixth—The design of double bar frame from the front pedestal to bumper beam.

The reasons for considering Clauses 5 and 6 are that if there is any weakness about the form or fastenings of these portions of engine frames, allowing them to work or bend and thus deprive the cylinders of their proper support, loose and broken cylinders are sure to follow.

The portion of the report which we publish in this issue is confined to the fastening of frames, cylinders and smokeboxes; and that portion of the report under heads 5 and 6 is withheld until our next issue, when we expect to present it together with a synopsis of the discussion of the repor

THE FASTENING OF CYLINDER SADDLES TO SMOKEBOXES.

One of the first indications of a loose cylinder is trouble with the steam pipe joints leaking. The smokebox may look quite secure on the saddle, and the paint around the bolts apparently be unbroken, but if the engine is examined when running and pulling hard, it will be found that the smokebox is lifting slightly off the saddle, generally at the back corners, allowing air to enter at the joints, which will penetrate around the bolts and along the grooves between the chipping strips, causing blowpipe jets wherever the air mingles with gas in the smokebox, producing intense heat locally. If such a jet strikes the base of a steam or exhaust pipe, it will burn the lug or bolt, or cause the pipe to crack, or by unequal expansion help to make the joint leak, which is already working on account of the boiler moving on the saddle. Bad workmanship is a very frequent cause of looseness between the smokebox and cylinders. In most locomotive and large railroad repair shops, the cylinders are fitted to the saddle by piecework—the amount to be chipped usually being scribed and center punched around the flange; two pairs of men with sledge hammer and chisel set, go at it to make time, and unless some inspector or foreman watches the job constantly the chipping will be done as shown at Fig. 1, making a nice fit (?) around the edge. A little red lead is rubbed skillfully over the balance of the surface, to make it look as if the smokebox had been well bedded. It is impossible to draw a smokebox and liner down to the irregular casting. The corners of the cylinder saddle flange carry most of the load, and frequently break off, the sheets, buckle and spring after a little service, and the joint is loose. The bolts, instead of being in shear are in bending strain, and the slight movement of the sheets under the head chews away the bolts, as at Fig. 1a, with which, no doubt, most master mechanics are quite familiar. Some makers deliberately invite trouble in this direction, by making their chipping strips as shown in Fig. 2, which cannot be too strongly condemned. Nothing less than a really good job, well bedded, showing a good bearing by red lead (and put on with the fingers or piece of stick) not less than one inch wide round and between each bolt, with the bolts in shear, and the plates well gripped down on the saddle, as shown at Fig. 3, is good enough. The mistake is often made of using bolts which are too small, and cannot be drawn down with a long wrench without the danger of stripping or breaking them; in addition to which the smaller bolts give too small a bearing surface, and will wear out under the head too fast, as at Fig. 1a. Experience has shown that 1¼ inch bolts are the best size to use for saddle bolts. On 18 or 19 inch engines the cylinder flange should be from 2 inches to 2¼ inches thick; for 20 inch and larger engines the flange should be from 2¼ inches to 2½ inches thick. After the holes are reamed, and before the bolts are driven, each hole should be examined to see that there are no bad places, as indicated at Fig. 1. A good black putty; or cement made with fine iron filings and black lead, should be smeared over the joint before the bolts are finally drawn down. The mistake is often made by designers of spacing the bolts too far apart. Fig. 4 shows about the right pitch for saddle bolts, if the smokebox sheet is to be well held down on the saddle. Each bolt head will press down the sheets for a certain distance around it, which might be called its area of pressure, and is indicated by the white lines on Fig. 4. In between the limits of these, the smokebox sheets can and will buckle and pocket, so that 4½ inches for 1¼ inch bolts is about as far apart as they should be placed. Even with this close spacing, and the use of a 7-16 inch liner to get additional stiffness and more bearing for the bolts, much trouble has been experienced with loose cylinders on heavy engines, and progressive designers have introduced a double row of bolts along the sides of the saddle. A good example of this, showing 1¼-inch bolts well spaced, and smokebox strengthened by a $\frac{7}{16}$-inch liner well riveted on, backed by a one-inch bar, also riveted to the smokebox, is shown in Figs. 6 and 6a, where the flange is well supported by ribs, and, while preserving the regularity of the bolt spacing running around the saddle, no bolt has been placed in the extreme corner of the saddle, which is a weak point, the flange frequently breaking out through such a corner bolt hole. The method of bolting the saddle to the ring forming the joint between the smokebox and extension front is shown in Fig. 5. The committee would like to recommend the drawings Figs. 3, 4, 5, 6 and 6a as standard practice for heavy engines. The two main objects to be attained are: to firmly and immovably connect together the cylinders, frames and smokebox; and, secondly, to make air leaks in the smokebox an impossibility. By referring to Fig. 7, which is a fair example of modern practice of securing cylinders to smokeboxes, it will be seen that a $\frac{7}{16}$-inch liner is well riveted to the inside of the smokebox, through which, as well as the smokebox sheet, all the cylinder saddle bolts pass except those in front, which go through the extension front ring. The use of this $\frac{7}{16}$ liner, especially if it is continued some distance up the sides of the smokebox, beyond the cylinder saddle, adds very greatly to the stiffness of the smokebox, and it is therefore to be recommended, but even the use of this liner does not suffice to prevent the smokebox from denting in, or flattening, as the engine gets older, which is shown by working at the riveted joint at A, Fig. 7, and by the fact that the liner rivets come loose in the holes, and that the liner when taken up shows unmistakably that it has worked on the smokebox sheet. By reference to Fig. 7, it will be seen that the front of the cylinder is very much better supported than the back. The front of the saddle being bolted directly to the stiff extension front ring, while the back portion is only supported by the smokebox sheet and liner. Experience has shown that in an arrangement similar to Fig. 7 the front bolts will stay tight while the back bolts will commence working after the engine has been some time in heavy service. A much better and very good arrangement is shown in Fig. 8, recommended by the Cooke Locomotive Works. Here both the front and back of the cylinder are supported by rings of ample stiffness, which, being riveted entirely around the smokebox, cannot give appreciably. In addition to these rings, 1 inch by 7 inch bars are fitted down closely between these two rings and riveted fast to the smokebox, as shown. Through this the side bolts of the saddle are driven, shown also in Fig. 6, so that all cylinder saddle bolts are about of one length. They all have equal bearing surfaces, and the small box is well clamped down to the flanges of the cylinder saddle, the saddle being well supported front and back. Another excellent arrangement is that shown on Fig. 8a, submitted by the C. B. & Q., and used also, we believe, by the P. R. R. This arrangement is somewhat more expensive, but excel-



lent in design, attaining the same objects which are accomplished in Fig. 8. In both these arrangements the smokeboxes can and should be fitted to the cylinders separately, and when so fitted they should be lined up in place and the rivets connecting them with the boiler driven afterward. In case renewals are necessary, these rivets can be cut out, the cylinders and smokebox removed from the boiler and frame; or in case the cylinders and smokebox are all right, and the boiler has to have a new firebox, then the boiler can be withdrawn and taken to the boiler shop without disturbing the original setting up or the joints of the cylinders, frame and smokebox.

In Figs. 9, 10 and 11 are shown three typical methods of arranging the chipping strips on the saddles. Fig. 9 only provides for a bearing around and between the bolt holes. Figs. 10 and 11 provide for a bearing over almost the entire surface of the saddle, but your committee thinks that it is extremely improbable that the chipping will be so done that the somebox will bear at all on these inside chipping strips. This might be the case if the cylinder saddles were planed, as it is the practice on the C., R. I. & P., instead of being chipped, but even supposing that the smokebox does touch all over these chipping strips when newly fitted, any one who has watched the way the heat warps and buckles these sheets where they are not firmly held down by bolts closely spaced, will admit that the utility of these inside chipping strips is very conjectural. It is a good principle to bear in mind that every job that has to be done by the workman by hand will be better done if it is easy to do, and the more difficult the job the less likely it is to be done well. Let us suppose these chipping strips on Figs. 10 and 11 are being chipped: the men doing it will be constantly changing position; there is very little straight-away work about it. Your committee believe that an arrangement about as shown on Fig. 12, which will be very much less expensive to make in the pattern, and will give nothing but straight-away work for the chippers, or, if the saddle could be planed to the right sweep, will allow of the largest amount of work being done with the fewest amount of adjustments of the planer tool while giving ample support to smokebox sheets, is preferable to any arrangement such as is shown in Figs. 9, 10 and 11. If the bar is used as shown in Figs. 6 and 8, the smokebox sheet and liner could be cut away to correspond with the inside edges of the chipping faces, or both the liner and the smokebox could be cut very readily to fit up against the flat faces of the projection, into which the steam pipe and exhaust pipe holes are cored. The spaces under the smokebox could be profitably filled with fireclay, and the surface of the above mentioned projection can be planed off in the planing machine at the original setting of the cylinders. Some firms of locomotive builders, if not watched, will turn out engines with the smokeboxes and extension fronts made out of one sheet. This is done for cheapness in first cost; but to men who are familiar with roundhouse work, and with the appearance of engines after collisions, it is not necessary to explain why this practice should be condemned.

FASTENING CYLINDER SADDLES TOGETHER AT THE CENTER.

The same size (1¼ inch) bolts should be used for bolting the two cylinders together, and the spacing shown in Fig. 5 gives good proportions and great strength for a heavy engine. It is absolutely necessary to have a complete row of bolts running the entire depth of the cylinder saddle on both the front and the back. The tendency to separate is greatest at the center line of the cylinders, which is generally a little below the lowest of these bolts. When the engine is working hard, the cylinders have a tendency to separate as well as to slide relatively to one another on the center joint. It is therefore very desirable to have additional bolts securing the cylinders together as near the level of the center lines of the cylinders as possible, as shown in Fig. 15, or below the center lines, as shown in Fig. 17. In Fig. 15 is also shown an excellent arrangement of introducing one or more keys in the central joint, which will relieve the bolts of a great portion of the shearing strain. This arrangement can be used on engines with four wheel trucks. On mogul or consolidation engines an arrangement similar to Fig. 17 can be used to good advantage. Fig. 17 shows how the equalizer leading to the front truck can be very well provided for in the cylinder saddle. In Fig. 16 is shown another method of keying the two cylinders together, which is found to give good results, but is not as good as the arrangement shown in Fig. 15, the keys in Fig. 15 being more directly in the line of the strain. It is not an uncommon thing to find openings between the two cylinders, as shown in Fig. 14, which were left for the purpose of saving work on the planing machine. This deprives the vertical joints of part of their grip or holding power, for the reason that the surfaces in contact are reduced, and the bolts passing through these openings are in bending strain instead of in shear, in addition to which the cold wind in winter can penetrate through these openings and strike directly on the hot walls of the steam passages. This joint should be planed off to a true surface for the entire depth of the saddle, as shown on Fig. 13; then also the bolts are in shear. In Fig. 17, bolt holes are shown intended for bolts to secure the two saddles together at the top at "xx." In Fig. 18 the designers have provided for 12 similar bolts to secure the cylinder saddles together in the center. An examination of Fig. 18 will show that it will be very difficult indeed to fit these bolts, especially the upper ones, as there is no room up in the saddles after they are placed together, for a man to use the reamer or hammer or wrench, unless it be a ratchet wrench with a screw feed. If such bolts are to be made driving fit (and they would be of little use unless they were so fitted), they will have to be forced in and out of the holes by means of small steel wedges and small specially designed screw jacks. The difficulty of putting these bolts in well will undoubtedly defeat the object which the designer had in view, for the reason that the workmen certainly will not take the trouble to make a good job of the fitting, especially if the work is being done by piece. Ample strength can be obtained by bolting the saddles together with sufficient bolts of the proper size, front and back, as shown on Fig. 5 and by bottom bolts and keys as shown on Figs. 15 and 17.

Mr. Reuben Wells, of the Rogers Locomotive Works, has called attention to a point in the design of cylinder saddles which is of importance. By reference to Fig. 18 it will be seen that there is no clearance in the center between the faces of the saddles where they bolt together; therefore the vertical walls of the steam passages, SS, abutt against one another at the joint. This can be clearly seen in Fig. 37. Now the expansion of these walls due to the heat of the steam is bound to be greater than that of the outer vertical front and back walls of the saddle. There will therefore be a tendency to "rock" on the center of the joint, especially in cold weather, when the differences in temperature will be more noticeable. Either the bolts will break in the vertical flanges, or the flange will be torn off, or the saddles will crack open at the II Fig. 37. All of these results have occurred, and have been traced to the unequal expansion above referred to. The remedy is shown on Fig. 13, where there is a space left between the saddles at the center, they bearing together only at the outside flanges and along the top and bottom.

FASTENING OF SINGLE BAR FRAMES TO CYLINDERS.

The upper surface of the single bar running from the front pedestal to the cylinder in a single bar frame is either level with or slightly above the center line of the cylinder. The lower portions of Fig. 13 and Fig. 15 show the prevailing methods of securing the single bar frames to the cylinders. Horizontal bolts should be used through the frame and cylinder flange, the holes being carefully reamed and bolts well fitted. These bolts should not be depended on, however, to take up the thrust. This should be taken up as shown in Fig. 13, by heavy lugs forged on the frame bar. In this connection, the committee wishes to call attention to the differences as between Fig. 13 and Fig. 14. As between Fig. 27 and Fig 28 and Fig 29, as well as between Fig. 30 and 31. With the former of each of which it is practicable to face off the cylinders where they bear against the frame lugs at the time they are being bored out, provided this face is made to come in line with the back cylinder face. Then if the distance between the face of the front pedestal leg, and the face of the lug bearing against the cylinder are always maintained exactly to a gage, the frames can be placed to the cylinders, the keys on the front ends drawn up, cylinder bolts reamed and driven, with the assurance that the frames and cylinders are absolutely true and square, that the distance between the axle and the cylinder centers are correct, and that the axle will be square with the center lines of the cylinders without the necessity of any trying, of drawing a little bit ahead, a little bit back, or of squaring up to lines. This also renders the replacing of broken frames and broken cylinders a comparatively inexpensive matter. In Fig. 16 is shown a method of securing the single bar frames to the cylinder, which is cheap and comparatively strong. In this arrangement the frame is inclosed in a groove, planed out of the lower surface of the cylinder saddle. One-inch bolts pass through frame and cylinder at the front and back of the saddle, and a wrought iron tie cap, held to the cylinder saddle by ⅞-inch studs, holds the frame well up to the cylinder. The taking out of such a frame is very easily accomplished when repairs are necessary, but on the drawing submitted no lugs are shown on the frame, and the fore and aft pull is entirely taken by two 1-inch though bolts. This arrangement has the disadvantage of wakening the inder saddle at a point where it is very apt to break anyhow, in addition to which in case of collision, the cylinder is very apt to suffer if the frame is bent sideways, whereas, if arranged as in Fig. 13 the bolts will break way and allow the frame to bend off from the cylinder flange without breaking the saddle. Vertical bolts through the frame leading up into the cylinders where the nuts have to be tightened up inside the saddles are objectionable, for the reason that the tightening up has to be done with a very short wrench, or a crooked wrench, and it will certainly not be well done in the average shop practice, in addition to which these nuts cannot be conveniently inspected. A vertical bolt, front and back of cylinder saddle, is all that is necessary to hold the frame up to its place in addition to the horizontal bolts as shown at the lower parts of Fig. 13.

FASTENING OF THE DOUBLE BAR FRAME FO THE CYLINDER.

The same remarks about keying the frames on the front only, and preserving a standard distance between the face of the frame, where it bars against the cylinders and the face of the front pedestal leg, see Figs. 32 and 33, are applicable in the case of the double bar frame. As far as the bolting of the frames to the cylinder is concerned, reference to Figs. 13 and 14 will show what may be considered as good and bad practice. Fig. 13 provides for ample fastening for both bars to the cylinder. There is no interference to the free run of the exhaust and steam passages, the dimensions of which can be made ample, the cores for which are very simple, and the strength of the saddle at its weakest point is increased on account of the ribs and upper flange. In case of repairs the bolts can all be easily removed and the frames and cylinders easily separated. In Fig. 14, long through bolts are used, which experience has shown are apt to break off, and when broken requires a surgical operation to remove the pieces. The coring of the cylinder is difficult, the steam and exhaust passage ways are crooked and obstructed and there is not a single thing to recommend it when compared with Fig. 13. In Fig. 15 the upper bar of the frame is carried in a groove or trough, which groove or trough weakens the cylinder at its weakest part, and obstructs both the steam and exhaust passageways very seriously. In addition to which, in collisions, the cylinders will suffer by being broken, as explained in the case of Fig. 16.

It is not an easy matter, in handling large masses of iron, such as a 20-inch cylinder for a consolidation engine, and 4½ inch by 4 inch frames, to make an absolutely perfect fit of a frame on both sides of a groove or trough, as shown in Figs. 15 and 16. In examining a number of engines having their frames and cylinders so fitted together, it was found that the frames generally do not fit, and that it is possible to insert a knife blade or slip of tin between the frame and the cylinder casting on one side or the other, showing that the object of the designer has been defeated owing to the difficulty of obtaining perfect workmanship with such large masses of iron.

Master Car Builders' Association Notices.

The following circulars have been issued by committees of the M. C. B. Association, and it is specially requested that replies be forwarded to the respective chairmen not later than Feb. 15:

Freight Car Trucks.

1. Do you consider it advisable to adopt standard size and shape of arch bars and channel transoms for diamond trucks for cars of 60,000-pound capacity?
2. If so, what would you recommend for length of wheel base?
3. What dimensions would you recommend for arch bars?
4. What do you recommend for the rise or set of top arch bars?
5. What do you recommend for the depth or set of bottom arch bars?
6. What size of column bolts would you reeommend, and how many to each side of truck?
7. What size of journal box bolts would you recommend?
8. Give dimensions of channel transoms which you recommend.
9. Is there, in your opinion, any advantage in the use of swing bolster over the rigid truck as to flange wear, roadway or load carried in cars?
10. Would you prefer to adopt swing bolster truck for freight cars, provided it did not increase cost of construction and maintenance over that of a rigid truck?
11. What style of truck do you consider the most practical and economical to maintain?
12. Do you prefer brakes attached to trucks or car body?
13. If to trucks, is it advisable to hang brakes below truck springs?
14. How many cars have you with trucks constructed exclusively of iron and steel? If any, what make?
15. What has been your experience with such truck?
16. How many cars have you with new design of trucks? If any, what make?
17. How many cars have you with metal truck bolsters?
18. What has been your experience with metal truck bolsters?
19. What has been your experience with later designs of wood trucks for 60,000-pound capacity cars?

The Committee requests members to send drawings of later design of trucks whenever possible, as well as to give their recommendations for standard arch bars and channel transoms for 60,000-pound capacity cars as above form. If any member knows of any improvement for freight-car trucks, the Committee would be greatly obliged if he will call attention to same in his reply and send plan or a sketch of same, if possible.

Address replies to J. J. HENNESSEY, M. C. B. C. M. & St. P. Ry., West Milwaukee, Wis.

J. J. HENNESSEY, SAMUEL IRVIN, JOHN H. DAVIS, WM. VOSS, F. H. STARK, Committee.

Lubrication of Cars and Prevention of Hot Boxes.

The Committee, in order to enable it to make a full and complete report on the subject assigned it, which will be of value to all members of the Association, requests that you will, as promptly as possible, give full and complete answers to the questions given below:

1. What kind of lubricants do you use, oil or grease?
2. From your experience which do you prefer, and why?
3. What quality of oil or grease do you use, and what is its cost?
4. What is the cost of oil or grease per thousand miles run for (*a*) passenger equipment? (*b*) freight equipment?
5. Do you use any special lubricants or cooling compounds?
6. If so, what are they, and how are they applied?
7. What results have you obtained by the use of such compounds?
8. Do you keep a careful record of all cases of hot boxes on passenger and freight equipment?
9. If so, to what extent are you having hot boxes per thousand miles run on (*a*) passenger equipment? (*b*) freight equipment?
10. If you keep a record of hot boxes, please attach copy of form on which you have reports made?
11. Do you use cotton or woolen waste for packing, and which has given the best results?
12. If you use any other material for packing, please state what it is and its advantages over cotton or woolen waste, if it has any.
13. With the grade of oil and waste you are using, how many pints of oil do you find it takes to fully saturate a pound of waste?
14. What is your method of preparation of packing for use in journal boxes; include in your answer how long you allow waste to soak in oil before using?
15. At what intervals should packing be renewed in (*a*) passenger equipment? (*b*) freight equipment?
16. Have you any rules in force at inspection points, at shops, or for train crews, regulating the care and attention to oiling, inspecting and repacking of journal boxes? If so, please attach copy or a statement of your general practice.
17. Do you use any special design of oil box, which has features specially designed to overcome tendency to hot boxes? If so, please furnish sketch or blueprint, or full description of the special features?
18. Do you use any special design of dust guard? If so, please furnish sketch or blueprint, or give full description?
19. Do you find any clearly evident advantages from such special dust guard? If so, what are they?
20. Please state what, in your opinion, is the best material for a dust guard?
21. Have you found from experience any advantages in either steel or iron axles, as compared one with the other, in the avoiding of hot boxes? If so, which is better, and what special feature seems to cause the better results?
22. What rules or specifications do you find it necessary to make in order to insure journals to be finished sufficiently well to avoid heating in service? Please include in answer, to what extent any black seam marks, open seams or dirt streaks may exist without making journal liable to run hot; also please attach copy of your specifications for axles?
23. What, from you experience, have you found to be the best material for journal bearings?
24. Will you please personally examine your patterns for your M. C. B. standard journal bearings and wedges, for 3⅜-inch × 7-inch and 4¼-inch × 8-inch journals. Compare them carefully with the new standard drawings accompanying the 1893 Master Car Builders' Association report, and advise if they conform strictly to all points in the standard? If differing, please state in what particulars and the reason for the difference? Please send blueprints of your M. C. B. wedges and journal bearings for 3¾-inch × 7-inch and 4¼-inch × 8-inch journals, from which your present patterns are made?
25. What mixture and percentage of different metals do you use in (*a*) passenger journal bearings? (*b*) Freight journal bearings? If any scrap material is used please state the amount allowed?
26. Do you use self-fitting (solid lead-lined) or filled shell journal bearings?
27. What is your experience as to the comparative freedom from heating with the above two styles of journal bearings?
28. What is your experience as to the comparative number of cut journals with the two styles of journal bearings?
29. Do you require solid journal bearings to be bored or ground before lining? If so, which, and on how much larger radius than the radius of the axle?
30. What metal or mixture do you use for lining solid bearings?
31. How thick do you use the lining, and what should the limits in thickness be?
32. Do you line the entire face of the journal bearing, or only part? If only part, describe how much and reason for such practice?
33. If you use filled shell bearings, what metal do you use for the shell and what for the filling? Give proportion of metals in the filling.
34. If not a plain shell filled, please indicate by blueprint or description any peculiarities of construction, and any advantages you experience as shown from the special design?
35. Have you had any experience or data as to the comparative freedom from heating with M. C. B. journal bearings and wedges with curved backs, as compared with straight backs?
36. Do you use any method of testing journal bearings and wedges by gages or otherwise, to insure that they are the proper standard shape and size, and that they will fit properly? If so, please send blueprint or full description of gages and prescribed test.
37. Do you find that journal bearings commence heating first at the front or at the back end? Please give your opinion as to the cause of such result.
38. Do you find the same experience with both passenger and freight cars?
39. Do you find that hot boxes are sometimes caused in passenger equipment by a twist of the equalizer, causing the feet of the equalizer to rest unevenly on the top of the oil boxes? If so, what is your rule in building or overhauling trucks to overcome such tendency?
40. Do you have any special rule with regard to the position of the thin bottom end of equalizer springs on passenger equipment, as to the position the end of the spring shall have as regards the equalizer, in order to avoid the tendency to tip the equalizer by the spring bearing harder on one side than the other? If so, what is your practice to avoid this?
41. What influence does the use of the power brake have in causing hot boxes?
42. If you have had personal experience in connection with the above, please state results of that experience and your deductions from it.
43. Have you had any experience as to the comparative effects of the use of brakebeams on each side of each pair of wheels? If so, please state experience.
44. If you have had no definite experience, please state your opinion.
45. What is your shop practice as to the extent of overhauling given to passenger equipment trucks with view to preventing hot boxes?

Please send all replies to A. M. Waitt, Gen. M. C. B., L. S. & M. S. R'y., Cleveland, O., before Feb. 15, 1894.

A. M. WAITT, W. H. THOMAS, I. E. WOOD, F. A. STINARD, W. K. CARR, *Committee.*

CLEVELAND, O., Jan. 10, 1894.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

OUR DIRECTORY.

The directory of railroads and railroad officers that is published in each issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER has just been officially corrected up to date. We have recently sent circulars requesting the necessary corrections to 538 roads, and now have returns from all but 29 small roads. Our directory as now published is the most correct list of railroad officers in print.

HAND VERSUS MACHINE SET TYPE.

About a year ago we made some changes in our methods of setting the type for and printing the NATIONAL CAR AND LOCOMOTIVE BUILDER that at the time were believed to be improvements. For 23 years the type for the pages of this paper had been set by hand, but the twenty-fourth year (1893) the type was set by type-setting machines, the object being to avail of the latest improvement in the art of printing. Our only regret is that we were allured from the even tenor of our way, and that we have consequently inflicted on our readers several issues of the NATIONAL CAR AND LOCOMOTIVE BUILDER the interesting contents of which were marred by presentation in very bad print. Our last issue was an aggravating example in point and capped the climax. We have now returned to hand-set type and shall not depart from its use again until a medium of typographical superiority is perfected.

INDUSTRIAL IMPROVEMENT.

There is a generally improving tone noticeable in business and industrial circles, and the indications are numerous that the ordeal of depression we have been subjected to during the past eight months is shortly to end. The numerous items appearing in this issue reporting recent orders received by the contract shops for new cars and locomotives show the growing improvement in the car and locomotive building industries.

Two large railroads, the Atchison, Topeka & Santa Fe and the Cheasapeke & Ohio, are large prospective buyers of new rolling equipment in the near future, and the general deterioration of such equipment on all the roads that have been sparing in repairs during the dull times is sure to cause great activity in repair shops all over the country. The stock of necessary supplies has been allowed to run as low as practicable on nearly all roads, and replenishments must soon commence and cause activity in the wide range of industries that contributes to the production of such supplies.

What is said of the prospects of increasing activity in these branches doubtless applies to all other departments of railroads and to all other industries. There has been a general husbanding of resources, reduction of expenses, putting off of needed repairs and renewals, exhaustion of supplies and goods on hand; in fact, a general using up and wearing out process everywhere. This must soon stop, and the work of repair, renewal and recuperation must soon begin. The favorable reports we are receiving from all parts of the country, of closed shops reopening and re-employing thousands of workmen, of suspended industries of every character resuming, and of increasing demand for various kinds of equipment, lead us to believe that the end of the era of depression is near at hand.

THE ABOLITION OF CAR PLATFORMS.

In our last issue we published an article on "Passenger Car Construction," written by Mr. Ernest Merrick, Mechanical Engineer of the Canda Car Company, in which a radical change in the end construction of passenger cars was recommended, including the abolition of end platforms. In this issue we give liberal space to the illustration and description in detail of his proposed plan of construction, which, while perhaps open to criticism in some particulars, will yet certainly commend itself to car builders as a much stronger end construction than the ordinary; and there can be little doubt that in case of collision, either head or rear, this style of construction would offer much greater resistance to telescoping. This would either prevent telescoping, or, in its event, greatly mitigate its severity, because a much larger portion of the moving energy of the entering car would be spent in breaking through the strongly built breastwork of composite steel and wood forming the end of the car. The abolition of platforms would also largely decrease the chances of telescoping and mitigate its severity, as the space between the end of a car platform and the superstructure certainly gives just so much of a clear run to the adjacent car in case of one platform mounting or breaking down another in collision. The immense impetus gained by such a start is doubtless responsible for much of the destruction resulting in accidents of this kind.

The abolition of platforms is a problem that many car builders have devoted considerable attention to, but so far without any practical results. Others are contemplating the extension of the longitudinal sills to the platform end timber, and thus make the platform an integral part of the floor framing. Still others believe in maintaining the platform as an attachment so that when damaged in accidents it can be cheaply repaired or replaced. Of these three propositions there seems to be at present but small chance for a middle ground on which to compromise. The extension of the longitudinal sills so as to make the platform an integral part of the underframing might, in case of damage, necessitate the renewal of the entire underframing of the car, and this is the principle objection (in regard to maintenance) that is advanced against dispensing with the end platforms.

Whether it is decided to abolish platforms or not on passenger cars there seems to be no good reason why they should not be abolished on mail, express and baggage cars. Their principal use on these cars now on some roads is as a base of operations for highwaymen. The plan of construction proposed by Mr. Merrick, or some modification of it, seems excellently adapted for the ends of mail cars. These are generally run next the locomotive, the tender of which, being stronger built and narrower than the car, often telescopes it in collisions. The abolition of the platform and the adoption of this strong end framing might prevent this.

Mr. J. N. Barr expressed the opinion at a recent meeting of the Western Railway Club, that the prevailing excessive weight of passenger cars is a great element of danger in collisions, as, in case of telescoping, the heavier the entering car the further it will go. Mr. Merrick brings out the point that excessive length is dangerous, as the behavior of such cars in collision tends strongly to telescoping. Both of these objections are absent from the plan of construction he proposes.

A good many changes in car construction are approaching and we believe that among these the requirements of the ends of *all* passenger cars to avoid or resist telescoping will receive more attention than has been given heretofore.

SOME THOUGHTS ON RAILROAD TRAVELING.

About the first thought that suggests itself to a person about to take a railroad journey is, in these days of frequent accidents: Where is the safest place on the train? Extremes are generally objectionable, and so, as a place of safety, are either the extreme rear or forward parts of a passenger train. In case of a head collision, the engine and forward cars have to furnish the means for absorbing the moving energy of the train, and this energy is usually so great that one or more cars are wrecked before its force is spent. In the case of a rear collision, the rear cars must furnish the means of absorbing a large portion of the moving energy of the striking train.

Perhaps fully half of this force is spent in wrecking the striking train, and a considerable portion of the force of the blow is spent in knocking the standing train forward. The balance of this force is spent in compressing the springs of the draft appliances on both trains and in wrecking the rear part of the train that is struck. Therefore it is plain that in case of head or rear collisions, the front or rear parts of the train, as the case may be, are dangerous places; and the front more so than the rear for the reasons stated, and for the further reason that the forward cars of a passenger train are usually lighter and less strongly built than the heavy parlor or sleeping cars that usually make up the rear of the train. The blow of a head collision will do more damage to the forward cars of a train than a colliding blow of equal force will to the rear cars of the train as ordinarily arranged.

For these reasons, the very best form of insurance for travelers is a parlor or sleeping car ticket; although the rear car of the train, even if of the strongest construction, may be destroyed in a rear collision.

The belief is becoming quite common that the safety of passengers is not jeopardized very much by the higher train speeds that are now attained. There are good reasons for the belief. It is probable that the fastest train on a railroad is the safest to ride on. Of course, the higher the speed at which a train runs the greater is its potentiality of self-destruction, but as such can result only from accident, safety is really enhanced by the higher speed because accident is more zealously guarded against on the fast than the slow train, and the probability of its occurrence therefore is largely decreased. The cars of the fast trains on our railroads, and the engines that haul them are, perhaps, more carefully inspected and are certainly more carefully maintained in the safest and most perfect running order than are the cars and engines of slower and what are considered less important trains. The most competent and reliable employés are generally selected to operate the fast trains, and perhaps the chief element of the safety of these trains lies, in the fact, that not only the men who operate them, but all the employés connected with the train service on the division of the road on which the fast train is running are on the *qui vive* respecting its safe and successful passage. Interference with it in any way is sure to get the employé at fault into trouble, and the knowledge of this inspires all who have to do with the movement of trains with unusual alertness in regard to the specially fast train.

Each of these influences is a safeguard against accident, and their combined effect is to make the very fast trains very safe trains to travel on.

When the time arrives for one's berth to be made up the question is usually asked if he prefers to sleep with his head or feet toward the engine—the direction the train is running. Porters find a wide diversity of opinion among travelers on this question, but during the last few years the greater number have come to direct that their berths be made up for them to sleep with the head toward the engine. Others, and among them some of the most experienced travelers, prefer to sleep with their feet toward the engine. Each have apparently nearly equally good reasons for the opposite choice.

Those who ride with the feet toward the engine do so because it seems to them the most natural way, and the safest way. If they glance out the window they face the direction in which they are traveling, and they reason that in case of a very sudden stop, caused by collision or derailment, the feet and legs will take the shock; whereas, those who ride with the head toward the engine must feel that they are riding backward, especially if they look out the window, and in case of such a sudden stop as above referred to the head and neck instead of the feet and legs must take the shock, which might and perhaps sometimes does result in serious or fatal injury.

The chief reason usually given by those who ride headforemost is, simply that they sleep better that way. They advance numerous theories to account for this, some believing that inertia operates to cause the blood to flow more toward the feet and thus relieve the brain and permit sleep. Others consider the headforemost motion the most natural. Birds fly and fishes swim that way, and with rare exceptions all animal life instinctively moves in that direction. The theory of evolution teaches that our ancestors traveled on all fours, and therefore necessarily headforemost. Perhaps the functions of our organism are still responsive to the ancient habit and rebel against a reversal of it. Swimmers find that it is more pleasant to dive than to jump into water, and those who ride in fast moving elevators in tall buildings know that a rapid ascent is not as disagreeable as a rapid descent.

Another reason given for riding headforemost while asleep is that there is thus less exposure to drafts and less danger of contracting colds. The headboard of the berth wards off drafts from the head of the sleeper in this position, and if either of the windows be raised for ventilation the incoming air (with whatever dust or cinders it may be laden) will blow toward the feet, which are generally protected with covering. In the opposite position the sleeper is exposed to such drafts blowing upon the more vulnerable and perhaps unprotected upper portions of the body.

Of the reasons named for riding with the head toward the engine it is probable that the latter is the only one worth serious consideration, and of the reasons given for riding with the feet toward the engine that of having the feet and legs take the shock of a possible very sudden stop, is the only one of importance. Aside from these the choice of the traveler for either position is perhaps largely the result of fancy or the example of others. For safety in possible accident it is best to have the feet toward the engine, and for safety from the possible effects of drafts it is

best to have the head toward the engine. Accidents slay their hundreds, but colds and complications slay their thousands. Therefore, for those who are susceptible to colds, and perhaps for all during inclement weather, the reasons preponderate in favor of sleeping with the head toward the engine.

THE LACKAWANNA WRECK.

The disastrous rear-end collision of passenger trains that occurred on the Delaware, Lackawanna & Western on Jan. 15 killed nine passengers outright and seriously injured 41 others, of whom three have since died. The wreck was the result of running trains in a fog on the short time interval of four minutes, the absence of any block system, and utter dependence on the judgment and alertness of employés. In this instance three passenger trains were closely following each other in a dense fog. The leading train slowed up for a drawbridge over the Hackensack River, and its engineer in feeling his way through the fog in approaching the bridge lost a couple of minutes' time. The second train, running at a high rate of speed, apparently quite regardless of the river, the drawbridge or the preceding train, overtook and telescoped the rear car of the first train, shoved this car part ways through the car ahead, which in turn telescoped the car ahead of it.

Like some other people who lock the barn door after the horse is stolen, the Delaware, Lackawanna & Western company has now decided to equip its road with some system of block signals. In answer to the criticisms heaped upon it for not having previously done so, the officers of the road are quoted as having said that the operation of block signals cannot always be depended on "in severe weather," probably meaning that they become invisible in heavy snows or fogs. This is indeed a lame excuse, for there are perfected signal systems that can be seen by all but the blind, and, if not seen, heard; and there are other systems that, if the signal is neither seen nor heard, will effectually shut off the engine and apply the breaks to train which it is set against. The art of train signaling has reached a high state of excellence, and it cannot be truthfully said that none are reliable.

AN ECHO OF THE BATTLE CREEK WRECK.

After the head end collision on the Grand Trunk road at Battle Creek, Mich., last October, in which 27 people were killed and 36 injured, the conductor and engineer of the eastbound train, whose gross carelessness caused the wreck, were arrested and charged with manslaughter. The conductor has been acquitted, and in consequence the charge against the engineer has been dismissed. This is a sad miscarriage of justice, for if ever there was carelessness that was criminal in its atrocious disregard of the safety of others it was the carelessness that caused this wreck and holocaust at Battle Creek, and of which these men are equally guilty.

They received orders at Battle Creek to meet a westbound passenger train within the yard limits. The conductor delivered the orders to the engineer and neglected to ascertain that they were properly understood as he was in duty bound to do, but, instead, he hurried up the engineer who in compliance mounted his engine and pulled out without looking at the orders, and smashed into the train he was to wait for.

We know nothing and care less about the technicalities by which these men have been able to escape the legal consequences of their miserable blunder, but we know that the fact of their acquittal will have anything but a salutary effect on careless railroad men. These should be impressed with not only their moral responsibility in the careful performance of their duties, but also with their legal responsibility and the legal consequences of carelessness that jeopardizes the safety or destroys the lives of others.

While these acquittals establish a prominent and unfortunate precedent that may encourage others to dismiss all fear of legal punishment for criminal carelessness, yet there can be no escape from the moral consequences and conscientious punishment of such atrocious carelessness as these men are guilty of. Those who must bear the knowledge that they have carelessly and needlessly caused death in its most terrible form to many and indescribable suffering to others they have maimed, cannot be said to escape punishment.

Improvement in Southern Industrial Conditions.

In a review of the industrial situation for the week ending Jan. 15, the *Tradesman*, of Chattanooga, reports that in the organization of new industries the Southern States have maintained the average during the week, with an increase in the number of enlargements of manufactories. Inquiries for new machinery continued to be unusually large.

Thirty-two new industries were established or incorporated during the week, together with 12 enlargements of manufactories and 12 important new buildings. Among the new industries named are the Fordyce Nut Lock Company, of Fordyce, Ark., capital $100,000, by John D Dunn and others; the Brown Automatic Car Coupler Company, of Alexandria, Va., capital $100,000, by P. C. Brown and associates; electrical works, capital $20,000, at Jackson, Miss., by W. Watson and associates; new car works at Augusta, Ga., and car coupler works at Tar River, N. C.

Literature.

McClure's Magazine for January is a notable New Year's number, and contains many articles of interest and portraits of well known men, among which are those of John Tyndall, Huxley, Max Müller, the Duke of Argyll and Samuel Smiles. There is a contribution from Professor Tyndall which is probably one of the last articles he wrote, as a cablegram announcing it was received by the publisher just 24 hours previous to the announcement of Professor Tyndall's death. There is also an illustrated story of a journey made by an old engineer from New York to Chicago in 20 hours on the engines of the "Exposition Flyer," which is claimed to be the longest and swiftest journey ever made in an engine-cab.

The January number of *Aeronautics* contains a paper by Professor Langley, of the Smithsonian Institute, on "Aerial Navigation," and also other interesting matter relating to aerostatics. As previously announced in this column, *Aeronautics* is a monthly paper ($1 per year, 10 cts. single copy), published by the *American Engineer and Railroad Journal*, 47 Cedar street, New York.

The January issue of the *Engineering Magazine* is a souvenir number of the Columbian Exposition. It is superbly illustrated and contains 144 pages. The leading articles on the Fair are: "Its Value to the American People," by Andrew Carnegie; "Effects of the Centennial Exhibition," by Gen. A. T. Goshorn, Director Centennial Exhibition, 1876; "The Architectural Event of Our Times," by Henry Van Brunt, Architect of the Electricity Building; "Electricity in 1876 and in 1893," by Prof. Elihu Thomson; "The World's Fair and the Railways," by Col. H. G. Prout; "An Era of Mechanical Triumph," by Prof. R. H. Thurston; "The Mining Industry and the Fair," by R. W. Raymond; "International Effects of the Fair," by Edmund Mitchell; "Designers and Organizers of the Fair," by E. C. Shankland, Chief Engineer World's Columbian Exposition; "Cost and Income of the Great Fair," by Anthony F. Seeberger, Treasurer World's Columbian Exposition.

The Northwest Railway Club.

The January meeting of the Northwest Railway Club was held at the Hotel Ryan, St. Paul, on the evening of Jan. 9.

After routine business, discussion was opened on the paper read by Mr. W. C. Dallas at the preceding meeting, which was entitled, "Some of the Defects in the Construction of Cars and Engines, and Their Effect Upon Lubrication." This discussion was taken part in by Messrs. McIntosh, Lenhart, Hickey, Ellis and Bryan. The customs of different roads in regard to car oiling were given in detail, and Mr. Bryan gave an account of how he had used manilla rope cut into short pieces and stood on end in driving box cellars for the lubrication of driver bearings that could be kept cool in no other way. Mr. Hickey called attention to the fact that a bearing having more than 250 lbs. pressure to the square inch was likely to run hot under freight cars, as the oil would be forced from the bearing by pressure exceeding this amount.

Following this discussion Mr. Brooks, Master Mechanic of the St. Paul & Duluth Railway, read a very interesting paper on the subject for the evening, which was "Steel vs. Iron Axles." His paper went into the theory of the making up of iron and steel to some extent, and showed how their different structure would cause different results from the same treatment in service. His conclusions were in favor of the iron axle, provided a good article of each was considered. The paper was afterward partially discussed by the members present, but it was more in regard to the action of steel generally and its life when subjected to intermittent and constant stress.

Owing to the absence of Mr. Pattee, of the Great Northern Railway, and Mr. Preston, of the Omaha, who had also promised papers on the same subject, the subject was continued for the next meeting, at which these other papers will be read. The subject of steel for piston rods was selected for topical discussion at the next meeting.

The meeting was very well attended, and the proceedings were very interesting. The secretary was requested to correspond with the other clubs with a view to ascertain the cost of printing proceedings in pamphlet form.

The date for the next regular meeting will be Feb. 13.

Staybolts.

A staybolt should have a good thread on it, the hole should have a good thread, and the bolt should fill the hole; it is not necessary that it should screw in with a very tight fit, but it should reasonably fill the hole, and the less heading over, the less pounding done on the end of that staybolt, I think the better. I find that a great many staybolts put in of good material are rendered brittle by being tortured out of shape by the extra pounding they get in heading them up to make them tight. I use iron for staybolts that costs six and a quarter cents in the bar. I don't think any railroad builder of to-day, unless he was tied down pretty tight with specifications, would expect to pay over two and a half or two and three-quarters for staybolts That expenditure of money in the first instance is saved in the better wear, and avoidance of repairs. We all know the expense of taking out a broken staybolt and putting in a new one. Then the hole is enlarged a little, and a larger bolt has to be put in. The danger from broken staybolts is a material one. I was called a few months ago to examine a boiler that had exploded and killed three men. The side sheet of the furnace had pulled off from the staybolts and gone across the furnace, and lay across the sheet on the other side, so there was room to make a thorough examination. There were 19 broken staybolts in one bunch; every one was all closed over; there were six or seven others in the immediate vicinity almost broken, and nine that had been put in new only one week before. My investigation showed that the boilermaker—a very competent man, I judge—had tested these staybolts and found nine broken, and put in new ones, and failed to find the other 19, and the consequence was an exploded boiler and three dead men.—*Mr. J. N. Lauder, before the December meeting of the New England Railroad Club.*

Strength of Old Rails.

Some recent tests of the bending strength of old rails at the Watertown Arsenal have developed some interesting facts relative to the employment of this material for constructive purposes. When the rail was placed so as to bring the head in tension and the base in compression the rails broke with a clean fracture, but when turned over and the head put in compression and the base in tension they bent without fracture.

It appears that a thin layer of metal on the top and corners of rails becomes hardened or crystallized in service. Rails that had about $\frac{1}{16}$ inch of metal planed off from the head did not break, but bent, whether the head was in tension or compression; but when this $\frac{1}{16}$ inch was taken from the top, but not from the corners, the rail broke as before.

What is known as the Eastern Express between Paris and Constantinople has been materially accelerated. The journey is now made in 66½ hours, showing a reduction of about 7 hours.

At a banquet following a recent convention of railroad men the following apt toast was one of the list: "Our mothers—the only faithful tenders, who never misplaced a switch."

Speaking of the smoke nuisance that has again revived in the "Smoky City," the late James Parton said that Pittsburgh at night reminded him of "hell with the lid taken off."

The cars exhibited by the Kreibel Palace Car Company at the World's Fair have been overhauled at the Bloomington shops of the Chicago & Alton and are now being placed in service over that road for tours between Chicago and Californian points.

Out of a total of some 300 miles of electric street-railways now in operation in the various countries of Europe, more than one-half is equipped with machinery of American manufacture. The over-head trolley system is used on about two-thirds of the total mileage.

A mogul locomotive, while engaged in snowplow service on the Canadian Pacific, near Harvey Lake, Jan. 13, jumped the track and went flying out upon the ice, which broke under its weight, and went down in 30 feet of water. The engineer was saved, but the fireman was drowned.

One of the longest electric railways in the country is that from Oakland to Hayward's, California, a distance of 15 miles. The cars on this road make a speed of 35 miles per hour, and the distance between the termini has been run in 35 minutes. Some of the cars run an average of over 200 miles per day.

That was a wise orator who, on the occasion of the dedication of a new passenger depot on a Western road, said:

Any remarks I may make shall be brief, because I am satisfied from experience and observation that many otherwise good speeches, like many great railroad enterprises, fail for want of terminal facilities.

At the January meeting of the Western Railway Club, held on Jan. 16 the paper read at the previous meeting by Mr. J. D. McIlwain, of the Harvey Steel Car Works on "Steel in Car Construction," was quite fully discussed. Mr. G. W. Rhodes read an interesting and valuable paper upon "Air Brakes," which will come up for discussion at the next meeting. There was an unusually large attendance.

Railway surgeons would rather deal with the victims of a night than a day accident. The injured suffer from mental as well as physical shock, and the mental shock is greatest where through the sense of sight the injured is conscious for a few moments of approaching danger. The case of a man who catches his foot in a frog is a good illustration. He cannot tear himself loose. He sees a car coming and knows what is to happen. The mental shock to that man makes his condition much worse than that of a man whose foot is caught and crushed so suddenly that he does not have time to appreciate the impending danger. It is said that many fatalities occur for which this mental shock is responsible rather than the physical injury, and that injuries received at night are less likely to prove fatal, because the person injured has not been able to comprehend what was coming, as he might have done in the daytime.

Personal.

Mr. John MacLeod was on Dec. 30 appointed Receiver of the Ohio Valley railway.

Mr. T. M. McDonough has been appointed Master of Machinery of the Abbeville Southern.

Mr. A. L. Sanger has been appointed Purchasing Agent of the Evansville & Terre Haute road.

Mr. James F. How, Vice-President of the Wabash, has resigned and leaves the service of that road Feb. 1.

Mr. Charles Clark has been appointed Receiver for the Oregon Pacific Railway, vice E. W. Hadley, resigned.

Mr. Henry S. Chubb has been appointed Receiver of the Florida Midland in place of Mr. A. E. Drought, resigned.

Mr. J. T. Odell, Vice-President of the New York & New England, has been appointed General Manager by the receivers.

Mr. C. H. Newman, Division Master Mechanic of the Western New York & Pennsylvania at Oil City, Pa., has resigned.

Mr. F. C. Helm has been appointed Purchasing Agent of the Toronto, Hamilton & Buffalo, with headquarters at Brantford, Ont.

Mr. H. G. Reeves has been appointed Master Mechanic of the Indiana, Illinois & Iowa, succeeding Mr. L. H. Miller, promoted.

Mr. C. B. Duffy has been appointed Purchasing Agent of the Columbus, Hocking Valley & Toledo, with headquarters at Columbus, O.

Mr. G. W. Cushing has been appointed General Master Mechanic of the Cincinnati Southern Ry., with headquarters at Paducah, Ky.

Mr. James Meehan, Superintendent of Motive Power and Machinery of the Queen & Crescent, has resigned and the office has been abolished.

Sir Samuel White Baker, famous for his achievements as an African explorer from 1861 to 1873, died at his home in Devonshire, England, Dec. 30.

Mr. E. M. Humstone has been appointed Master Mechanic of the Philadelphia, Reading & New England, with headquarters at Hartford, Conn.

Mr. F. C. Locey has been appointed Master Mechanic of the Illinois Central, to succeed W. H. Whittaker, with headquarters at McComb City, Miss.

Mr. James A. Gohen has been appointed Master Car Painter of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind.

Mr. Lewis H. Miller, Master Mechanic of the Indiana, Illinois & Iowa, has been appointed Superintendent of the road to succeed Mr. T. M. Bates, resigned.

Mr. James L. Ellis has resigned the position of Master Mechanic of the Philadelphia, Reading & New England, and is succeeded by Mr. E. M. Humstone.

Mr. Edward Richardson, Master Mechanic of the Pittsburg, Shenango & Lake Erie Railroad, died at Greenville, Pa., on Jan. 2, of paralysis, aged 64 years.

Mr. Geo. J. Parkin has been appointed Division Master Mechanic of the Pennsylvania Railroad, with headquarters at Erie, Pa., in place of J. A. Wood, who resigned.

Mr. T. H. Fennell has resigned as General Superintendent of the northern division of the Lehigh Valley at Buffalo, N. Y., and is succeeded by Mr. Charles L. Beach.

Mr. J. E. Wilcox has been appointed to succeed Mr. G. W. Stevens as purchasing agent of the East Tennessee, Virginia & Georgia. Mr. Wilcox formerly held the same position.

Mr. W. J. Vance, formerly General Foreman of the Cleveland, Akron & Columbus, has been appointed Master Mechanic of that road, with headquarters at Mount Vernon, O.

Mr. L. B. Houck has resigned as Purchasing Agent of the St. Louis, Cape Girardeau & Fort Smith, to devote all his time to the St. Louis, Kennett & Southern and Houck's Missouri & Arkansas roads.

Mr. C. Skinner, formerly foreman of the mechanical department of the Ohio & Mississippi at Washington, has been appointed Division Master Mechanic, with headquarters at Washington, Ind.

Mr. E. B. Wall, who has been Assistant to the President of the Pennsylvania lines during the past year, has been transferred from Chicago to Pittsburgh and appointed Assistant to the General Manager.

Mr. W. E. Gray, Superintendent of Transportation of the Chicago & Alton, has been appointed General Superintendent of that road with headquarters at Bloomington, Ill., and his former position is abolished.

Mr. J. M. Winslow has been appointed Superintendent of Motive Power of the Washington & Columbia River, succeeding Mr. William Saxon, resigned. Mr. Winslow's headquarters will be at Hunt's Junction, Wash.

Mr. Joseph Billingham, Master Mechanic of the Gulf, Colorado & Santa Fe at Galveston, Tex., has been appointed Master Mechanic of the Baltimore & Ohio shops at Garrett, Ind., to succeed Mr. George R. Ott, deceased.

Mr. Edward C. Hiser, formerly Master Mechanic of the Adirondack & St. Lawrence Railroad, has been appointed Division Master Mechanic of the New York Central & Hudson River Railroad, with headquarters at Utica, N. Y.

Mr. George H. Hazelton, formerly Master Mechanic of the Rome, Watertown & Ogdensburg, has been appointed Master Mechanic of the lines west of Syracuse, in the place of Mr. James Buchanan. Mr. Hazelton is succeeded by Mr. P. T. Lonergan.

Mr. H. O. Hukill has been appointed Purchasing Agent of the Pennsylvania lines west of Pittsburgh, with headquarters at Pittsburgh, Pa., to succeed William Mullins, deceased. Mr. Hukill has heretofore been assistant in the Purchasing Agent's office.

Mr. Peter Fowler, for many years General Foreman of the Lake Shore & Michigan Southern machine shops at Buffalo, N. Y., has been appointed Master Mechanic of the Pittsburgh division of the Western New York & Pennsylvania, to succeed Mr. C. H. Newman, resigned.

Mr. Alexander Mitchell, Superintendent of Motive Power and Rolling Stock of the Lehigh Valley, has been appointed Superintendent of the Wyoming division of that road, with headquarters at Wilkesbarre, Pa., in place of Mr. O. O. Esser, assigned to other duties, and the office of superintendent of motive power and rolling stock has been discontinued.

Mr. W. H. Taft has been appointed Acting Superintendent of Motive Power and Machinery of the Boston & Albany, succeeding Mr. Arthur B. Underhill, resigned. The office is to be transferred from Springfield, Mass., to Boston, where Mr. Taft has been Division Master Mechanic since October, 1886. Mr. Taft began as fireman for the Boston & Albany Railroad in 1862, and was made an engineer in 1864. In May, 1879, he was appointed foreman of the machine shop at Worcester by Mr. Underhill, and remained there until appointed Division Master Mechanic.

Unique Car Shops.

At the car building shops of the Duluth Manufacturing Company, all kinds of cars but passenger cars are built; together with mining machinery, milling supplies and architectural, bridge and dock work.

The plant is the largest single manufacturing enterprise at the head of the great lakes, and was located at Duluth in 1889. Fifteen freight cars complete a day is the average output of the shops.

Two specialties, one a logging car and the other a dump car for mine stripping and general contracting work, are manufactured, and each has taken a leading place among cars of its class.

The shops and foundries cover nearly 15 acres of ground and include a rolling mill, axle forge and blacksmith shop, car wheel and soft foundry, machine shop, wood working shop, lumber department, planing mill department, ware and storage houses and office.

The forge works are equipped with one 6,000-pound hammer and two 2,500 pound hammers, and manufacture shafting and other forged articles up to 10 inches in diameter. The rolling mill is fitted with two trains of rolls, one 10 and the other 18 inches and turns out bar iron from ¼ to 10 inches. The blacksmith shop is a new building completed early in the autumn and is supplied with the newest and best machinery. The wheel foundry can turn out 200 car wheels per day, and the capacity of the soft foundry is 50 tons of castings in the same length of time.

This plant as a car factory is the most complete of any in the world, because it manufactures more articles which enter into the construction of a car than any other. The lumber is cut at its own mills, sawed and planed, and the bar iron, wheels, axles, castings, nuts, braces, lag screws, etc., are all manufactured by this company. Were it not for patented articles the only purchases of manufactured material would be paint, nails and springs.

The present officers of the company are: L. G. Matthews, President; H. H. Hanford, Vice-President; O. H. Simonds, Secretary; William Macalster, Treasurer; F. H. Duesler, Auditor; R. T. Ettenger, Superintendent, and W. J. Matthews, Assistant President.

Definition of "Baggage."

The defining of the word "baggage" has often been a difficult matter for the Courts. Many cases arise over the loss of articles carried in the trunks of passengers, and as railroad companies are usually required to convey only ordinary baggage, the meaning of the word is important. John D. Lawson, who has written some useful law books, attempts in *The Central Law Journal* to show the meaning attached to the word in legal decisions. He says that there are included in the term "such goods and chattels as the convenience, or comfort, the taste, the pleasure or the protection of passengers generally make it fit and proper for the passenger in question to take with him for his personal use, according to the habits or wants of the class to which he belongs, either with reference to the period of the transit or the ultimate purpose of the journey." Among the articles which have been included "baggage," according to legal decisions, are watches, opera glasses, gold spectacles, guns, fishing tackle, students' manuscript, dental and surgical instruments and watchmakers' tools. One passenger carried a spring horse 44 inches high and weighing 78 pounds. He was not allowed to recover for the loss of it, as it was held not to be baggage. A concertina, handcuffs, stage properties, presents for friends and salesmen's samples are among the articles which have been held not to be baggage. The decisions in the courts of various States have not been uniform, but Mr. Lawson finds some general rules which are usually followed.

The Protection of Iron and Steel from Chemical Action.

At a meeting of the Manchester Association of Engineers, held on Nov. 24, an interesting paper was read by William Thomson, F. R. S., Ed., F. I. C., on "The Influence of Some Chemical Agents in Producing Injury to Iron and Steel." Referring to the corrosion of iron in steam boilers by oxidation, the writer mentioned the system for preventing this, invented by Hannay, who claimed that by suspending a ball of zinc in the water of the boiler and attaching to it wires, the other ends of which were fixed in metallic contact with the shell and furnace flues, not only corrosion, but—to a very material extent—incrustation also was prevented. The iron of boilers was often corroded, and extensive "pitting" produced by free sulphuric acid, which was present in some waters, and it was very important that no trace of free acid should be contained in the water used in boilers. The nitrates and nitrites contained in some waters employed for steam raising purposes were liable to attack the iron or steel of the boilers and produce "pitting." Some pieces of zinc placed in the boiler prevented the action of these compounds, and the presence of tannate of soda had a similarly useful effect, while the mixture of one part—by weight—of bisulphite of soda to two parts of soda ash also aided in preserving the iron from the action of the nitrates and nitrites which might be present in the water.

Repairing Locomotives.

BY J. T. HEFFERNAN.

(*Continued from page* 6, NATIONAL CAR AND LOCOMOTIVE BUILDER *for January.*)

Facing Valves.

Fig. 58 represents a cylinder with the steam chest removed. We will now describe in detail the different operations of facing the valve-seat. As a rule all seats are worn hollow, caused by the valves having a shorter travel when the links are hooked up. After having removed the top casing remove the side casings next, and then take off the steam chest cover; then disconnect the valve stem from the valve rod, and lift off the steam chest. When removing the studs place them in a position, so there will be no difficulty in having each stud go back in its own hole.

A very handy arrangement for holding the studs is shown in Fig. 59, which is a box about 16 inches square and about 4 inches deep; around the edges of this box holes are bored, large enough to allow the studs to drop in through. Inside each hole on the box an ordinary screw is set into the wood, and on this screw the nut which came off that stud may be placed, preventing any chance of the studs and nuts being mixed up. A mark may be made on the box representing the front end, and then as the studs are taken out of the steam chest they can be placed in a hole in the box corresponding to the hole in the steam chest.

Fig. 60 shows a full-size sketch of a small tool which is very handy for removing studs; it might properly be called a key nut, and its action will at once be seen by a study of the sketch, which is full sized. A represents a key let into the nut proper, and with teeth on the edge B, the key being made taper grips the stud and it can be used for screwing in or taking out studs by simply turning the nut over.

The first operation after removing the steam chest is to examine the valves for cracks, then examine the fit of the yoke on the valve, and if lose the yoke may be sent to the blacksmith shop and closed on the sides. In fitting the yoke to the valve, see that there is no shoulder on the valve above where the yoke fits. If there is a shoulder, trim it off before sending the yoke to the blacksmith shop, and it is better to send the valve into the blacksmith shop also and let the blacksmith close the yoke and fit it on the valve, instead of closing from a given measurement. The yoke should always be fitted so as not to pinch on the valve, but should be just a free fit, avoiding shake as much as possible. This fitting may be done by a machinist, but is hardly necessary if the blacksmith is at all careful in closing the yoke. If there is a valve planing machine in use for facing off the seats, it is generally set up on four studs screwed into the corner holes of the cylinder. The hight of the tool from the seat is arranged for on the studs, they having a nut on the top and bottom of the clamp which projects from the machine.

When a seat is worn very badly, that is, worn low at some one corner, some make the claim that the seat should be faced off just as the wear shows; but I cannot see any reason for this, and would prefer to make a seat true with where it was at first, and to do this would caliper from the planed edges of the cylinder to the machine. Having the machine all trued up, commence with the tool in the center and feed toward the outside edge of the valve seat. It would be very handy to have a little engine to drive this machine, but in most shops it is done by hand.

In shops where there is no planing machine and the work has to be done by hand, set dividers to the lowest corner of the valve seat and draw a line clear around the edge of the seat; then with a sharp chisel bevel the edges off to this line. In case there is very much stock to come off, it would be well to use a cape-chisel first; then use a chisel a little wider than the ordinary one for taking the finishing chip, after which the seat is to be filed to a fit with a face plate, or, as is common in most shops, fitted to the valve itself. Very often when the valve is on the seat there may be a rocking. Try and make sure where this rock is—whether it is in the valve itself or in the seat. If the rock is in the valve, it will always be across the same corners of the valve no matter in what position the valve is placed on the seat; and if the rock is in the seat, it will always be at the same point on the seat. When the seat shows a good bearing with the valve, tap it around the corners and see if it sounds solid all around.

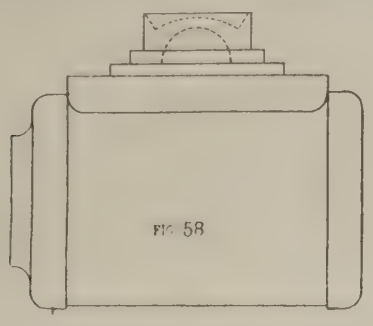


FIG. 58

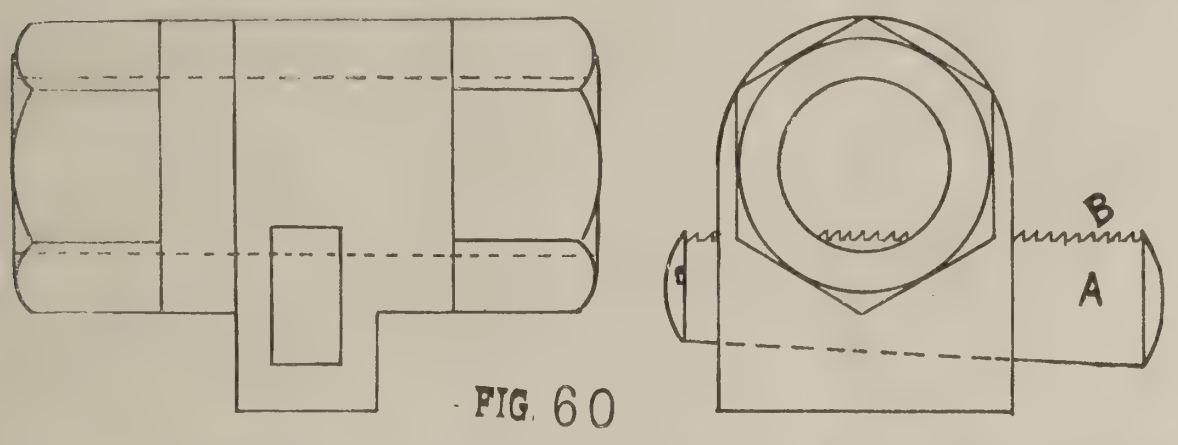


FIG. 60

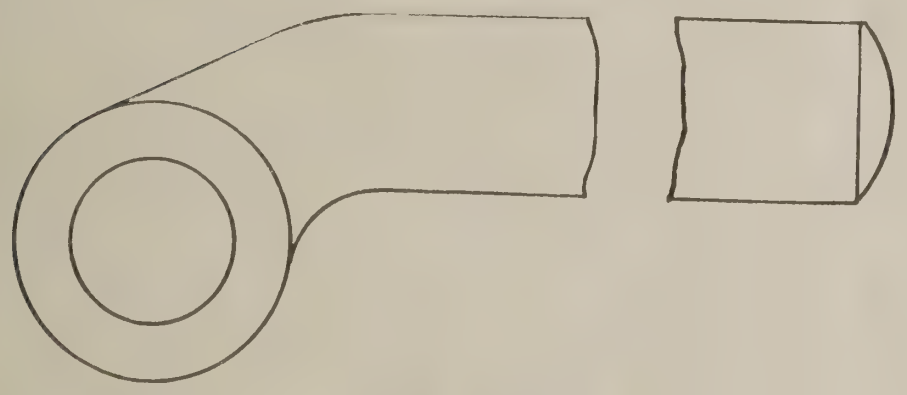


FIG. 61

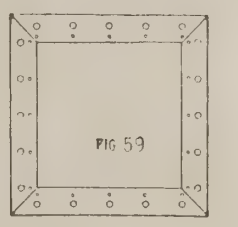


FIG. 59

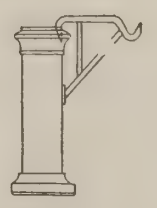
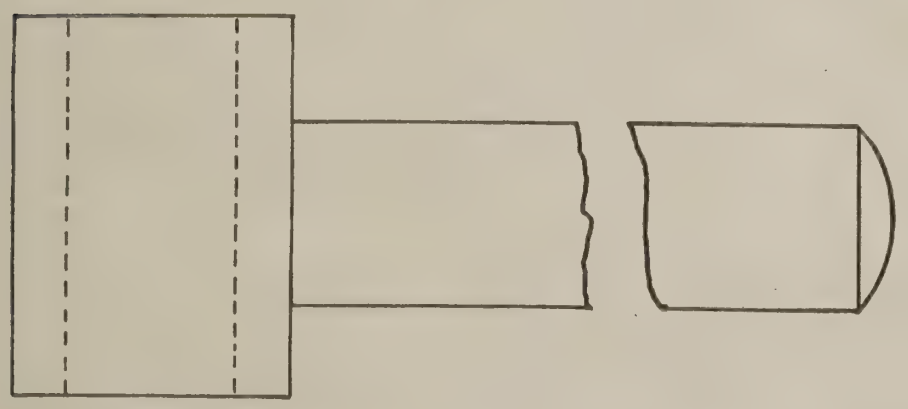


FIG. 63



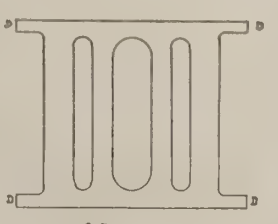


FIG. 65

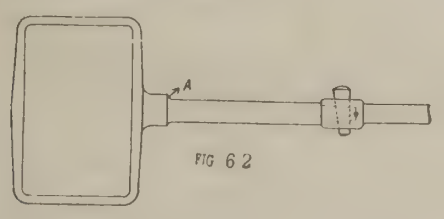


FIG. 62


FIG. 64

The use of a scraper is very good on a seat to put the finishing touches on, but should not be used very much, as the seat can be brought down to a very good bearing with a file.

On valves that are not balanced it is hardly necessary to spend a great amount of time to bring the valves to a fine fit with the seat, as a good general bearing will, in most all cases, be found to give as good results, as the pressure on the valve is so great it will be found that, after one trip, the valve and the seat come together in a fit.

With a balanced valve much more care should be taken, as the pressure of the valve on the seat is not so great. The valve in this case should be faced to a good fit with the seat. When valves of the balanced type, such as the Richardson valve, are used, they should always have a hole connecting the balance chamber with the exhaust port, which will take off any pressure which might accumulate on the back of the valve from leakage, if there was no hole there.

The Richardson valve has of late years come into very general use, and it might be well to explain here how to fit this valve up. This valve is balanced by taking the pressure off the top of it, which is done by fitting four strips into recesses planed in the top of the valve; these strips work to a fit against the under side of the cover, or a better way is to bolt a plate onto the under side of the cover, which is called a pressure plate. This strip is held to the cover by four bolts and it has this advantage: that as the valve and seat wear, the pressure plate can be lowered from the cover by fitting washers in between the cover and the pressure plate. The strips should be fitted in the valve to a nice working fit; that is, fit so that they will just go in with no shake, and when the steam chest cover is in place the strips should not project over one-eighth inch above the valve so as to give as much bearing of the strips in the valve as possible. For washers to use between the steam chest cover and pressure plate, cast iron is much better than either brass or copper, because where they are used, especially copper, the action of the oil on the copper tends to eat away the cast iron. The strips are held against the pressure plate in addition to the pressure of steam by springs, either elliptical or spiral. In regard to springs, it is hard to say which is best, for where spiral springs are used they soon gum up, and the elliptical springs must be made quite stiff, as there is only one of them to each strip; and they also wear very thin where they come in contact with the valve and break off, letting the strip drop down and thus allowing the full pressure of the steam on top of the valve. This soon makes itself known by the constant blow through the small hole in the top of the valve.

Fig. 62 shows a valve yoke, on which the stem has been turned up to within about two inches of the neck, or just far enough so it clears the steam chest at its full travel. As it is a very common job to have to weld new stems on yokes when they become worn, I think it much better to leave this much of the valve stem without turning, as then when a stem is to be welded on it gives the blacksmith stock enough to work on after cutting off the old stem at A. When the stem has been turned up all the way, each time the valve stem wears and is trued up in the lathe, it becomes very much smaller, giving the blacksmith still less chance to make a good job of putting on the new stem than he would have with a small piece of the old stem left without turning. Valve stems sometimes stick pretty tight in the valve rod, but if a small hole is drilled (as shown at B) through the valve rod, and drilled so the valve stem comes over the hole about half way, then a small taper pin can be driven in the hole and the valve stem can be started very easily.

When the valve and steam chest have been put in place, prepare to take the port lines; first move the valve to the edge of the port and see if the lines true all across; in case it has a little more opening at one corner than the other, note which corner it is; then move the valve and try the other edge with the other steam port, when if the opposite corner also shows the valve to be out, the yoke must be bent in the neck so as to bring the valve square with the seat. This can be done by blocking the yoke at opposite corners and pinning the stem in the neck. It will require but a few blows to bring the yoke square. It is better to try this before putting the steam chest in place by connecting the yoke with the valve rod, and trying the valve in place.

Some master mechanics don't like the idea of pinning the stem, preferring to heat it and bend it while hot, but for all purposes pinning will be found to answer very well. Of course, when the yoke is fitted to the valve, the stem is tried with the edge of the valve by a square, and also by laying on a face plate and trying the stem to see that it is in line with the planed face of the valve; but then sometimes the ports are not square and the valve stem has to be bent a little to bring the valve square.

Having the valve in line with the ports get ready to take the port lines. I like taking the port lines in the direction with which the valve moves; that is, taking it on the lead side instead of taking the line as the valve closes, or the cut-off side. Chip a small nick in the corner of the cylinder immediately back of the steam chest, and put a fine center mark in the side of the nick; then move the valve until it just comes to the edge of the port, and with a tram mark the valve stem, having one point of the tram in the center mark on the cylinder. Now move the valve to the edge of the other port and make a corresponding mark on the edge of the stem. The reason why marking from the cylinder is better than marking from the steam chest is that there is a chance of the steam chest moving when the cover is being screwed down, and the center on the cylinder always remains the same; that is not affected by any movement of the steam chest. Draw a horizontal line on the valve stem through the tram marks, and center this line where it crosses the tram mark. Now we can put on the cover and draw it tight with the studs. If the gaskets are not in good shape it may be necessary to set the cover down with a sledge.

A good tool for straightening the studs is shown in full size in Fig. 61, which is nothing but an eye to fit over the stud, having a handle on it about three feet long. In the matter of gaskets there is a great difference of opinion, some preferring the round gaskets, others the flat; but round gaskets seem to be coming into favor more each year. When the round gaskets are used, the steam chest could always have a recess planed in it to receive the gasket, and this should always be soldered to the chest.

Fig. 63 shows a small derrick which can be hung from any smokestack, and will be found very handy in handling heavy steam chests.

Fig. 64 shows a very handy rig for planing valves, and is composed of two clamps, *C*, '*C*,' held together by a bolt at each end and long enough to take any length of valve between the bolt; the action of it is very simple. the valve being placed in the clamps and the bolts screwed up tight, then laid on the planer and the clamps clamped to the planer. There is no setting up required about this rig, as the clamps are planed parallel all over.

After valve seats get worn down, false seats are placed on them. These seats are put on in a great many different ways; some roads make a practice of just bolting a plain seat onto the original seat, holding it down by taper headed screws; others turn a recess in the seat and make the false seat to fit this recess, and then hold this false seat down by screws; but a simpler way, and one that gives better satisfaction all around, is to face the original seat off true, then have a false seat, as shown in Fig. 65, scraped to a fit with the original seat, but not held down by screws or any other means. This seat has four lugs, *D*, *D*, *D*, *D*, extending from it, which lugs are to be fitted into the steam chest; they should be fitted so as to be just easy in the steam chest; that is, be loose without having any lost motion. This seat is held in position by the pressure of the value on it, and as the seat is bound to work a little, be it ever so small, it will be enough to keep the valve always a fit on the original seat, and it will not eat out across the bridges, as seats that are fastened down will invariably be found to blow through after a short time of service. This seat has another great advantage in that it can be removed when worn, and planed off in a planer just the same as a valve, and the fit between the false seat and the original seat, if made a good job of once, will always remain tight.

Communications.

Structural Changes in Wrought Iron.

Editor National Car and Locomotive Builder:

All who work with metal appreciate the effect of varying conditions under which it is worked in process of manufacture. Common wrought iron is in very general use, and reference to so well known a material may seem behind the age; however, there is one thing that may sometimes be overlooked in regard to working it, and the question may be put in this way: How frequently in the history of its use has wrought iron been finished at too high a heat to insure a fibrous condition?

The following test was made of four hammered car axles which will illustrate the point. The four axles were roughed in the same heat with same quality of hammered scrap slabs. Axles numbered 1 and 2 were worked to finish at a dull red heat. Axles numbered 3 and 4 were worked to finish at almost white heat, though considerably below a welding heat. The four axles were finished under like conditions, except as to degree of heat in finishing,* and allowed to cool off in the open air. The next day they were broken under the M. C. B. drop test (1,640-lb. hammer) with results as follows:

Number of test axle.....	1	2	3	4
Diameter of axle.....	4⅜ ins.	4 5/16 ins.	4¼ ins.	4¼ ins.
Number of blow.	Deflection of axle, in inches.			
No. 1—drop 12 ft.....	1⅛	1¼	1⅝	1⅝
No. 2— " 12 ft.....	1½	1¼	1¾	Broke
No. 3— " 12 ft.....	1¼	1⅛	1⅛	
No. 4— " 17 ft	1⅝	1¾	Broke	
No. 5— " 17 ft.....	1⅛	1½		
No. 6— " 20 ft..	2	1⅝		
No. 7— " 20 ft.....	2⅛	1⅝		
No. 8— " 23 ft.....	2¾	1⅞		
No. 9— " 23 ft.....	Broke	2		
No. 10— " 23 ft.....		2		
No. 11— " 23 ft.....		2⅛		
No. 12— " 23 ft.....		2¼		
No. 13— " 23 ft		Broke		

Fracture of above as follows:

Nos. 1 and 2 showed a uniformly fibrous iron with irregular or "torn" fracture.

Nos. 2 and 3 were entirely crystalline in structure, and fracture resembled a coarse cast iron.

The four axles were made to demonstrate the effect of heat in working, and of course represent extremes of effect not common to car axles, but illustrating a quality of wrought iron well known to skilled blacksmiths.

Axles 3 and 4 were not "burned," in the common acceptance of the term, yet owe their failure to having been finished and allowed to cool off at too high a temperature, a molecular change having been induced whereby the fibrous structure was changed to a crystalline form. The degree of temperature at which wrought iron will retain its fiber may be stated as a red heat. Beyond this and approaching white heat the particles will set to form as crystals if the mass is not worked until its temperature is reduced to red heat.

Other conditions will produce this molecular change. It is well known that wrought iron that has been in use for some years, especially where exposed to continued vibration, as bridge rods, locomotive and steamboat work, tends to crystallize. It is not so well known, but nevertheless true, that fibrous wrought iron may be entirely altered in its structure by contortion at right angles to the direction of its fiber. If good wrought iron bars be twisted near their limit of strength, the change will be noted on breaking the bar. The entire nature of the metal may thus be altered in a few moments from fibrous to crystalline, and an increased tensile strength imparted to it.

This increased strength is, however, given at an expense of ductility, and iron in this state may be said to have little value for most engineering purposes, where ductility or toughness is to be depended on. Such may be said of "old iron" or of iron that has been finished at too high a heat.

HOWARD STILLMAN,
Engineer of Tests, Southern Pacific Co.

SACRAMENTO, Cal., Jan. 8, 1894.

Editor National Car and Locomotive Builder:

I rode in a passenger coach recently the wheels of which were cast in a contracting chill. These wheels had been but partially ground before being put under the car, and the noise made by them was simply atrocious. This recalled to me the old saw that there is nothing new under the sun, as I remember quite well some 25 years since, when I was working as a "cub" in the old C., C., C. & I. R. R. shops at Cleveland, O., seeing on the face plate of the "big lathe" a chill for the wheel foundry, which was next door. This chill had an annular passage around it for the purpose of placing therein a wick which was to hold coal oil, with a view of heating the chill and expanding it, while the tread face of the chill had four or six saw cuts on it, as are used to-day, for the purpose of allowing the chill to contract. Wheels made in it were very true, and the contracting chill of to-day is simply that old chill of 25 years ago, but with more saw cuts on the tread face.

F. G. KAUFHELZ.

* Both sets of axles had been subjected to welding heat in process of roughing.

Cars with End Platforms Are Satisfactory.

Editor National Car and Locomotive Builder:

In your last issue I read the article by Mr. Merrick advocating plainer interiors and stronger ends for passenger cars and the abolition of platforms. While interested in the arguments advanced I do not agree with the conclusion arrived at. The remarks about overfinishing of interiors has been going around ever since we had railway papers, but all this talk has so far resulted in things going the other way. I do not consider that cars are overfinished; the public pay for their use the same as they do for a hotel. I suppose we could ride in a car finished something like a caboose car, with proper seats, etc., but most of us prefer to ride in a more handsome car.

The remarks on the strength of European cars as compared with ours are not true. It is not necessary to go into details, but simply refer to the matter of weight; our cars weigh from 50,000 for an ordinary coach to 100,000 for sleeper (we built four cars last year weighing 97,350 pounds). Are there any cars like this on the other side? Now if we put all this weight into a car we must certainly get *some* of it where it is needed, and I think the American car builder knows enough to do that.

It is true that our platform supports are bolted to the underside of the body sills, but this brings the line of draft below the sills; the buffers are placed on a liue with the sills and the compression comes therefore in a straight line. Cars with properly constructed platforms do not and cannot telescope, and this is especially true of the Miller platform; in a collision it is usually the connection between the engine tender and the first car that gives way (and here we must acknowledge that there is room for improvement) or else the connection between two cars that are equipped with different styles of couplers, and in that case are usually coupled with a link and pin. The buffers not being in contact, the link gives way, and allows one car to mount the platform of the other, and once there, no reasonable amount of end framing will prevent its entering. I am not sure that a car without any platforms would be much stronger; the buffers could, of course, be on a line with the sills, and would be somewhat nearer the end sills, but the couplers would still be below the line of sills and that would call for some framework. In fact, it would be the same construction as now with the difference that it would be shorter. If the coupler was placed on a line with the sills the end-sill would have to be cut away and the distance between the cars increased the same as on European cars, and that would increase the danger of telescoping in collision, of which the recent horror in Italy furnished a striking example.

But granting that a car without platforms would prove stronger in collision, I do not think we are willing to give up the advantages of the end entrance; and an arrangement calling for steps that are not in position at all times is practically doing this. It seems to me that the European system of side doors, with the addition of an internal communicating passage, as used in some of the cars over there, would be preferable to this. As to Mr. Merrick's proposed special arrangement of the ends, with doors at each corner set at an angle, I fail to see the advantage of this over a central opening; the end frame would certainly be more cut up and the communication not nearly as direct.

SUPERINTENDENT CAR DEPARTMENT.

The Inside Finish of Passenger Cars.

Editor National Car and Locomotive Builder:

I have recently read several articles on the above subject, noticeably one from Mr. McKeon in the June number of the NATIONAL CAR AND LOCOMOTIVE BUILDER, and as none of the articles meet with my unqualified approval, I will describe my method as well as I am able to do.

We will suppose that we have an average first class passenger car with the inside finished in quartered oak, and ready for the painters. We should first apply a coat of any good hard wood paste filler (a number of which are in the market) thinned to the proper consistency with equal parts of raw linseed oil and turpentine, and stained to match the wood; and if antique oak is desired use dark filler below the head lining, but in all cases keep the lining as light as possible. This filling should be done by an experienced workman and rubbed well into the pores of the wood, or scraped in on level surfaces with a broad, smooth-edged knife, leaving none on the surface nor in the grooves or corners.

After standing twelve hours putty all nail holes, etc., with lead putty, colored fully as dark as the wood, taking care to leave no stains on the surface. When the putty is thoroughly dry, go over the whole surface with fine sandpaper and see that all grooves and corners are clean. Then, instead of applying a coat of shellac, as is ordinarily done, we will apply a coat of shellac substitute, a colorless liquid which we buy in the market at less than half the cost of, yet which is equal to, the best grain alcohol shellac in every particular, except for finishing mail car trays and counters where it is necessary to have a sleek surface. On carved or uneven surfaces it is superior to shellac as it does not raise the grain of the wood as shellac will do, thereby avoiding the necessity of sandpapering, which is a large item on this class of work. Allow six hours for this shellac substitute to dry, then sandpaper thoroughly with fine paper.

We will next proceed to ornament the head lining, using mainly warm colors, and endeavor to produce harmony and repose by the proper arrangement of tints rather than by contrasts; and avoid covering too much of the lining. When dry we will apply a coat of good body-rubbing varnish to the entire inside of the car, except the window sills, on which we will use equal parts of rubbing and wearing body varnish mixed. Allow at least 24 hours to dry, and apply second coat, the same as the first, except we will use a good hard drying body varnish on window sills.

Let dry for two or three days, and sandpaper with "O" paper, taking special pains to leave the lining smooth, or it may be necessary to go over the lining with pumice and water. Then apply the finishing coat, using a fine, flowing varnish on the head lining, fully as elastic as the rubbing that we have used for first coats, and taking great pains to leave a full, clean job, which completes the head lining.

Apply a third coat of body rubbing to the sides of the car, and another coat of hard drying body, or even a medium drying body varnish will be suitable for the finishing coat on window sills.

Also for the finishing coat on tank stands and such parts as are exposed to moisture we will use the hard-drying body varnish.

When this finishing coat of varnish is dry we will proceed to rub from the head lining down to the window sills, using good pumice and raw linseed oil, with a small portion of gasoline added, and wipe off well with dry cotton waste, which will leave a good even-oiled surface.

The seat frames we will finish the same as the main parts of the car. These should be rubbed, but may be left in the gloss if desired.

The blinds, if made of light colored, fine-grained wood, we will first prime with equal parts of raw linseed oil and turpentine, adding a little pale japan, and when dry apply a coat of shellac substitute, which works very free, will not stain the most delicate woods, and will not leave laps, as is the case when shellac is used. Then we will finish the blinds with three coats of varnish exactly the same as we have done with the window sills.

The floor, if made of hard, close-grained wood, we will oil the same as we have done the blinds, and apply two coats of shellac substitute, allowing six hours between coats, and finish with one (or at most two) coats of tough, hard-drying floor varnish.

I consider it labor lost to rub the sashes, the insides of closets, or below the window sills on an ordinary passenger coach. When a coach finished in this manner is returned to the shop to be revarnished, after running twelve or even fifteen months, it will be found that it is not necessary to scrape the window sills and parts of the blinds, as is always the case where a car has been finished all through on the inside with an inside car or rubbing varnish.

J. C. STOUT.

MINNEAPOLIS, Minn., Jan. 21, 1894.

The Pennsylvania lines east of Pittsburgh for December, 1893, as compared with the same month in 1892, show a decrease in gross earnings of $632,078, a decrease in expenses of $816,556; an increase in net earnings of $184,478. The 12 months of 1893 show a decrease in gross earnings of $2,456,620, a decrease in expenses of $1,823,344, a decrease in net earnings of $643,276. The lines west of Pittsburgh for December show a decrease in gross earnings of $707,392, a decrease in expenses of $431,830, and a decrease in net earnings of $225,511. The 12 months of 1893 show a decrease in gross earnings of $1,227,186, a decrease in expenses of $877,435, and a decrease in net earnings of $349,751.

The Secretary of the Association of Railway Air-Brakemen announces that the society will hold its next annual meeting at Columbus, O., on the second Tuesday in April, 1894.

It cost the brotherhoods $105,000 for the privilege of being whipped in the Lehigh Valley strike.

The New York, New Haven & Hartford opened its new office buildings in New Haven, Jan. 1.

The Michigan Central is the only road in the Vanderbilt system of which an actual majority of the stock is held by the Vanderbilts. Its President, Mr. H. B. Ledyard, is regarded as one of the best railroad men in the country.

The Wilkes-Barre & Eastern is building an 18-stall roundhouse at Laflin, Pa., on the Western end of its line near Wilkes Barre.

A by-law granting a bonus of $100,000 to the Grand Trunk Company for the erection of car shops at London, Ont., was carried by a large majority at a recent election.

The Manhattan Elevated Railroad has received six of the twenty locomotives ordered from the Pittsburgh Locomotive Works.

The Wickes Refrigerator and Car Company is having 450 of its new refrigerator cars built by the Missouri Car & Foundry company of St. Louis. These are expected to embody all of the latest improvements which have been made by this company. The ice tank of these cars will be somewhat larger than usual, having a capacity of 6,000 lbs. of ice. The cars will be equipped with the Drexel coupler, Hinson drawbar attachment, Drexel truck, Hutchins roof and the Schoen pressed steel brake beam.

New Locomotive Shops of the C., C., C. & St. L. Ry

The following is a description of the new shops of the Cleveland, Cincinnati, Chicago & St. Louis Railway, at Bellefontaine, O. The old shops of this road at Cleveland have become too small for the work that has to be done, and the site on which they were built does not admit of their extension, so it became necessary to construct a larger plant and locate it at a more convenient point. Bellefontaine was chosen on account of its natural advantages, and because of its being a central point between Cleveland and Indianapolis, making it a terminus of two divisions. It is also a station on the Sandusky Division, thus making the shops very convenient for handling heavy repairs for three divisions. It being the highest point in the State, the drainage problem was very simple.

The shops are quite extensive and are located on a strip of ground parallel to the main track and at a distance of half a mile from the depot. They are adjacent to the freightyards, making it convenient to repair crippled cars. The shops are built on the sides of a rectangle with an open court between. They are constructed of brick with stone trimmings and foundations and present a neat appearance. The plant comprises a 17-stall roundhouse, erecting and machine shop, boiler shop, blacksmith shop, tank and copper shop. The shop roof trusses are of angle-iron construction and the roof is covered with slate, except where large skylights supplement the light received from doors and windows. The subject of light has received careful consideration, and as many windows as possible were put in. The space between the windows is as small as consistent with the strength necessary to support the roof.

The Sturtevant steam hot blast apparatus furnishes the heat for machine, boiler and blacksmith shops. The round house, tank and copper shops are heated by steam from boilers located in the annex to the roundhouse. The hot blast apparatus is located at the end of the machine shop, on a raised platform, and galvanized iron pipes distribute the heat to the various shops. The steel plate fan used with the heating apparatus is driven at night by an independent automatic engine, and during working hours by a belt from a pulley on the main line shaft. The heater uses either exhaust steam from the Corliss engine or live steam from the boilers. It is thought probable that the heat derived from the exhaust steam will be sufficient to heat the shops, except in very cold weather, then live steam will be turned on. Fire protection is assured by the location of fire hydrants and hose reels about the shops.

The erecting and machine shop, under one roof, is 100 feet × 270 feet. In one-half of the shop is located the machine tools, and the other half contains 12 tracks with a capacity for 11 engines. Each track contains a pit, with bottom raised in the center, running the entire length of the engine. At intervals along the tracks, drop pipes are located to supply the necessary air from the blacksmith shop fan for the purpose of supplying air to the portable forges for heating rivets, etc. Each pit is provided with hose connections to water mains for filling boilers. At right angle to pits a standard gauge track runs through the shop. Heavy machine tools are located near this track and suitable trucks carry material to and from the machines.

The shop is provided with the necessary columns and supports for an electric traveling crane of sufficient capacity to lift the heaviest locomotive. The crane is to be supplied later on. The transfer table is also to be driven by an electric motor with additional apparatus for pulling engines in and out of the shop. Until the electric plant is installed the table will be operated by hand.

The machine tools are mainly new and are from the Pond Machine Tool Company, Niles Tool Works, Lodge & Davis and others. In the center of the shop is located the toolroom, in which are all toolmaking machines. The check system is used, each man giving a numbered check for each tool taken from the room. The foreman's office is also located here.

Power to drive the machinery in these shops is derived from a 180-horse power Bates-Corliss engine, situated in an annex to the machine shop. It has a 16 × 42 inch cylinder, 10-foot band wheel and runs at a speed of 60 revolutions per minute. The boiler pressure is 80 pounds, and steam is cut off at one-fifth stroke. In future, should circumstances require it, power can be largely increased by increasing the speed of the engine and the pressure of steam.

Steam for the engine and heating system is supplied by two boilers 60 inches diameter by 16 feet long. Space has been left in the boiler-room for the application of a third boiler, should the plant require it. A sheet iron pipe 40 inches in diameter connects the boilers with a brick chimney 120 feet high. It is substantially built and is equipped with a neat iron ladder running to the top of chimney.

The water used for boiler feeding is derived from two sources—from the city water main through an injector, and from a well receiving the condensed water from the heating apparatus. The water of condensation is forced into the boilers by a duplex pump.

The boiler shop is 50 × 136 feet, and is equipped with modern punching and measuring machines, power rolls, etc. The track in this shop will hold four boilers. The blacksmith shop is 75 × 219 feet. It is equipped with 20 double forges, a 4,000-pound steam hammer made by the Morgan Engineering Company, a heavy bar iron shear and a steel pressure blower. The shop is kept free from smoke by a 100-inch duplex steel exhaust fan. Over each fire is a sheet iron hood. This is connected to a 17-inch pipe leading to a large main pipe, which is connected to the exhaust fan. The smoke is exhausted from the hoods and blown out through a pipe in the roof. The tank and copper shop is 62 × 138 feet. It has four tracks and capacity for eight tenders. At one end of this building is the Master Mechanic's office and the storeroom for supplies. The roundhouse has 17 stalls and is heated by steam from boilers in an annex. Two stalls are provided with a drop-pit for removing wheels. The smokejacks have a drop hood. The oilroom is 21 × 37 feet and contains nine oil tanks fitted up in the most approved manner. The coal chutes contain 20 pockets holding five tons each. At one end of the coal chutes the sandhouse is located. The dry sand is elevated to a storeroom; from there it is conveyed to the locomotive sandboxes by a sheet iron pipe.

From this description it will be seen that these shops have been designed to give the best results, and that all points of location and construction have been carefully studied with this desirable end in view.

The construction of the Florence & Cripple Creek Railroad, from Florence, Colo., on the line of the Denver & Rio Grande to Cripple Creek, has been commenced.

The Prevention of Radiation by Means of a Vacuum.

During the investigations of Professor Dewar at the Royal Institution, London, regarding the liquefaction of gases at low temperatures and pressures, he discovered the fact that one of the best preventives against radiation employed in the course of his experiments was a high vacuum. Indeed, this discovery was a material aid to him in pressing forward his investigations to a point that seemed at one time scarcely possible. Further evidence of the extent to which a vacuous chamber may serve as a non-conducting envelope has been furnished in connection with the transit of a quantity of liquid air from the professor's laboratory at the Royal Institution to Peterhouse College, Cambridge. The liquid air was carried in a double-glass flask, the space between the inner and outer vessels containing nothing but a highly-attenuated mercurial vapor, together with a little liquid mercury. On pouring liquid air into the inner flask its outer surface becomes covered with a mercurial film of extreme thinness, produced by the condensation of the metallic vapor upon it, thus forming a bright reflecting surface. As soon as this was produced the whole double-flask arrangement was packed in solid carbonic acid, which at once froze the liquid mercury, arrested further deposit upon the mirror, and reduced the residual mercurial vapor to an infinitesimal quantity, forming an almost perfect vacuum, and supplying an envelope having a temperature 80 degrees below zero. So efficient did this protecting envelope prove, that it was found on arrival of the package at Cambridge that the liquid air contained in the inner flask had suffered but a trifling loss in bulk. The protective influence against radiation exerted by the high vacuum and the mercurial mirror will be perhaps the better realized when it is remembered that the temperature of liquid air is as much below that of solid carbonic acid (which has a temperature of 108 degrees Fahrenheit) as ice is below boiling water.

Steel Barrels.

One great difficulty with barrels made of any other substance than wood is the lack of bilge and weakness of chimes. This difficulty has been surmounted by Messrs. Barraclough & Heaton, in a steel barrel. Steel plates of proper thickness are stamped cold into the desired form, and the longitudinal seam is welded by electricity. The flanged heads, which are stamped with corrugations for stiffness, are forced into the ends of the barrel and are reinforced by hoops inside and out. All four thicknesses of metal are then welded together by electricity, making a strong and serviceable chime. The rings for bung and spigot holes are also welded in; for dry goods the end hole may be made very large, or a screw in head may be used. All of these barrels, it is asserted, are tested with a pressure of 40 pounds per square inch for tightness. When a hole is broken in one, it can be easily repaired by welding a piece of steel over it. One great advantage of these barrels is the greater capacity for equal bulk. For instance, a barrel of the same outside dimensions as a petroleum barrel will contain 50, instead of 40 gallons; this will allow a saving of 20 per cent. in the number of barrels and in space occupied.

The Evolution of the Nail.

The first nails produced in the United States were made by hand, and Fisher Ames, of Massachusetts, in a speech made before Congress in 1789, when it was proposed to put a duty of a cent a pound upon all imported spikes, nails, tacks and brads, in order to foster the home product, said of this industry: "It has become common for the country people in Massachusetts to erect small forges in their chimney corners, and in winter and on evenings when little other work can be done, great quantities of nails are made, even by children. These people take the rod iron of the merchant and return him the nails, and in consequence of this easy mode of barter, the manufacture is prodigiously great. This business might be prosecuted in a similar manner in every State exerting equal industry."

In August, 1797, Samuel Briggs, of Philadelphia, in connection with his son, is said to have received the first patent for a nailmaking machine ever issued by the United States, but as at about the same time several inventions for manufacturing nails were made by various persons in different parts of the country, it is still a somewhat disputed point to whom the credit of absolute priority is due.

In 1817 the device known as the Blanchard machine, an invention of Thomas Blanchard and others, of Boston, was successfully demonstrated in practical use, and the patent sold to a company for the comparatively small sum of $5,000. This Blanchard machine was intended particularly for small nails, brads and tacks, and is the basis of the inventions which are in use to-day.—*The Iron Age.*

Norfolk & Western New Passenger Cars.

The Norfolk & Western Railroad has just received a number of new vestibule coaches built by the Balleyer & Small Company, of York, Pa. The cars weigh 70,000 pounds, and are 55 feet long and 10 feet wide. The floor framing is of oak, plated with iron, and the body is framed with yellow pine, thoroughly seasoned.

Double floors lined with mineral wool serve to deaden the sound. Thirty-six side posts, besides door and corner posts, hold the roof, which is covered with galvanized iron. The draw and buffing gear is the Janney Buhoup system, sustained by eight oak draw timbers, 4 by 12, lined on either side with heavy iron plates. These, with the most modern system of vestibule, render telescoping improbable. The interior has 25 of Hale & Kilburn's latest style of high back tilting seats, all upholstered in crimson plush. The windows, 34 in number, are of the finest crystal plate glass, and have the Burrows car shade; they are separated from each other by choice selected oak panels carved in neat and tasty designs. The whole interior is of the finest oak, selected especially for the place it was designed to occupy. The deck or clearstory lights are of muffled glass of a delicate plum color. Twenty-eight deck sashes, each of which open independent of each other, give perfect ventilation, while brass wire screens secure the passenger from the dust and dirt of travel. Heat is furnished by two of Spear's improved heaters. A lavatory occupies one corner of the car, water being furnished automatically from an overhead tank. Plate glass mirrors with aluminum plaques give a drawing-room finish to the car, which is heightened by an elegant Brussels carpet upon the floor.

The saloon accommodations are upon the most modern scientific principles and are all finished in keeping with the body. The male portion of the patrons of the road have not been forgotten by the builders, for a luxuriously furnished compartment invites the smoker. This is upholstered in maroon leather, with broad seats, with high backs, and an easy chair. A finely finished movable table suggests a quiet, social game.

The cars are lighted by the Frost system, diffused through seven center lamps of tasty design. The whole interior has been finished with the finest of varnishes, brought to a rich, dead finish, while the head lining is of lignomur, paneled and colored to harmonize with the whole. The trucks have each four 36-inch wheels, equipped with hollow brake beams.

Another Air-Brake Injunction.

On Jan. 16, a motion was argued before Judge Coxe, of the United States Circuit Court for the Northern District of New York, for an injunction against the Eames Vacuum Brake Company, restraining that company from the manufacture of air-brake apparatus, infringing the claims of the Westinghouse patents, the validity of which was established in the recent suit against the New York Air-Brake Company. This motion was granted by Judge Coxe and an order for an injunction similar to that entered against the New York Air-Brake Company has been entered against the Eames company.

"The Locomotive" in discussing cracked boiler plates says: "They are likely to first appear at the edge of one of the firesheets, and to extend gradually inward. Often they are stopped by running into the rivet hole, and do not extend further. Frequently, however, they run past the rivet-hole, or cross it and extend into the sheet on the further side of it. It then becomes very important to check their further progress. This may often be done by drilling a small hole through the sheet at the very extremity of the crack. This hole may afterward be filled with a rivet, or it may be tapped and filled with a screw plug."

The proper direction in which work should be fed to a milling cutter has been discussed in the columns of the "American Machinist." Of course the usual practice is to feed the work against the cutter, but it is asserted that experiment shows that the cutters keep sharper and last longer if the work is fed in the same direction as the motion of the cutting edges, thus reversing the old practice. As an explanation of this it has been suggested that, in the usual method of feeding, the cutting edge first slides over the work to a certain extent before it commences to cut, thus giving rise to a grinding action which is absent when the feed is in the other direction.

There has been a trial of electricity as a motive power for canal boats on the Erie Canal. The test was made not far from Rochester, and is declared to have been entirely successful. A trolley line was used, the wire being stretched over the canal in much the same manner as it is stretched over the streets of cities, except that two wires and two trolleys were used, one wire and trolley being for the return current. The motors were of the Westinghouse type, about as are employed for street cars, but in this case used to turn propellers. It is the intention to build electric tugboats to draw other boats, and electricity is expected to be taken from the Niagara Falls plant.

The Lake Superior, Southwestern & Gulf Railroad Company, with a capital of $5,000,000, has filed articles of incorporation at Des Moines. The corporation has for its object the construction and operation under one management of one or more roads in Minnesota, one north and one south line in Iowa, with a system in Missouri, which, with the construction of 200 miles south from Aurora, Mo., will give the new road access to Little Rock, where connections for New Orleans and Sabine Pass will be made. The whole system will be a direct line of rail communication from Duluth to the Gulf at Sabine Pass. J. V. Farwell, Gen. G. M. Dodge and George W. Cable are among the backers.

At the annual meeting of the stockholders of the Baltimore & Ohio Railroad Company the annual report was presented, showing that the gross earnings for the 12 months were $26,214,807; expenses, $19,041,981; net earnings, $7,172,825. Adding to the net earnings the income from other sources ($2,251,377), which includes dividends on stocks, interest on bonds, etc., held by the company, and deducting the net earnings of the Washington branch ($213,536), the total available income of the company is shown to be $9,210,666. After the interest on its own bonds, rentals, taxes and other charges were paid out of this latter amount, a balance of $2,513,440 remained, showing $68,706 decrease. On the Philadelphia Division gross earnings were $2,139,325, and the net $640,392, the former being an increase of 8.79, and the latter 10.90 per cent. The old Board of Directors was re-elected.

"Glaser's Annalen" describes a safety air buffer for railway cars. This air cushion buffer is intended to avoid the inconveniences attaching to the ordinary buffer. Spring buffers are soon worn out, especially because the springs, which are supposed to possess a resistance of about three tons, do not have a third of that resistance after some time of service, so that, even if slight shocks are produced, the buffers act as if they were not supported by springs. In the new buffers, the rod is lengthened toward the interior of the carriage, and bears at its end a small piston which moves tightly into an air cylinder. This arrangement may be easily added, for it only requires two or three rivets to fix it to the body of the carriage. It is evident that, if a violent collision takes place, the air in the cylinder behind the piston acts as a spring, and prevents the rod of the buffer running its whole length.—"Engineering Review."

Railroad Building, with Reference to Economy in Operating.*

In locating a line of railroad, the ideal line is a line straight and of uniform grade between the terminal points. Such line is seldom seen, for the reason that the large cuts and fills necessary would usually prohibit such location; If deviations from the ideal line are made they ought not to be made haphazard, or even according to the caprice of the locating engineer, but only so far as it appears that economy will result from such deviation. The resulting economy must depend in part upon the cost of construction, but must also be based upon a full consideration of the cost of operating. It needs only the statement of the fact to carry conviction that an increase of distance, of the amount of curvature, or of grade, will occasion a disadvantage sufficient to justify an appreciable expenditure to avoid it. It is further true that an increase of "rise and fall" is attended with a similar disadvantage. It has been recognized for very many years by at least a few engineers, that some allowance should be made in favor of a straight and level line, and that certain methods of procedure should be prescribed to determine what that allowance should be.

If we know the resistance to be overcome by the engine on curves and on grades, as well as on a straight and level line, we can readily figure out the distance on straight track which will give a resistance equal to a given amount of curved track. We can find also the distance which will cause the same resistance as a given amount of grade of known rate. If then we take the actual length of line, add to this the distance which equates for curvature and add again the distance which equates for grade; the total will be the "virtual length" of the line, or the length of the straight and level line which will require the same mechanical work from the engine as the given line with curves and grades. The treatment of the question in all these methods thus laid down, or in the formulas given, seems to the writer to be inadequate, There seems to be no recognition of the fact that certain parts of the expense in operating are independent of the mechanical work done by the locomotive, and of those dependent many are not doubled when the work of the locomotive is doubled; there is therefore no recognition whatever of the fact, which is certainly true, that the addition of a mile to the length of an operating division does not add to the expense an amount equal to the average cost of running a train one mile.

On most railroads it is known how much it costs to run a train one mile, and how much is to be assigned to the special items going to make up the operating expense. The statistics of the United States Census for 1880 shows details of expense for the average of the United States as follows:

	Per cent.			
Fuel for locomotives	9.31			
Water supply	.68			
Oil and waste	1.06			
Repairs of locomotives	6.19			
Total engine		17.24		
Repairs, passenger cars	2.99			
Repairs, freight cars	6.40			
Passenger car mileage	.23			
Freight car mileage	2.21			
Total cars		11.83		
Engine service wages	7.72			
Train service, passenger	2.85			
Train service, freight	5.64			
Train supplies, passenger	.33			
Train supplies, freight	.36			
Total train wages and supplies		16.90		
Total train expense			45.97	
Repairs, roadbed and track	11.23			
Renewals of rails	1.89			
Renewals of ties	3.04			
Repairs of bridges	2.55			
Repairs of buildings	2.17			
Repairs of fences, crossings, etc	.42			
Total maintenance of way		24.30	24.30	
Total transportation expenses				70.27
Loss and damage, freight	.28			
Loss and damage, property and cattle	.31			
Loss and damage, passengers	.39			
Total loss and damage		.98		
Agents and station service	10.42			
Station supplies	.81			
Telegraph	1.01			
Taxes	3.77			
General officers and clerks	3.46			
Legal	.70			
Insurance	.26			
Stationery and printing	.76			
Agencies and advertising	1.34			
Contingent and miscellaneous	6.22	28.75	29.73	29.73
Grand total				100.00

Distance.—Having then the details of operating expense, how much can we profitably spend to avoid an increase in the length of the line, so that an operating division may be kept at 100 miles in length, rather than increased to 101 miles? What will be the cost of one additional mile? Looking critically at the matter, it appears that very few of these items would be, for an extra mile, increased exactly in proportion to the distance. For instance, fuel is consumed in stopping and starting, in banking fires; even in standing still heat is radiated. So that altogether the increase for fuel on an extra mile will be probably only 67 per cent. of that consumed on the average. Engine and car repairs, in a similar way, are not all occasioned by running on the open line. There are various items entering into the average cost; the effect of age, of stopping and starting, of making up trains, of grades and curvature will all enter into the the cost, and as a result 35 or 40 per cent. only will be found to properly apply in the case of an extra mile. Some items are practically unaffected by a slight increase in length of line; as the station, general and terminal expenses, and some others. Train wages will or will not enter into the cost, dependent upon whether the wages are paid on a mileage basis or by the day or trip. Car mileage will increase directly with the distance, or will increase 100 per cent., and perhaps the same is true of repairs of road bed and track, and renewals of rails and ties.

Each item is investigated in this way, and summing up the effects it appears that when the average cost of a train mile is $1 the cost of an extra train mile is not $1, but perhaps 35 cents. For any other cost of train mile the result would be in proportion; for instance, for a train mile cost of 80 cents the increase would be 28 cents instead of 35 cents.

The more trains there are running over the line the more the expense of hauling them over this extra mile. For a daily train each way we should have in a year 730 extra train miles; at 28 cents per mile this would amount in a year to $204.40. Again, in order to take care of this $204.40 per per year we may consider that we set aside a sum of money which at interest will produce this sum. At 5 per cent. this captalized sum will amount to $4,088. Then this $4,088 is the sum which we can afford to spend in order to save one mile of distance, if we have one train only each way daily. If we have 10 trains each way daily we can afford to spend ten times as much, or $40,880 in order to save a mile of additional distance. For 25 trains each way we can expend $102,200 to save a mile or $19.36 to save even a foot of distance. This expenditure is justified, it should be borne in mind, in order to save in operating expenses.

* Abstract of paper read before the January meeting of the New England Railroad Club, by Prof. L. Frank Allen, of the Boston Institute of Technology.

Where a saving of five or ten miles is in question, one additional station may be necessary, and certain items will then enter in which were not considered for one mile or less. So that for ten miles we must use a slightly greater value per mile; it is hardly necessary to follow this out in full.

Curvature.—In a similar way it costs something extra to haul a train around any curve; the longer the curve, the greater the extra cost, and the sharper the curve, the greater the extra cost for a given length. Engineers have found by experience how much power it takes to haul a train around a given curve. The best information we have on this point is to the effect that a one degree curve increases the resistance by one pound per ton, a two degree curve by two pounds, and so on in direct proportion.

If an engine is pulling its full train load at a slow speed on a maximum grade, it is evident that, on reaching a curve, additional resistance is encountered, which is liable to stall the train. It is found that, by lowering the grade around any curve which occurs on maximum grade, it is possible to make the resistance sensibly equal, whether on tangent or on curve. Just how much the grade shall be lowered in any case is determined by experience rather than by experiment—that is, when the grade is lowered it is then observed whether a train picks up or slows down on the curves, and in time it is found how much allowance to make. An allowance which is equivalent to 1 lb. per ton [per degree of curvature] has frequently been adopted as correct, and experiments on train resistance have been in harmony with this assumption.

If train resistance on a tangent is taken at six pounds per ton, and on curves as one pound per ton extra for a one degree curve, then the resistance on a six degree curve will be just double that on a tangent, and in one mile of six degree curve there will be 317 degrees of curve all told. Just as it requires double the power, or mechanical work, to haul a train over two miles that it does over one mile, in entirely similar fashion it requires double the power to haul a train over a mile of six degree curve (317 in all) that it does over a mile of tangent. We have seen how to find the increase of cost due to the extra mile of distance, and in a similar way we can find the increase of cost due to 317 degrees of curvature. We found that, in doubling the resistance by adding a mile of distance, we did not double the cost of a train mile. In a similar way, doubling the resistance by means of 317 degrees of curvature, we do not double the cost of a train-mile.

Taking the itemized cost of a train mile as before and investigating the effect upon each item, we find in this way that it is reasonable to assume that the increased resistance will increase the item of fuel 50 per cent. The item of engine repairs would probably be increased by 67 per cent. for this large amount of curvature. Repairs of cars would show about 60 per cent. increase. The wear of rails on a six degree curve would be more than double that on a tangent, and for this item it seems proper to allow 150 per cent. It seems hardly necessary here to specify or tabulate all the items, many of which show no increase. Suffice it to say that the total increase of expense due to 317 degrees of curvature will amount to about 30 cents when the average cost of a train mile is $1, or 24 cents when the cost of a train mile is 80 cents. In the latter case the cost of one degree of curvature will be nearly 0.08 cent per train mile, and the annual cost for one train each way 58.4 cents. At five per cent. interest, the capitalized sum will be $11.68. That is, on a road where there is one train each way daily, we can afford to spend $11.68 to save only one degree of curvature, that is to say, $\frac{1}{360}$ part of a circle. With ten trains a day we can spend $116.80, and with 25 trains a day, we can safely spend $292, and save even one degree of curvature. In turning a right angle, or 90 degrees, the figures would show for one train a day $1,051.20; for ten trains $10,512, or for 25 trains, $26,280.

Rise and Fall.—There can be little doubt that in passing from one point to another, it costs more to haul a train if a succession of summits has to be passed over, than if there is a continuous rise or a continuous fall from one terminus to another. It is, perhaps, less easy to investigate this matter than the cases of distance and curvature, but reasonably satisfactory conclusions may be reached here. It may readily be shown that it takes about the same power to raise a train vertically 26 feet as to haul it a mile on a level. We then seek to find how much the cost of a train mile will be increased, if the train be raised through a height of 26 feet and then lowered again, or if, in other words, there occur in the mile 26 feet of rise and fall. It will make a difference in the cost whether, in running down hill, brakes need to be used constantly, occasionally, or not at all. Taking the medium case, where steam is occasionally shut off and brakes occasionally set, in running down hill; investigating in detail as before, we shall find that for 26 feet rise and fall we shall increase the cost about 3¾ cents when the average cost of a train mile is $1, or about 3 cents for a train mile cost of 80 cents. The cost of one foot of rise and fall will be $\frac{3}{26}$ cent, and this for one daily train each way will in a year amount to 84 cents, or capitalized at 5 per cent., we can afford to spend $16.80 to save 1 foot of raise and fall; $168 for 10 trains; and for 25 trains a day we can profitably spend $420 to save only 1 foot of rise and fall. These figures reached in the case of distance of curvature, and of rise and fall, may seem large. It must be remembered that they result from a slight increase in the cost of running each train. Anything which would cause an increase in the number of trains would in all probability cause even a greater yearly expense, and would justify even a larger expenditure, if by making it the increase in the number of trains could be avoided.

Maximum Grade.—When you increase the grade on a railroad you increase the resistance of the power required to haul a given train. With an engine of given power, as you increase the rate of grade you must decrease the length of train or the engine will not haul it. With a given traffic to be carried over the line, an increase in the grade means an increase in the number of trains, unless you increase the weight of locomotive, and this in general may be considered out of the question. Yon are probably using the heaviest locomotive practicable in any case.

As in the case of distance we found the increase of expense due to hauling a train over double the distance, and as in our consideration of curvature and rise and fall, we consider the increase of cost due to doubling the resistance; in a similar way, in investigating the effect of grade, we proceed to find the increase of cost due to doubling the resistance, but in this case doubling the resistance by doubling the number of trains. Without here stating the items in detail, it is sufficient to say that an investigation similar to the others is again made in this case, and it is found that the train mile cost for an additional train is about 50 cents, when the average on the road is $1.00 or 40 cents for a train mile cost of 80 cents. Now if we wish to compare two given grades, it is clear that if we know what allowance to make for train resistance, and have the given weight and proportions of the locomotives used, we can without difficulty calculate the weight of train that can be hauled on each of these grades. A comparison of the train weights on the two grades will show by what per cent. the number of trains must be increased on the steeper grade in carrying a given traffic. If the increase in the number of trains is 20 per cent., then the increase in cost will be 20 per cent. of what we have found as the proper figure for doubling the number of trains. It must be further understood that when you increase the number of trains, each additional train must run over *every mile of the division*, and if the division be 100 miles long, each additional train will cost, using our previous figures, 40 cents for each mile, $40 for the division, and this for each train.

Calculations made for an average consolidation engine, show that on an operating division 100 miles long, a difference in grade between 0.70 per 100, or 37 feet per mile; and 1.00 per 100, or 53 feet per mile, for one daily train each way, at 80 cents per train mile, will justify an expenditure of $8,000 per year; capitalizing at five per cent., we find that we may profitably expend $160,000 of capital rather than make the maximum grade of the division 53 feet per mile, if by this expenditure we can keep the grade at 37 feet per mile. For ten daily trains each way we can spend $1,600,000, and for 25 trains per day, $4,000,000, to secure the lower grade. In figuring the number of trains, all trains running should not be included, but only those (mostly freight) whose length would be affected by the difference in grade.

The figures shown for grade seem large, and they are large, but the writer believes them to be substantially correct, and they prove that the work of the civil engineer in designing work for economical operation is of the highest order of importance. The opportunity for waste is so great that it seems wicked that a considerable portion of the earlier work in railroad location should have been done without proper appreciation of such questions, or sometimes in disregard of them.

It is desirable that attention should be called to the fact that the sum that can profitably be expended in any of these cases depends on the number of trains. It follows then logically that on lines where the traffic is small we shall make the location so that cuts and fills shall be as light as may be, even though the line be longer and more crooked; on a line of large traffic, on the other hand, we shall make the line as straight as practicable, even though the cuts and fills are large. We should do this, however, not blindly, but we should lay the line where we find that first cost and operating expense, both considered, will give us the most economical line. The figures we have given will further convince us that many earlier lines were properly located for the conditions of the meagre traffic which then existed, but have since become unsuited to the larger traffic in later times carried over them. While the matter of location, then, is a striking instance, it is not the only instance of importance in railroad building. That this is true is instanced by a report of P. H. Dudley, who is well known in railroad circles in connection with valuable work done through the medium of his dynagraph car. Following certain experiments on train resistance and certain investigations as to coal consumption, he announced that if the train resistance on the L. S. & M. S. R. R. could be reduced one-quarter, the saving to the road in operating expense, based on the amount of traffic in 1873, would amount to more than $750,000. That a saving of 25 per cent. was then possible for many roads was evidenced by the fact that, comparing two roads entering Cleveland at that time, one with iron rails and low joints, the other with steel rails well laid and ballasted, a difference in train resistance of as much as 57 per cent. was found. The moral to be derived from his statement and showing is that the engineer who figures only upon the comparative cost of heavy and of light rails for a series of years, stops far short of his whole duty. The smaller train resistance and corresponding smaller operating expense in favor of the heavier rail is a consideration of definite importance.

In a similar way, but to a minor extent, ties treated by preservative agents find their economy not alone in longer life directly considered, but in some degree at least to the freedom from disturbance of track for a longer period, and the resulting gain in lower maintenance of way expenses and lower train resistance.

In another direction, too, railroad building with reference to economy in operating is a necessity not by any means fully appreciated. This is in the design or arrangement of yards and stations. Many railroad men assert unequivocally that a well designed yard in this country is a noteworthy exception. It is no doubt true that yards for sorting trains can be operated very economically by gravity, as in the Edge Hill yards near Liverpool, England, where about 2,500 cars are every night started without the use of locomotives. Probably where the sidings are arranged so that switching can be done mainly by "poling," economy also results. Nevertheless it is believed to be true that neither of these methods are very extensively used in this country, even where the topography is well suited to their use.

In another direction the design of structures for the handling of coal, opportunity for building with reference to economy in operating is evident. In the proceedings of the Master Mechanics' Association for 1887, the report of a committee shows that the handling of coal by ordinary platform costs 20 cents per ton; by the Kerr or Clifton chute, about seven cents; while by using a high trestle and hopper bottom cars, the cost may be reduced to four cents a ton. The chute which gives the greatest economy of operation costs the most money. Where a small amount of coal is to be handled the expensive plant will not be justified; where a large amount of coal is to be handled, it would prove ruinous to pay the h gher cost per ton for handling.

It is not the purpose of this paper to multiply examples. It is enough that the principle to be observed should be established. The most important points to which attention should be given are: 1, location; 2, track surface; 3, yards. Beyond these, however, profits in railroading, if there are any, are made up nowadays largely of minor economies; to secure these, railroads must be designed and constructed with careful attention at every step to the securing of economy in operating.

Report of M. C. B. Association Committee on Standard Sizes for Catalogues, Specifications, Etc.

This report will be presented at the next annual M C. B. convention for consideration and action, and is published in advance upon request of the Chairman of the Committee because of the suggestions contained, which may be of value, regardless of the action of the Association.

The Committee appointed at the close of the last annual convention to confer with a committee of supply men with a view to adopting standard sizes for pamphlets, specifications and trade catalogues submits the following:

A meeting was held at Lakewood immediately after the adjournment of the convention, Messrs. Geo. Morris, French Spring Company; Jas. Cullen, Niles Tool Company, and R. A. Parke, Westinghouse Air Brake Company, being present on behalf of the supply men. The question of pamphlet sizes and their adaptability to trade circulars was fully discussed and the details were then left in the hands of the M. C. B. Committee. This Committee has gone carefully over a large assortment of circulars and printed matter, and has also consulted with the different technical associations and papers, and now submits the following recommendations for the Association's standard:

Postal card circulars, (1) 3¾ × 6⅛ inches; pamphlets and trade catalogues, (2) 3¼ × 6 inches, (3) 6 × 9 inches, (4) 9 × 12 inches; specifications and letter paper, (5) 8¼ × 10¾ inches.

In explanation of these recommendations: (1) 3¾ × 6⅛ inches is recommended as the size generally used in postal card notices. (2, 3, 4) 3⅛ × 6 inches, 6 × 9 inches, 9 × 12 inches. The sizes may be folded, without much waste, from stock paper 25 × 37 inches. The size 9 × 12 inches will go into a compartment or drawer 10 × 12⅜ inches and by dividing it with a tin partition the 6 × 9 inches catalogues can be filed. By dividing it into four compartments, the 3⅛ × 6 inches catalogues can be accommodated. These small compartments would also take the U. S. postal card of 3¾ × 6⅛ inches. The No. 2 size is a convenient pocket size. (5) Fo specifications and letter paper, 8¼ × 10⅛ inches was selected, as it can be cut from folio size 17 × 22 inches.

For the convenience of members the Committee submits a cut of a cheap filing case suitable for filing papers of the above dimensions, which is constructed so as to rest on a chest of drawers about three feet high, and may be described as follows:

Proposed Filing Case.

The case is 3 feet 4¾ inches wide, 3 feet ⅛ inch high and 11¼ inches deep over all. The upper portion is divided into pigeon holes, covered by glass doors, and is 10⅝ inches deep over all; it contains 30 places for pamphlets 6 × 9 inches, 6 places for pamphlets 9 × 12 inches, 3 places for specifications and letter paper 8¼ × 10¾ inches, and one small compartment for cards 3¾ × 6 inches. The lower part of the case is divided into six drawers, not covered by doors. These drawers are divided into compartments suitable for either the small cards or pamphlets 3¾ × 6⅛ inches, and 3⅛ × 6 inches, excepting one drawer which is partitioned for the standard index card 3 × 4 13/16 inches.

It is intended that the pigeon holes and compartments be numbered and the pamphlets in them have a corresponding number, and that they be indexed by title and reference to this number. Those preferring it can use the ordinary filing cases now on the market by dividing the inside by light tin partitions, so as to take the 6 × 9 inches and postal card sizes. Most letter cases are arranged for 9 × 12 inch sizes, and will consequently take the special size, 8¼ × 10¾ inches.

The advantages of having a properly indexed file of railway trade catalogues and pamphlets are so great that it is believed it will require little effort on the part of the members to bring about uniformity in such matters, both with the railway and supply houses.

GODFREY W. RHODES, W. H. LEWIS, R. P. C. SANDERSON, Committee.

The filing case proposed by the Committee contains 30 holes for pamphlets 6 × 9 inches; six holes for same 9 × 12 inches, and three holes for specifications, etc.; places for letter paper 8¼ × 10¾ inches; five drawers with five compartments each for small cards and pamphlets; and one drawer with two compartments for index cards 3 × 4 15/16 inches.

Meeting of Mechanical Engineers.

Of the papers read at the recent meeting of the American Society of Mechanical Engineers, and named in our last issue, we have selected that on "Recent Progress in the Manufacture of Steel Castings," by Mr. H. L. Gantt, for publication in this issue of the National Car and Locomotive Builder; and it will be found on another page, together with a part of the discussion it brought forth.

To the question, "Which is the best process to repair old files—sand-blasting etching, or recutting?" which was discussed at some length, Mr. Henry L. Binsse replied to the effect that it did pay to have them recut twice if the files were originally good ones, and that these good ones were the only kind of files that it paid to buy in any event, and he gave some cases from his experience to prove it. He said that first-class files properly recut were as good as new, and reduced file bills about 30 per cent. Others, however, thought the best way to repair old files was to throw them away and get new ones.

An Opportunity for Inventors.

The Metropolitan Traction Company, of New York, have appropriated a sum of $50,000 as a prize to any person who shall, before March, 1894, submit an actual working system of motive power for street railway cars, which shall be as efficient in speed and economy as the cable or trolley, but without the use of poles and overhead wires. The Railroad Commissioners have promised co-operation in the matter, and it is expected that the company's liberal offer will stimulate some inventive genius to devise a method of street transportation more suitable to a crowded metropolis than those now in use. The experience of the new cable cars on Broadway since their inauguration a short time ago, where traffic has increased 25 per cent., while operating expenses have decreased 20 per cent., has convinced the traction company that some more speedy and reliable motive power than horses is demanded by the public. As the desired system is intended for use over the entire city the cable would be inapplicable, while the overhead features of the trolley system would be so objectionable in the crowded streets of New York as to make that method undesirable.

Schladebach, in Germany, which for a long time was credited with having the deepest bore hole in the world, has more recently been outclassed by the town of Paruschowitz, in upper Silesia, at which there is now a bore hole over 6,560 feet in depth. The smallest diameter of the hole is about three inches. A series of careful temperature measurements is to be made at different depths.

Steel in Car Construction.

At the December meeting of the Western Railway Club, Mr. J. D. McIlwain read a paper on steel in car construction. This paper opened by giving a short description of the steel cars exhibited at the World's Fair, both foreign and domestic, the description being accompanied by numerous illustrations showing the general construction of the cars.

The following is an abstract from the paper:

The writer asks your indulgence while he tries to describe what he considers without prejudice the coming type of metal car. Doubtless you were all at the World's Fair, and I will assume that you were in the Transportation Building and took more or less interest in the cars on exhibition, and that you took some interest in what might be considered an innovation in old-established practice. Steel cars are looked at with a doubting eye, largely because previous attempts have not developed a car up to the present idea of standard. This lack of success of other types has led to the design of a car frame that should overcome the lack of confidence generated by previous attempts. From previous experience and with knowledge obtained through other channels, it has been demonstrated that a steel frame car can be built that will embody 150 per cent. or 2½ times greater resisting strength, at least 300 per cent. longer life, cost 50 per cent. less cost for maintenance, and weigh 15 to 20 per cent. less than the modern American wooden car. These figures may appear startling. Let us analyze them:

Greater resistance: It should not take long to satisfy any man who can or will compare the resisting power of wood and steel, that the strength of four 6-inch 13-pound and two 12-inch 32-pound I-beam longitudinal sills, combined with 6-inch 15-pound I-beams for end sills, and body bolsters of 10-inch steel plates, will give a resisting strain 2½ times greater than six 5-inch by 9-inch wooden sills as constructed in present practice.

Length of life: The average life of a wooden car is twelve years, decay being largely the cause of disease. A steel frame will last say forty-eight years, or four times longer than a wooden one. This is based on what we actually know regarding wood and by comparison in steel. Take for instance iron or steel bridges and buildings built twenty or more years ago. At the present time they appear to be good for more than twenty years more, yet the exposure is greater than if in a car.

Maintenance: We claim a saving of 50 per cent. There may be some doubts about this. In steel there is no shrinkage, therefore there is no labor expended the first two or three years in taking up slack, which is necessary with all wooden cars. There is no wear and very little tear in steel, while with wood it is continually on the increase from start to finish. When a car is twelve years old it costs more to maintain it in safe condition than it is worth, according to the M. C. B. rules of depreciation. In a steel car all that requires renewal is the wooden parts, such as floor, siding and lining. Of course the wheels, axles, journal bearings and brake-shoes depreciate the same on all cars, wood or steel. Taking these facts into consideration, 50 per cent. less in cost for maintenance is a moderate estimate.

Less weight: The Harvey cars on exhibition weighed as follows: Box car, 28,900 pounds; gondola, 22,000 pounds; tank car, 19,000 pounds; against an average weight for wooden cars of 34,000, 26,000 22,000 pounds, respectively. Yet with all these advantages over the wooden construction, it is very hard to convince the average railway manager that it is economy for his company to pay 20 per cent more for a steel car. A little calculation will show what can be saved by using steel cars. The average life of a wooden freight car is 12 years. We will take the low estimate of 36 years for a steel car properly constructed. The cost per year to maintain a wooden car is estimated at $50, or $600 for 12 years. First cost, $650; two renewals, $1,300; total, $1,950. Add to this maintenance for 36 years at an average of $50 per year, or $1,800; making total principal invested $3,750. Adding to this 6 per cent. compound interest would make an outlay of $2,151.40 for 12 years; $6,478.39 for 24 years, and $15,144.44 for 36 years for one wooden car. For a steel car, first cost would be $800; maintenance, at an average of $25 per year for 36 years, would be $900.00; a total of $1,700.00 principal invested; with six per cent. interest added, would make an outlay of $2,027.68 for 12 years, $4,795.54 for 24 years, and $9,310.29 for 36 years, showing a saving in favor of the steel car of $123.72 in 12 years, $1,682.85 in 24 years and $5,834.15 in 36 years, an average of $162.06 per year. On 1,000 cars, according to above calculation, $162,060.80 would be saved in one year, and $5,834,150 on 1,000 cars in 36 years, by using steel cars instead of wood.

How can steel replace wood in construction, especially in details? One of the weak points in cars built at present is the draft appliance, which is subject to harder service than any other part of the car, and no doubt costs more to maintain. The question of steel center sills was before the M. C. B. Association last year. It was the last subject and was received among salvos of thunder, lightning and rain, which may be the reason that it did not receive more attention and discussion than it did.

I am satisfied that steel center sills, including the draft arrangements, can be successfully applied to freight cars, and that steel in passenger car construction can be more successfully used than it has been yet. In new construction a good plan would be to use steel center sills of 12-inch I beams and 8-inch by 8-inch end sills of oak, the top of the end sill to be flush with top of floor. This would leave 6 inches of center sills below end sills. The lower half of the center sills should be cut away and project flush with outside edge of the end sills, forming a draft sill, to which the stops can be bolted or riveted. This would form a very simple and strong continuous draft rigging, doing away with separate draft timbers. By using 12-inch center sills, one of the weakest and most expensive points is overcome, viz., the breakage of center sills over bolsters, and the continued renewal of draft timbers. These two items cost more for maintenance than all the rest of the car above the wheels. If the expense of these two items can be reduced (and it can) thousands of dollars can be credited annually to the car repair account.

A great deal of adverse comment has been made on the weak construction of our passenger cars, more especially since so many serious wrecks have occurred during the World's Fair period. If a good non-telescoping device were in use on all cars in passenger trains, no doubt the loss of life, limb and property would be reduced to a minimum. The vestibule has done much toward preventing this evil, but the vestibule is not in general use enough to accomplish much. The vestibuled cars are nearly all in limited trains, and the tracks are kept clear for them, hence very few accidents happen and very few cars are telescoped. The accidents happen to trains with cars that have no vestibules, or with a train of cars with and without them; the former generally come out best. The writes believes that the coming car will be built on radically different liner from the present. The principal change will be in the end. Instead of the platforms, draft timbers and vestibules being separated from the car frames proper, they will and should be one and the same. Is there any good reason for using the antiquated separate platforms and draft timbers, when continuous sills can be used with the draft rigging between the center sills on the same principle as shown in Fig. 18 for steel center sills for freight cars?

An outline of what I would call an ideal passenger car frame that would make telescoping and crushing in of ends and sides a thing of the past, is the following: Use two 12-inch I beams about 32 pounds per foot for center sills, and six 8-inch 18-pound I beams or side and intermediate sills; two 8-inch, 20 pounds per foot I beams for end sills. The center sills to project below the end sills, say 6 inches, to permit the draw bar passing between the center sills. The draft stops should be placed the same as in freight cars. Make the side plates of 6-in. I beams, 13 pounds to the foot, the end plates of 6-inch I beams, 16 pounds to the foot, with eight 3 by 4 inch angles for corner and end posts, with ⅛ by 3 inch plates for end braces. With a superstructure like this composed of steel sections properly put together and braced, with the usual buffing attachments, etc., for vestibule, would reduce the liability of wrecks to a minimum. No doubt there are some orthodox car builders who would consider it heretical to build a passenger car without the present and past style of platforms, and to mention steel frames for any kind of car, well, "they don't want to live to see it," at least they "don't expect to." If there are any such within my hearing to-day (and I hope there are none), take my word for it, the day is not far distant when you will not only see steel center sills, but complete steel frames for both passenger and freight cars. For the former as a matter of safety, strength, long life and economy; for the latter as a matter of economy in cost for maintenance and dead weight. In may be contended that the cost of repairs will be greater with steel than with wooden frames. That is a question open for argument. The object of using steel is to increase the power of resistance; which it will do, as before stated 250 per cent. This will therefore reduce the amount of repairs necessary caused by rough handling 250 per cent. or more, and the repairs necessary for wear and tear must be very much less because of there being no shrinkage nor decay. As to its being necessary to have special machinery to repair steel cars, very well appointed railway locomotive and car shop is equipped with punches, shears, cold saws, bulldozers, etc., and that is about all that is needed to frame and form material for renewals and repairs of steel parts. If standard sections are used very little forging will be necessary. If put together on car-building lines and not like a boiler, it will be as easy to remove and repair bent or defective parts, as in a wooden car. The evolution would be gradual from wood to steel. The same would be the case with appliances for repairing. The cost for any change in the repairing plant would be small compared to the reduced amount of repairs required with the use of metal frames. In European and other foreign countries the evolution from wooden to metal cars has been quite rapid. It having been demonstrated that the metal car costs much less for maintenance than the wooden car, yet the difference in cost of metal and wooden cars is much more than it is or will be in this country, as they build a car there without much regard to future cost of maintenance, which is a very important item in this country. Thus far our metal cars have been built with a view to future maintenance, which is a considerati on absolutely necessary.

The question of dead weight is of considerable importance. To obtain a steel car with 15 per cent. less weight than a wooden car of same capacity means a saving in cost for haulage of 15 per cent., which insures a less number of cars to do the same amount of business, a less number of cars to maintain and renew, making a very marked reduction in the cost of rolling stock, and should leave a large balance on the right side of the yearly earnings to pay dividends with.

Finally, the question of the success of metal cars in this country depends largely on the disposition of our railway managers and car owners to pay 20 per cent. more for new equipment that will reduce the present cost of operation and maintenance 50 to 75 per cent.

Annual Reports of the Vanderbilt Lines.

At the semi-annual meetings of the several Vanderbilt railroads, held in New York recently, the following statements were made:

The New York Central for the quarter ending Dec. 31, partly estimated, shows: Gross earnings, $11,834,000, decrease, $365,284; net $3,771,000, decrease $110,730; first charges $2,585,000, increase $130,094; profit $1,186,000; decrease, $239,823; surplus after usual dividend $61,100, decrease $239,869. For the six months ending Dec. 31 the showing is: Gross $24,046,000, decrease $219,880; net $7,715,000, increase $165,195; first charges $5,215,000, increase, $250,874; surplus after dividend $264,300, decrease $85,671. The New York Central operated in 1893 2,334 miles, as against 2,096 last year, and the percentage of operating expenses was 68.15, compared with 68.18 last year. The profit for the quarter has decreased from 2.89 to 2.79 per cent.

The Lake Shore reports for the year ending Dec. 31, partly estimated: Gross earnings $23,686,519, increase $1,235,136; operations and taxes $17,061,750, increase $1,258,560; net $6,624,769, increase $12,576; fixed charges $3,370,000, decrease $5,364; profits $3,254,769, increase $17,940; surplus after usual dividend $286,779, increase $17,940. The expenses include all equipment expenditures brought forward from 1892, and $1,100,000 expended this year for renewal and additions to equipment and betterments. Nothing has been charged to construction or equipment since 1893. The funded debt has been decreased during the year $250,000 by the operation of the sinking fund. The operating expenses were 72.03, against 70.50 per cent. last year.

The Michigan Central for the year ending Dec. 31 shows: Gross earnings $16,075,000, increase $167,000; operating expenses $12,136,000, increase $90,000; surplus after interest and rentals $1,538,000, increase $80,000; profit after deducting Canada Southern proportion $1,065,000, decrease $12,000; other income $46,000, decrease $1,000; surplus after regular dividend $80,399, decrease $13,000. All expenditures for improvements and betterments have been charged to operating expenses.

The Chilian Claims Commission has overruled the demurrer of the government of Chili to the claim of the North and South American Construction Company, the largest and most important case referred to that tribunal. This company made a contract with the republic of Chili in 1888 to construct and equip a railroad 600 miles long, from Santiago northward into the mining districts, for which it was to receive $17,000,000 United States gold. The government took possession of the road that had been finished and all the material and plant of the company in 1890, and stopped the work of construction. The company's claims amount to about $6,500,000.

Master Mechanics' Association Notices.

The following circulars have been issued by the respective committees of the Master Mechanics' Association :

Special Shop Tools.

Your committee appointed to report on "New or approved appliances, either hand, power, pneumatic, hydraulic or electric, applied or applicable to locomotive manufacture and repair," desire to get all the information possible on the subject, and in order to present a paper at the next Convention of our Association that will give the members full information as to what is now in successful use in various shops, earnestly request all members who have in practical use in their shops any of the devices named, or who can give reliable information concerning the use of them in other shops, to send blueprints, photographs, printed cuts or pencil sketches, with any written or printed matter they can get in connection with them.

Your committee hope that members will not confine themselves to applicances purchased from builders, but include any device that they may have gotten up, or that may have in any way originated in their shops.

In many shops there are special forms of jigs, holders and small tools, invented to cheapen work or to make production accurate and interchangeable. Particulars concerning these minor tools ought to be sent to the Committee without fail.

Answers to be sent to T. W. Gentry, Master Mechanic, Richmond & Danville Railroad, Manchester, Va.

T. W. Gentry, Geo. L. Potter, H. D. Gordon, G. R. Joughins, Wm. Swanston, F. B. Miles, Committee.

Location of Exhaust Pipe and Size of Nozzles.

1. Do you know how to locate exhaust pipes to get the best results? If so, how?

2. Should location of exhaust pipes be the same for straight stacks and taper stacks?

3. Have you had any experience that would show that too large an exhaust nozzle would have the same effect on the fire as one too small?

4. Your committee realizes that they have considerable work before them, and would be greatly obliged to you if you will promptly reply to the foregoing questions; and if you have any suggestions on this line that will be of benefit, and have had any experience that the Committee could make use of we will appreciate same.

Please send replies to R. Quayle, C. & N. W. Ry., So. Kaukauna, Wis.

R. Quayle, W. S. Morris, J. W. Hill, J. McNaughton, Wm. Forsyth, D. L. Barnes. Committee.

Cost of Maintaining Locomotives.

Your committee appointed to report on the above subject at the next convention of the Association have carefully considered its various phases, and are of the opinion that the cost of maintaining locomotives is influenced to a large degree by the manner in which the engines were built, the conditions of service, the facilities the railroad has for economically making both light and heavy repairs, and also that the methods of accounting have an influence on the *apparent* cost.

In order that the committee may have the results of the experience of the members to guide it in its work, you are requested to reply to the following questions:

1. Please send us a copy of your latest monthly performance sheet in detail, also a statement or performance sheet covering the last fiscal year.

2. Furnish a statement of the number of eight-wheeled, moguls, ten-wheeled, consolidation and twelve-wheeled engines in freight and passenger service; also the size of the cylinders of each class.

3. What was the average mileage of your engines during the last fiscal year, excluding the engines that have not been in service during the year? If possible, give separate figures for road engines, switches, construction engines and suburban engines.

4. If not given in your performance sheet, please state the average cost of repairs per engine-mile on your road for your last fiscal year.

5. Give the mileage for the 10 engines making the highest mileage on your road during the last year.

6. Do you keep an individual repair record for each engine, or are all repairs pooled?

7. Please state to what account each of the following items are charged :

Material and labor employed in the regular repairs of locomotives.

Material and labor employed in the repair of wrecked locomotives.

Material and labor employed in the repair of foreign locomotives wrecked on your road, or bills which your road must settle for the same.

Material and labor employed in building or rebuilding engines to fill vacant numbers.

Cost of engines bought to fill vacant numbers.

Cost of new shop tools purchased from outside parties.

Material and labor employed in building new shop tools and machinery in your own shops.

Material and labor employed in repairing shop tools and machinery.

Heating, lighting of shops and shop supplies, such as fuel for stationary engines, oil. waste, brooms, laborers' tools, etc.

Salaries of master mechanics, clerks, foremen and other items of supervision.

Salaries of traveling engineers and air-brake inspectors.

Wages of laborers, watchmen, etc.

Laboratory expenses.

Drafting room expenses.

Rental of engines, when they are leased for any cause whatever.

If, in addition to such of the above items as you charge to locomotive repairs, there are other items not mentioned here which you also charge to that account, please enumerate them.

8. What difference, if any, have you found in the cost of maintaining locomotives built in railroad and in contract shops, particularly for the first three years of their lives? Give full particulars, and if the figures have been affected by an unusual breakdown or mishap of any kind (notably the unlooked-for failure of firebox sheets, frames or cylinders), inform the committee of the fact.

9. State what proportion of the entire expense of locomotive repairs is spent on the boiler, the cylinders and running gear, and the tender. Please itemize the repairs in this manner when making the comparison between contract and railroad-built engines.

10. In maintaining your locomotives in first-class condition, what average percentage of the total motive power is necessary in the shop?

11. Are your branch lines and division terminals fully equipped for doing running repairs?

12. Please state, according to your experience or observation, what facilities for making running repairs should be provided at round-houses away from shops in order to do that kind of work economically.

13. Do you provide facilities for making heavy repairs at other than your main shops? If so, how does the cost of such repairs at these places compare with the cost at the main shops? Can the engine be turned out of the small shop as quickly as from the main one?

14. Do you find that, with your facilities, it is possible to build locomotives at your main shops for less than you can buy them?

15. If you cannot do so, would additional facilities in the way of new tools enable you to do so, and would such an outlay be warranted by the amount of work in prospect for such machinery? Will you please state what new tools would be needed to so cheapen the work of construction.

16. Could not additional tools required for such work be utilized for repair work also, and the cost of heavy repairs thereby be greatly reduced?

In formulating the above questions your committee is aware that it has in some cases asked for information which railroads may not desire to have published in connection with the name of the road. The committee will respect all such wishes, and does not desire the data for the purpose of making objectionable comparisons, but to guide it in further investigation.

Information bearing on this subject, but not called for in these questions will be greatly appreciated.

Answers should be sent to Mr. G. W. Rhodes, S. M. P. of the C., B. & Q. R. R., Aurora, Ill., as soon as possible.

G. W. Rhodes, Jacob Johann, W. Smith, J. N. Barr, W. Garstang, W. H. Marshall, Committee.

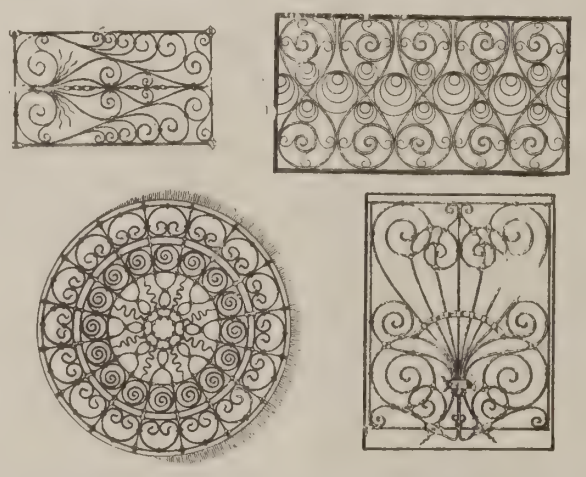
The "Indian Engineer" says that the experience of many railways, both in the United Kingdom and India, has shown that six-wheeled vehicles, constructed with a flexible wheel base, though more expensive in first cost, give greater comfort in traveling, and effect a certain saving in wear and tear. Further, by the use of six-wheeled vehicles, the risk, in cases of certain accidents, is reduced to a minimum. In 1889, the Government of India issued an order prohibiting the use of six-wheeled vehicles on all state railways in India, supposing quite erroneously that such vehicles must necessarily have a rigid wheel base. The order of 1889 has recently been withdrawn.

At various points on the Bosporous the current from the Black Sea to the Mediterranean has prodigious force, and it is now proposed to harness some of this waste power for the lighting of the whole city of Constantinople, and a considerable length of the adjacent coast by electricity. The way in which the inventor intends to turn the ocean currents to account is to erect three very powerful dynamo machines upon the three points of the Bosporous where the current has the greatest force. It is stated that the Turkish Government has taken the project into consideration and has nominated a commission to report on it.

The steamer "Jennie," belonging to the Arctic Whaling Fleet, lately arrived in San Francisco with the news that the "Newport" had wintered in the Herschel Islands, a small island west of the mouth of the Mackenzie River, and, aided by a sea remarkably free from ice, worked her way north this summer in pursuit of whales as far as the eighty-fourth parallel, or within six degrees of the Pole. If true, this is the nearest the Pole has ever been reached.

Venetian Ironwork.

The designers and makers of the Venetian ironwork, of which the following cuts are illustrations, are Messrs. A. J. Weed & Co., of 106-8 Liberty street, New York. Drawings and material for a large variety of designs in this work can be obtained of this firm, as well as tools for its manufacture. In this work the iron is shaped by special devices, and the



attachments are made not by welding or riveting, but by a system of clasping which is both efficient, rapid and cheap.

By this method very handsome designs in light ironwork can be turned out with but little required skill on the part of the operator. Full instructions accompany the tools supplied for this work. There are various sets of these tools made to suit the various qualities of output desired, and a set for experimentors is sent on application for a merely nominal sum.

The Western agency of the American Wire Glass Company, of which Thompson & Inness of New York are general agents, has been assigned to F. T. West, the Rookery, Chicago.

The car repair shops of the New York, Lake Erie & Western, at Jersey City, were burned on the night of Jan. 12. The loss was about $40,000. The buildings were mostly frame structures.

The Cleveland Twist Drill Company, of Cleveland, O., says that the business outlook "seems brighter than for any time in the past six months. We are running with most our full complement of men eight hours a day, and hope to soon be running the usual ten hours."

The Kinsman Block System Company, of New York City, is completing an installation of about eight miles of double track for the Chicago, Milwaukee & St. Paul. It is also equipping about three miles of track on the New York, Susquehanna & Western, near Weehawken, for experimental purposes.

Messrs. C. B. Hutchins & Sons, of Detroit, Mich., manufacturers of the well-known Hutchins freight-car roof, have issued a very neat pamphlet describing and illustrating the principal buildings of the Columbian Exposition. There is a good deal of entertaining reading in the pamphlet on different topics, and an occasional modest mention of the superiority of the Hutchins freight-car roof.

A two years' study at Gizeh has convinced Mr. Flinders Petrie that the Egyptian stone workers of 4,000 years ago had a surprising acquaintance with what have been considered modern tools. Among the many tools used by the pyramid builders were both solid and tubular drills and straight and circular saws. The drills, like those of to-day, were set with jewels (probably corundum, as the diamond was very scarce), and even the lathe tools had such cutting edges. So remarkable was the quality of the tubular drills and the skill of the workmen, that the cutting marks in hard granite give no indication of wear of the tools, while a cut of a tenth of an inch was made in the hardest rock at each revolution, and a hole through both the hardest and softest material was bored perfectly smooth and uniform throughout.—"American Analyst."

Recent Progress in the Manufacture of Steel Castings.*

BY H. L. GANTT.

Though it was about 1886 or 1887 before any large increase took place in the use of steel castings, they had been successfully made in this country at least as early as 1867. In July of that year the Wm. Butcher Steel Works, now the Midvale Steel Works, cast some crossing frogs for the Philadelphia & Reading Railroad of crucible steel. The molds were made of ground firebrick, black lead crucible pots ground fine, and fireclay, and washed with a black lead wash. The surface of these castings was very smooth, and the metal, which was practically tool steel, was so well adapted for the purpose that some of the castings made in those early days are said to be still in use.

This was before the use of silicon for solidifying steel was known, and the castings were very much honeycombed in all parts except the wearing surface of the frogs, which was "cast down." The possibility of getting one face of a casting approximately solid admitted of the use of steel, also for hammer dies, although their general sponginess was a great obstacle to their extensive adoption.

On April 28, 1876, two small hammer dies were made of open-hearth steel at the same place, and on May 29 a hammer head weighing 2,535 pounds was made. As long as castings were small, the molding mixture of ground brick, ground pots and fireclay was satisfactory, but on large castings made with that facing the surface was very imperfect, and the sand adhered to it with great tenacity. But little improvement in the method of molding was made for some time, and while the quality of the steel was gradually improved, the appearance of the castings was decidedly against them, and but little progress was made in their introduction.

The next step taken by the Midvale Steel Company was to leave the ground pots out of the molding mixture, and to wash the mold with finely ground clay firebrick. This was a great step in advance, especially in heavy castings, and a marked improvement took place in their general appearance, but the mixture still clung so strongly to the casting that only comparatively simple shapes could be made with certainty. A mold made of such a mixture became almost as hard as firebrick when dried, and offered so much resistance to the proper shrinking of castings that when at all complicated in shape they had so great a tendency to crack that their successful manufacture was almost impossible. The next step was to use a mixture of silicia, sand and flour. In small castings this gave pretty good results, as such a facing cleaned off the casting very readily, leaving a smooth surface much superior in appearance to that left by the ground brick. The great difficulty in the way of the extended use of such a facing was the tendency of the flour to burn in drying, leaving the sand without a proper bond, and often the burnt mold was so friable as to be entirely useless. In the case of large castings it was almost impossible to dry thoroughly the whole mold without burning that portion nearest the fire, and for such work flour was necessarily abandoned.

By this time the use of silicon for solidifying castings was becoming general, and the only obstacle in the way of making good steel castings was the want of a suitable molding sand. This was ultimately found in a mixture, the principal constituents of which were silica, sand and molasses thoroughly ground together.

The improvement in the appearance of castings caused by the use of a sand that left a clean, smooth skin was the cause of their rapid adoption; and the year 1887, when the Midvale Steel Company made the first gun carriage castings of steel, is approximately the date at which their rapid extension began.

At this time the necessity for hot metal did not seem to be understood, and castings frequently contained blowholes, when it seemed that all the conditions for making them perfect had been complied with. It was noted before a great while that small castings contained more holes than large ones, and that those poured last on a heat were worse than those poured first. The conclusions that hot metal was needed to make solid castings, and that smaller castings needed hotter metal than large ones, were soon deduced and amply verified. Apart from these considerations, the superior appearance of castings made from hot metal was sufficient to cause all steel casting makers to work in that direction. The difficulties in the way of getting uniformly hot metal are hard to overcome in an open-hearth furnace. The delay caused by a slow or difficult tap of the furnace, which is always liable to occur, is fatal to the production of best castings. Besides what has already been mentioned, cold metal in the ladle is to-day the cause of more complaints by purchasers and expense to the manufacturer than anything else in connection with the manufacture of steel castings. I will enumerate a few of the troubles that may be traced directly to this cause. What is known as a "bad shut off," or a leaky stopper, is usually caused by a small amount of metal chilling in the nozzle and preventing the stopper from going to its place. In cases where the dribble is slight the worst effect is that a small amount of metal runs into the mold while the ladle is being gotten over the runner. This metal is apt to chill, and make a bad looking spot on the casting, or, in the case of small castings, block up the runner entirely, and cause the loss of the mold. When the leak is very bad it not infrequently happens, especially when the heat is a large one, composed principally of small castings, that the flasks are covered by the molten steel and so strongly fastened together that it is almost impossible to separate them from the steel without considerable loss by breakage. Again, by a careful study of the subject, I feel that I have been able to lay to the door of cold metal one of the most fertile sources of complaint which steel founders have met with—namely, lack of homogeneity, which include both hard spots and loose places. I use the term "loose" rather than spongy, for the reason that I do not so much mean a cluster of holes as a spot where the metal simply seems less dense. Such places, without any visible continuous hole, or even without anything that would indicate the existence of such a hole, allow leaks in a hydraulic cylinder, and cause the failure of a test bar.

When we consider more in detail the process of making open hearth steel castings, we see why these defects are more apt to occur in cold than hot metal. While the metal is being tapped from the furnace, the silico-spiegel necessary to prevent blowholes is generally thrown into the ladle, usually in the solid, though heated state. If the metal is

* Presented at the New York meeting of the American Society of Mechanical Engineers, December, 1893.

very hot, and consequently thoroughly fluid, the silico-spiegel is dissolved at once and uniformly disseminated through the mass. If, however, the metal should not be so hot, it is easily seen that the silico-spiegel may not become at all thoroughly diffused, and the slightly viscous metal in the ladle may be the reverse of homogeneous, in which case the resulting castings may be very far from what is hoped for. It is now the practice in the best foundries to melt the silico-spiegel, and these defects in their worse form are thus practically eliminated.

Why hard spots should appear in cold metal is readily seen, for lumps of partially melted silico-spiegel would certainly form the nuclei for such spots; but why the loose places should occur is not quite so apparent. It may be noted that the loose places appear to a more marked extent in large masses than in small ones, and the most reasonable explanation seems to be that the silico-spiegel, which is but imperfectly melted when the metal is poured, finally melts thoroughly after the metal is in the mold, which can only occur in very heavy castings, burning a spot higher in carbon, manganese and silicon than the metal surrounding it. Such a spot would have a lower melting temperature than the adjacent metal, and would remain partially fluid after the other metal was set. The result of such a condition would be to drain away a portion of the fluid metal to feed the shrinkage in the metal solidifying about it, leaving a more or less spongy spot.

That shrinkage holes and cracks do still occur in steel castings is well known, but the success that founders have had in casting complicated shapes within the past year or two has been surprising. The fact that a steel casting must cool at the bottom first, and then gradually upward in the mold, is being learned by designers; and shrinkage holes are becoming less frequent, for the founder at once fixes on the heaviest portion for his sink head, which is usually about 20 per cent. of the total weight of the casting, and which must remain fluid until the whole of the casting proper is solid.

By a strict observance of the rule that a steel casting should, as far as possible, be of uniform thickness throughout, it has been possible to make within the past few years castings 20 feet long by 10 feet wide, which would have been considered impossible a few years ago. To one unfamiliar with the details of the process of making steel castings, the statement that to-day we can get large steel castings that are perfectly satisfactory, while it is almost impossible to get good small ones, would seem very strange. It is, however, a fact, and the explanation is simple. Most steel castings are made by the open hearth process, and the furnace usually melts from 5 to 20 tons. To pour even five tons of steel into castings averaging 100 pounds in weight would, as a rule, take so long that those poured last would be of inferior quality on account of the cooling of the metal. As a rule, a large portion of the heat is poured into a comparatively few large castings, and the remainder put into the smaller ones. If the metal is very hot to start with, this may give fair results, but in all cases the least desirable metal is put into the small castings.

This difficulty seems almost insurmountable by the open-hearth process, but is readily overcome by a small Bessemer converter, from which we can get two or three tons of metal as hot as we may wish it. Add to this the fact that we can get from the converter that quantity of metal of any composition we may desire every half hour throughout the day, and we realize the advantage of the Bessemer process for making small and medium weight castings. The manufacturers of electric motors who have been buying their castings from open-hearth foundries have apparently not realized what the Bessemer foundry has in store for them. It seems hard to believe that perfectly solid steel castings can be made of the following composition with regularity: Carbon, 0.12 per cent.; manganese, 0.30 per cent.; silicon, 0.30 per cent.; but it is a fact. It may be noted, however, that this steel, while very well adapted to electrical purposes, is of but little value for any miscellaneous castings, except very small ones, on account of the tendency it shows to crack during the process of solidifying, when cast in shapes at all complicated.

The fact that we can make a number of different kinds of steel each day if we use a converter, and but two or three heats at the most in 24 hours if we use an open-hearth furnace, gives a great advantage to the founder using the converter, especially if he is making all kinds of steel castings, enabling him, as a rule, to make far more prompt deliveries than is possible for the open-hearth founder doing the same variety of work.

Among the other advances made in casting steel may be mentioned one for making a casting having one or more faces of a steel much harder than the body of the casting. The process consists in lining such faces of the mold as will be adjacent to the parts of the casting it is desired to harden with a metallic alloy in a crushed or powdered state, capable of being melted and absorbed by the molten steel in contact with it, and of such a nature as to impart to the steel a hard face, or a face of such a composition as may be readily hardened. If it is desired that the casting shall have a permanently hard face and be used for stamp shoes, crusher jaws, hammer dies, etc., ferro-manganese gives the best results. If it is desired to do machine work on the face, and make it extremely hard afterward, ferro-chrome is most suitable. The fact that it is possible to produce a soft steel casting having a face that can be hardened without causing the remainder of the casting to become brittle will undoubtedly make it possible to use steel castings in place of chilled iron in many places with great advantage.

Discussion.

H. A. Royce, General Manager of the Thomson Electric Welding Company, described some experiments which they had made to remedy the evil effects produced by blowholes. The object aimed at was, when a blowhole was discovered, to fill it with steel in such a way as to make a perfect union between the plug filling the blowhole and the mass of steel itself. They had been able to do this successfully both from a commercial and practical point of view, and their process had proved to be not only perfectly efficient, but economical as regards cost and time, and resulted in the saving of many castings which would otherwise have been considered useless. He stated that this method was in use in Russia and had been introduced quite extensively and on a commercial scale in England.

Their first experiments consisted in the employment of the electric arc, the mass of steel forming one pole, and a carbon, held at the blowhole to be filled, forming the other pole. The formation of the arc by the current passing between these two poles furnished heat sufficient to melt small steel scrap or filings introduced into the hole. But this method was not successful, because of the chilling action of the walls of the hole on the plug of steel introduced into the hole, and the union between the two was therefore not perfect. Success of the most perfect description was obtained by heating the mass of steel in an oil or gas furnace and then utilizing the electric arc for the melting of the steel filings introduced into the hole. In this way they had succeeded in a few minutes in making so perfect a union between the plug introduced into the hole and the walls of the casting that no line of demarcation was apparent when the piece was planed down.

In answer to a question as to whether the Krupp steel locomotive frame exhibited by the Krupp concern at Chicago could be reproduced in this country in a commercial way in competition with the ordinary forged frame, Mr. Gantt answered that while the first frame produced would probably not pay, an order for 100 would be remunerative. He saw no reason why three or four firms at least could not make a frame of this character of a quality equal to that exhibited by the Krupps.

Riehle Measuring and Per Cent. Gage.

We present to our readers in this issue an illustration of the Riehle Measuring and Per Cent. Gage. An ingenious apparatus of this kind will be readily appreciated by those in charge of testing departments where the percentage of elongation on tensile specimens of metal is required. It has eight notches spaced 1 inch apart and is 12 inches long, the 4 inches beyond the notches being laid off and graduated to show the elongation in per cent. without either measuring or figuring. On the under side is a shoulder running with the length of the scale, so that the lines scribed to show the inches will be across the test piece at right angles to its axis. The scale is used either with the lines scribed with this instrument or with pieces laid off with the double-pointed center punch.

It is a great time saver, and its use also eliminates the possibility of error in measuring extensions and figuring the percentage of elongation. For pieces laid off in lengths other than 8 inches, the percentage scale is in proportion. Thus in 4-inch measurements the reading is doubled, and in 2-inch measurements it is quadrupled.

This machine is made only by Riehle Bros. Testing Machine Company, Philadelphia. Descriptive circular will be sent upon application. It is in use by several testing bureaus, among others the Robert W. Hunt & Co. Bureau of Inspection, Tests and Consultation, Chicago; also at the testing department of the Illinois Steel Works, North Chicago Works and the department of pnysical tests of Riehle Bros. Testing Machine Company, Philadelphia.

A Catalogue of Rubber Goods.

The New Jersey Car Spring & Rubber Company, of Jersey City, N. J., has just issued an illustrated catalogue and price list of its articles of manufacture. We advise those who are in any way interested in rubber goods to send for a copy of this catalogue, as it illustrates and describes a great many useful articles that are made of rubber.

To railroad mechanical officers the pages that treat of steam, air-drill and air-brake hose will be particularly interesting. The company manufactures extra heavy steam hose, from three-ply for 20 pounds pressure to eight-ply for 100 pounds pressure. The air-drill hose is made from duck of the highest grade, specially woven for this purpose, and capable of standing the most severe pressure and service. The rubber is of a grade that has proved its merit by many years of successful operation.

Perhaps there is no line of goods made by the rubber manufacturer on which so much depends as the construction and quality of air-brake hose. This company has made a most careful study of the subject, and its products in this line are the result of years of experience in supplying railroads, and countless experiments, aided by the advice and suggestions of the most practical railroad experts in the country.

The Consolidated Car Heating Company, Albany, N. Y., has received a second order from England for direct steam storage heating equipments. These equipments are so arranged that the temperature in each compartment can be separately regulated.

The C., C. C. & St. L., otherwise known as the "Big Four," the Lehigh Valley, the New York, Ontario & Western, the Fall Brook, the Connecticut River and the Boston & Albany railroads have recently abandoned all other patterns and have made the Sewall coupler their standard. The Consolidated Car Heating Company, of Albany, N. Y., has sold over 10,000 Sewall couplers since the beginning of the present heating season.

In our last issue we mentioned that Mr. Henry L. Leach, Division Master Mechanic of the Fitchburg Railroad at Fitchburg, Mass., had resigned to devote his entire time to the commercial interests of Leach's track sanding apparatus for locomotives, of which he is the inventor. We mentioned that his present address is North Cambridge, Mass. This is his home. Business communications should be sent to his old address, P. O. Box 1601, Fitchburg, Mass.

The Cleveland Twist Drill Company, of Cleveland, O., has issued a very neat and convenient calendar and memorandum combined.

Mr. J. K. Bole has resigned as one of the managing directors of the Otis Steel Company, and his present address is the Wade Building, Cleveland, O.

The Consolidated Car Heating Company, of Albany, N. Y., at a meeting held Jan. 9, 1894, declared its regular semi-annual dividend of three per cent., payable Feb. 15, 1894. Transfer books to close from Feb. 1 to Feb. 16. The affairs of the company were reported in a prosperous condition.

Those interested in woodworking machinery will be glad to learn that the Berry & Orton Company, of Philadelphia, Pa., has succeeded in making a settlement of its financial difficulties on terms satisfactory to all interested, and has resumed business. The trouble with this firm was caused by a disaffected stockholder, with whom a satisfactory settlement was made.

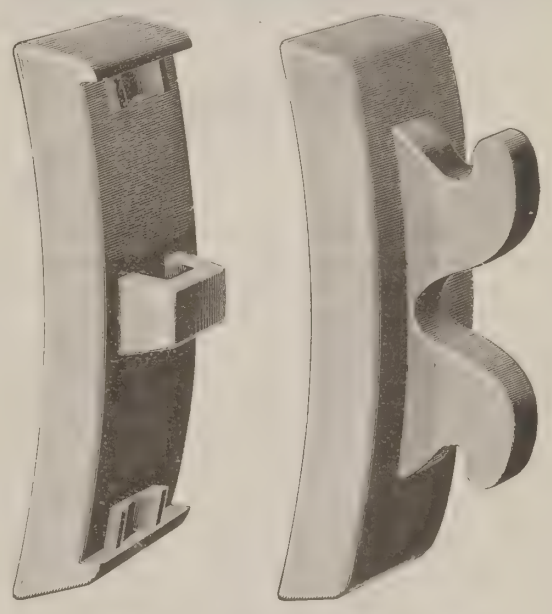
Improved Ventilating and Heating Plants.

Contracts have been given by the East Tennessee, Virginia & Georgia Railway for the equipment of its car and paint shops at Knoxville, Tenn., with the Buffalo "fan" system of heating and ventilating. The dimensions of each building are 337 × 90 × 33 feet, involving the use of a fan capable of delivering 82,000 cubic feet of air per minute.

The general office building of this road, at Knoxville, has been recently equipped with this same system of heating and ventilating. An 80-inch Buffalo Forge Company's fan draws air through a heater of 1,800 feet of steam pipe. The fan at normal speed will change the air of the entire building every fifteen minutes, and can be regulated at will. It will furnish 12,000 cubic feet of air per minute, and its distribution, after leaving the fan in pipes, varies according to the amount necessary to furnish the various rooms of the building. The steam is furnished from a locomotive boiler, and the fan is operated by a gas engine, both of which are located in the basement. This fan's work will also be greatly appreciated in the summer for its distribution of refreshing whiffs of air during the sultry months.

Forged Steel Brake Shoes.

The accompanying cuts show the steel brake shoes made by the Schoen Brake Shoe Company, of Pittsburgh, Pa. The shoe is made of mild steel forged by hydraulic pressure into the exact forms now in general use, and by a new process very low carbon steel is used. The tests of the company show that one of these shoes will outwear eight cast iron shoes, and its holding power is better than the cast iron shoe either on chilled or steel tired wheels; also that they act immediately to retard the train when brought against the wheels. The other advantages claimed for these steel shoes, are that they can be worn very thin before



PRESSED STEEL BRAKE SHOES.

there is any danger of breakage, that they wear the wheels less than cast iron shoes, and that taking into consideration the thinness to which these steel shoes can be worn, the total wear of each shoe is fully eight times that of a cast iron shoe under the same conditions. This, together with the low cost of the forged steel shoe, enables a saving, it is claimed, of outlay for brake shoes amounting to from 50 to 75 per cent.

Still other advantages accrue from the fact that with these shoes there is less labor required in inspecting and keeping up the brake equipment, and that the aggravating delays and annoyances due to breakage of shoes by driving in keys are removed, the metal being tough—not brittle like cast iron.

The Consolidated Car Heating Company, of Albany, has begun suit in the United States Circuit Court against the Chicago & West Michigan Railway for infringement of the Sewall coupler patents. The infringement consists of using an imitation of the Sewall steam coupler recently put upon the market.

In a sketch of the career of Robert Mitchell, President of the famous Robert Mitchell Furniture Company, of Cincinnati, Ohio, which recently appeared in the Cincinnati *Commercial Gazette*, Mr. Mitchell was asked by the reporter to what one thing he attributed his success in business. He replied that it was "the introduction of woodworking machinery."

The above-named concern has in daily operation one of the "Victor" 42-inch triple drum sandpapering machines which took a medal and a diploma at the World's Fair, Chicago, 1893. It is made by the Egan Company, Cincinnati, Ohio.

About a year ago the Joseph Dixon Crucible Co., of Jersey City, issued a pamphlet on lubricating graphite. It embodied an elaborate scientific opinion by Prof. R. H. Thurston on the value of graphite as a lubricant, and much interesting information on the subject from practical men. The pamphlet has had a large circulation, and the company has been enabled to obtain from well known men a vast amount of additional knowledge on the uses of graphite. Another pamphlet, twice the size of the former, will be issued early in February, and a copy will be sent free of charge to all interested in the subject of friction and lubrication.

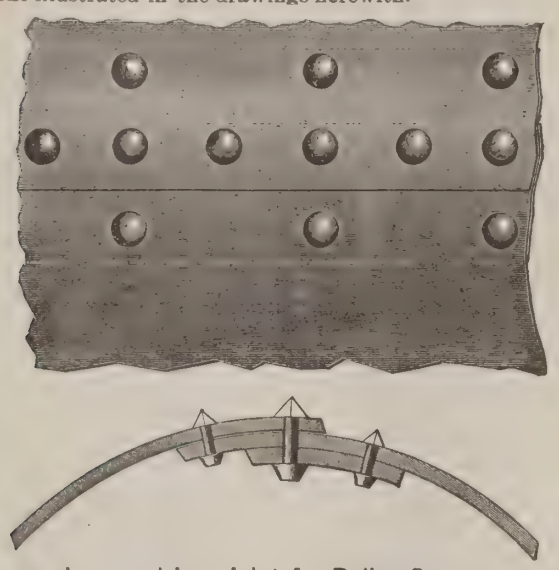
An Improved Lap Joint for Boiler Seams

Heretofore in the construction of lap joints for steam boilers there have been objectionable features which this improvement is designed to overcome, and that is, that the lapped ends of the sheets not having any provision for reinforcement, places them without the line of strain when steam pressure is on the boiler. This strain, which is substantially in a straight line, has been found to bend the lap so as not to present a direct line of pull on the rivet, but to bend and force the rivet to assume an axial line obliquely disposed to the line of strain, which not only tends to weaken the boiler at that point but also to uncalk the seams.

The purpose of this improvement is to overcome these and other objections by providing the interior of the boiler with an inside welt, extending laterally to one side, to a width sufficient to place it immediately below the calk line, whereby it relieves the lap joint of any torsion when the calking is being done.

Another feature is to reduce the number of rivets necessary to forming such a superior joint, and also enabling a tight joint to be made with only one line of calking, which is advantageous from the fact that the expense generally attending the seaming and calking is greatly reduced.

These results are attained by the construction and arrangement illustrated in the drawings herewith.



Improved Lap Joint for Boiler Seams.

They show a cross-sectional view, and a side elevation of a detached portion. A represents a segment of a circular boiler having its ends overlapping each other, and secured to the interior is an inside welt, placed so that the calking edge will be about its central longitudinal line, whereby when the sheets are subjected to the impacting process of calking the strain is taken up or absorbed by the welt. To illustrate, when we break a solid body apart we are not separating solid continuous surfaces, but simply overcoming the attraction for each other of particles already separated by distances very considerable in proportion to their own size. This force of attraction is called "cohesion," and we overcome the cohesion when we break or tear the body apart. It is this property of cohesion which gives to iron its tensile strength and enables the sheet to withstand the pressure which tends to burst or rupture the boiler. When by accident or design we separate the particles beyond the distance at which they can act effectively upon each other their cohesion is overcome, and we say the body or sheet is "broken.' In the manner noted the calking process separates the particles and weakens the boiler.

In the present practice of construction it is impossible to put together parts of a boiler without using rivets, and it is very certain that the direct result of riveted joints is that their strength is measured, not so much by the tensile strength of the sheets as by the laws determining the resistance to shearing offered by a rivet, and by the resistance to tearing on lines which are admittedly weakened by the calking process.

This improved lap joint entirely obviates these objections and may be used on circular, horizontal and vertical seams.

The rivets in the center row in the design illustrated above are spaced close together, and are larger in diameter than the two other rows, which are spaced twice as far apart. The designer of this arrangement, Mr. J. T. Connelly, of Milton, Pa., claims that it has material advantages in the way of general superiority and efficiency over the old methods of forming either lap or butt joints.

"Thou Shalt Not Covet."

A Valuable Invention Which Excites the Cupidity of Grasping Men and Leads Them to Desperate Deeds.

[*From the New York Recorder.*]

Mr. Charles B. Miller, president of the Magnolia Anti-Friction Metal Company, of New York, London and Chicago, has filled a complaint for libel against Joseph S. Donovan, general selling agent of a rival brand of metal, and, accordingly, an order of arrest has been granted by Judge Bischoff, of the Court of Common Pleas, New York, in the action therein.

The complaint tells but little of an interesting story, which, piece by piece, has been obtained, and is now put together in consecutive form for the first time. Mr. Charles B. Miller, the president of the company, said:

"You want me to tell you about this case. Well, it would take a book.

Ever since I became president of the Magnolia Metal Company, I, the officers of the company and the stockholders have been involved in a life-and-death struggle to protect our property. It is not enough to get hold of a good thing in New York; you have got to keep hold of it.

Some years ago I and my brothers came from Alabama with a valuable invention and less than $1,500 capital. The value of that invention has been demonstrated in more ways than one. It has received the indorsements of the most prominent, practical and scientific men of this country and Europe. Starting, as I said, with a capital of less than $1,500, we have done a gross business during the last few years of over $1,500,000. But, I may say, we have not been permitted to accomplish these results without a struggle. Every passenger on a railroad knows what a hot box is. Railroad officials also know, and those of them who are well informed know that our metal is the only alloy that will give satisfactory service in the prevention of annoying and costly stoppage. Magnolia metal is largely used also in the machinery of steamships and rolling mills.

The inventor of our formulas was an unfortunate man, now dead, named Singley, who after the assignment of his formulas, and making a contract of service with us, gave us not a little trouble. Naturally, I do not care to speak of Mr. Singley, except when it is positively necessary, and then as kindly as possible. It is proper to say, however, that, by virtue of the conspiracy planned and carried out against us, he suffered along with us. He was interested, not only in the domestic, but in the foreign patents, and, had he not been decoyed away by our enemies, would have profited largely because of his interest. In one instance which I recall, at an early stage of the company's history, we had practically concluded the sale of the foreign rights for $150,000. As a result of machinations, and the intrigues set on foot against us, the attacks made upon us, the deal was broken up. Mr. Singley's interest in the deal was 10 per cent. So you see, I can speak for him as well as for myself and for my associates. We have all lost by the meddlesome interference and insatiable cupidity of certain gentlemen here in New York who had no interest whatever in our company's affairs from beginning to end.

I can't begin to describe the length and breadth and depth of these malicious operations. Our first step in introducing our metal upon the home market was naturally to make the proper tests. The best English metal then in the market was Parsons' white brass. The following extract from the official report of the United States Government shows we achieved a signal triumph over the then ruling brand:

Jan. 17, 1888.	Revolutions per min.	Pressure per sq. in.	Highest temperature.
Magnolia	2,008	100 lbs.	103 deg. F
Parsons'	2,008	100 "	280 " "
Jan. 19, 1888.			
Magnolia	2,008	150 lbs.	130 deg.
Parsons'	2,008	150 "	360 "

Parsons' oil holes choked up and oil smoking.
Result in favor of Magnolia.

A summary of the results of the experiments on this machine shows the great superiority of the Magnolia metal over the Parsons white brass, the Magnolia, even after the heaviest stress, retaining a smooth, polished surface. This metal has also been tested in the friction machine up to 600 pounds per square inch—the limit of the machine. Respectfully,

C. J. M'CONNELL, Chief Engineer U. S. N.
WM. A. WINDSOR, P. A. Engineer U. S. N.
F. C. BOWERS, Asst. Engineer U. S. N.

REAR-ADMIRAL BANCROFT GHERARDI,
Commandant Navy Yard, New York.

The language of the commission is unequivocal, and, as a result of this and other official reports, the White Squadron of the United States now uses our brand. In fact, we have repeatedly come in contact with all American and foreign brands, and have invariably triumphed over them, so that now we can say, with some pride, under the circumstances, that the indorsement of eight leading governments is a conclusive reply to the attempts to attack the character of our metal.

To make a long story short, we had not long been in business in New York when an attorney whose business it was to travel about the city procuring evidence in favor of a certain railroad traffic company in accident cases, which might be brought or had been brought against this company, called at our offices. He made a proposition to buy out our right for $500,000, and, at his suggestion, I called at the office of a distinguished firm of attorneys, closely connected with a millionaire syndicate of world-wide reputation, and there was plainly told that I would be given $100,000 worth of stock in a company to be formed with a capital of $500,000, and that money would be obtained by the sale of the stock when the sole value depended upon the assignment of all that our company owned. This attorney was extremely candid. He informed me that his interest was the same as that of our ex-employee, Singley, and that if we refused to give up our property on these terms we would find that we would regret it. The prophecy of my legal friend has not been entirely fulfilled, but I will admit that he has succeeded admirably well in causing the members of our company and the stockholders a great deal of needless anxiety and serious financial loss.

Almost immediately upon the refusal of his offer, we found ourselves encompassed about on every hand. A strike was instigated in our factory. Bogus tests of our own brand, which fortunately we were able to expose, were instituted for the purpose of giving our goods what is known in the trade as a "black eye." These attempts were partially successful. For a while we were driven out of the home market, and had to fight our battle in the provinces—on the Pacific Coast for instance, and in foreign countries. This persecution did not ruin us. We received indorsements of eight leading governments, and by patiently correcting every misunderstanding and setting right every false impression, we held our own at home. In the middle of this campaign we were compelled to bring a suit against the patentee from whom we derived our rights, to restrain him from disclosing our trade secrets. Distinguished counsel appeared to defend him, and, viewing the combination formed against us, we had little hope of being able to successfully present the evidence to the court.

Justice Patterson granted the injunction and this seemed to be the end of the matter until finally, to my surprise, I found that printed copies of a letter, written to the firm of attorneys who had been so anxious to buy us out, which letter was a gross attack upon me, and which offered for $500 to obtain evidence to support this attack, and which, if you will believe me, was never used upon the trial of our application for injunction to restrain Mr. Singley, was actually being circulated in the ordinary way of business.

The original letter came from a firm of lawyers who were themselves interested in a rival brand of anti-friction metal, and was a privileged communication to those who admitted themselves to be interested with Mr. Singley. Obviously such a letter, utterly unsubstantiated and circulated to give an impression entirely contrary to the decision rendered by Justice Patterson in the Singley litigation where he found that the president of the Magnolia Metal Company had, in every particular, lived up to their contracts with Mr. Singley and their agents, was the last straw.

If civil actions concluded in our favor cannot protect our interests and the interests of the stockholders, who look to me, naturally, I am compelled to appeal to the courts for severer measures. I hope, once for all, to conclude this drama of persecution one way or another. I have not given you one tenth of the facts in this case. For years we have been contending against a tremendous conspiracy to wrest from our control what has been declared to be our property, in an action which completely covered all the merits of the case.

We have reason to believe that the injunction which Justice Patterson granted us has not been effective, and that one of our five formulæ is being used in defiance of our patent rights, which have been granted not only for this country but for all foreign countries. But, of course, we shall attend to this business in the proper way and at the proper time.

Mr. George E. Miller, secretary of the Magnolia Anti-Friction Metal Company, fully confirmed the president's statement, and stated: "For fully three years I was on the *qui vive* to keep outsiders from conspiring with the employees to abstract important documents from our office, from early in the morning until late at night."

Judge Roger A. Pryor, who was special counsel for the Magnolia Metal Company in the Singley litigation, said: "I do not remember all the details of the case, for I was just preparing to present it to the court when I was elevated to the bench. The invention is of great value, and my connection with Mr. Miller, brief though it was, was exceedingly pleasant."

John S. Durand, the junior partner of the firm of Tyler & Durand, counsel for Joseph S. Donovan, said in reference to the case that he had not time to read over the complaint carefully, but that he was satisfied that Mr. Donovan had not uttered anything libelous, and that he could successfully prove his innocence.

Col. Bacon, of the firm of Nichols & Bacon, 71 and 73 Broadway, whose recent triumph over John Y. McKane is still news, and who became counsel for the Magnolia Anti-Friction Metal Company upon the elevation of Judge Roger A. Pryor to the bench, and who was successful in obtaining an injunction for Mr. Miller in the famous Singley case, before Judge Patterson, took a different view of the Donovan case. "The letter which Mr. Donovan is circulating," said Colonel Bacon, "is undoubtedly libelous, and shows on its face an offer to purchase perjured testimony. However, the whole matter is one for the courts to decide."

The Loudest Noise Ever Heard.

No thunder from the skies was ever accompanied with a roar of such vehemence as that which issued from the throat of the great volcano in Krakatoa, an islet lying in the Straits of Sunda, between Sumatra and Java, at 10 o'clock on Monday morning, Aug. 27, 1883. As that dreadful Sunday night wore on the noise increased in intensity and frequency. The explosions succeeded each other so rapidly that a continuous roar seemed to issue from the island. The critical moment was now approaching, and the outbreak was preparing for a majestic culmination.

The people of Batavia did not sleep that night. Their windows quivered with the thunders from Krakatoa, which resounded like the discharge of artillery in their streets. Finally, at 10 o'clock on Monday morning, a stupendous convulsion took place which far transcended any of the shocks which had preceded it. This supreme effort it was which raised the mightiest noise ever heard on the globe. Batavia is 95 miles distant from Krakatoa. At Carimon, Java, 355 miles away, reports were heard on that Monday morning which led to the belief that there must be some vessel in the distance which was discharging its guns as signals of distress. The authorities sent out boats to make a search; they presently returned, as nothing could be found in want of succor.

The reports were sounds which came all the way from Krakatoa. At Macassar, in Celebes, loud explosions attracted the notice of everybody. Two steamers were hastily sent out to find out what was the matter. The sounds had traveled from the Straits of Sunda, a distance of 969 miles. But mere hundreds of miles will not suffice to illustrate the extraordinary distance to which the greatest noise that ever was heard was able to penetrate. The figures have to be expressed in thousands. This seems almost incredible, but it is certainly true. In the Victoria plains, in West Australia, the shepherds were startled by noises like heavy cannonading. It was some time afterward before they learned that their tranquillity had been disturbed by the grand events at Krakatoa, 1,700 miles away.—"Youth's Companion."

Our Directory.

Abbeville Southern.—T. M. McDonough is appointed Master of Machinery.

Baltimore & Ohio.—Jos. Billingham is appointed Master Mechanic of the shops at Garrett, Ind.

Baltimore, Ohio & Southwestern.—C. Skinner is appointed Master Mechanic at Washington, Ind.

Boston & Albany.—W. H. Taft is appointed Acting Superintendent of Motive Power.

Chicago & Alton.—W. E. Gray is appointed General Superintendent.

Cincinnati Southern.—G. W. Cushing is appointed General Master Mechanic.

Cleveland, Akron & Columbus.—W. J. Vance is appointed Master Mechanic, with office at Mt. Vernon, O.

Columbus, Hocking Valley & Toledo.—C. B. Duffy is appointed Purchasing Agent.

East Tennessee, Virginia & Georgia.—J. E. Wilcox is appointed Purchasing Agent.

Evansville & Terre Haute.—A. L. Sanger is appointed Purchasing Agent.

Florida Midland.—Henry S. Chubb is appointed Receiver.

Illinois Central.—F. C. Locey is appointed Master Mechanic at McComb City, Miss.

Indiana, Illinois & Iowa.—T. M. Bates, Superintendent, has resigned, and is succeeded by L. H. Miller. H. G. Reeves is appointed Master Mechanic.

Lehigh Valley.—Alexander Mitchell, Superintendent Motive Power, is appointed Superintendent Wyoming Division, and his previous office is abolished.

New York Central.—George H. Hazelton is appointed Master Mechanic at Syracuse. Edward C. Hiser is appointed Master Mechanic at Utica.

New York & New England.—J. T. Odell is appointed General Manager.

Ohio Valley.—John McLeod is appointed Receiver.

Oregon Pacific.—Chas. Clark is appointed Receiver.

Philadelphia, Reading & New England.—Master Mechanic J. L. Ellis has resigned, and is succeeded by E. M. Humstone.

Pennsylvania.—E. B. Wall is appointed Assistant to the General Manager of the lines west of Pittsburgh. H. O. Hukill is appointed Purchasing Agent of these lines. Geo. J. Parkin is appointed Division Master Mechanic at Erie, Pa.

Queen & Crescent.—James Meehan, Superintendent Motive Power, has resigned and the office is abolished.

Terre Haute & Indianapolis.—Benj. McKeen is appointed Superintendent of the Terre Haute & Peoria Division.

Toronto, Hamilton & Buffalo.—F. C. Helm is appointed Purchasing Agent.

Western New York & Pennsylvaaia.—C. H. Newman, Master Mechanic at Oil City, has resigned, and is succeeded by Peter Fowler.

Employment.

Wanted, employment by an American railroad man familiar with railroad methods of accounting, railroad appliances, the Spanish language, and the people and business methods of South American countries. Highest rererences given. Address South America, care of National Car and Locomotive Builder.

NATIONAL CAR AND LOCOMOTIVE BUILDER

MARCH, 1894.

CONTENTS.

The Central Vermont Railroad is building 10 freight cars at its St. Albans shops.

Compressed gas is being introdnced for motive power in river boats on the Seine.

The Metropolitan Elevated of Chicago is reported in the market for 100 passenger cars.

The Carlisle Manufacturing Co. has an order for a number of coal cars for export to Cuba.

The Minneapolis, St. Paul & Sault Ste. Marie is reported about to buy a large number of cars.

The Hall Signal Company is equipping 25 miles of the Lehigh Valley road near Mauch Chunk with its signals.

The Litchfield Car and Machine Works are building 100 ore cars for the Duluth, Mississippi River & Northern road.

The Baltimore & Ohio Southwestern order for 800 cars, announced in our last issue, has been placed with the Pullman company.

The Barney & Smith Car Company, of Dayton, O., is building 100 special dump cars for the Baltimore & Ohio Southwestern.

The Indiana Car and Foundry Company has 160 men at work. It is now working on a contract to build 250 refrigerator cars.

The Baldwin Locomotive Works have an order for building 10 heavy freight engines for the Delaware, Susquehanna & Schuylkill.

The administration of the Belgian State Railways has divided contracts for 30 locomotives among the principal Belgian mechanical firms.

The Jackson & Sharpe Company, of Wilmington, Del., will hereafter manufacture street cars in addition to its other lines of business.

The Niles Tool Works furnished the machinery which is being installed at the new shops of the Great Northern Railway at Spokane, Wash.

The Ætna Iron Works, St. Louis, Mo., has been organized with $10,000 capital. Incorporators: Edwin A. Sheble and Edgar A. Sheble.

The Gulf, Colorado & Santa Fe shops at Galveston have recently built a passenger train consisting of a passenger car, chair car and baggage car.

The Richmond Locomotive Works, of Richmond, Va., have received 20 locomotives from the Santa Fe, which are to be overhauled and rebuilt.

The maintenance of way department of the Pennsylvania Railroad reduced its expenditures $1,700,000 in 1893, compared with that of 1892.

A steel rail plant, with a capacity of 100 tons per day, will be soon started at Tonawanda. It will be known as the Reese Iron and Steel Company.

The car shops of Arthur King, Middletown, Pa., which have not been in operation for a number of months, started up recently on an order for 40 cars.

The Ohio Falls Manufacturing Company, of Jeffersonville, Ind., is building a number of passenger cars for the Chicago & Grand Trunk road.

The Pennsylvania Railroad has issued annual passes to all conductors and enginemen who have served in their present capacities for ten or more years.

The Lobdell Car Wheel Company of Wilmington, Del., has arranged to put a foundry in the plant of the North Carolina Car Company at Raleigh, N. C.

The Brotherhood of Locomotive Engineers will hold its first biennial convention at St. Paul, May 16. There will be a general election of officers at the convention.

The Schenectady Locomotive Works, of Schenectady, N. Y., have orders for three switch engines from the New York Central and for two from the Central Vermont.

The J. A. Fay & Egan Company, of Cincinnati, which experienced its first shut down last summer, is now employing about 300 men, principally upon foreign orders.

The Richmond & Danville has ordered five passenger locomotives from the Baldwin Locomotive Works and three from the Richmond Locomotive and Machine Works.

The Austrian Minister of Marine, in reviewing the position of the Austrian and other navies, says that petroleum is being generally abandoned as fuel for war-ships, owing to the risk of fire.

General Superintendent Welby, of the Rio Grande Western, has issued an order restoring the wages of all engineers, firemen and trainmen which were reduced 10 per cent. last October.

During 1893 the number of live cattle shipped from the United States to foreign countries was 241,827 head. From Canada 83,322 head were shipped, the total exports from the two countries being 325,149 head against 496,000 for 1892.

It is announced that Paris is to build, for the purpose of handling World Fair visitors in 1900, a tubular railway eight miles long, in which trains will run on two minutes' headway. Electricity will be employed for moving the trains.

Superintendent Dayton, of the Bloomsburg Car Works, Bloomsburg, Pa., claims that those works lately beat all former records in building two eight-wheel flat cars, giving them three coats of paint and lettering them within 29 hours.

The Mount Vernon Car Manufacturing Company, of Mount Vernon, Ill., is building a number of ventilated fruit cars of 60,000 pounds capacity for the Florida Central & Peninsular. The cars are to be equipped with Westinghouse brakes.

The New York, Susquehanna & Western has let contracts for 300 coal cars of 50,000 pounds capacity. The Bloomsburg Car Company, of Bloomsburg, Pa., will build 200 of the cars, and Murray, Dougal & Co., of Milton, Pa., will build 100.

A locomotive boiler explosion occurred Jan. 1 at Higginson, Ark., on the St. Louis, Iron Mountain & Southern Railway. The engine was hauling a freight train at the time and several cars were derailed and wrecked. One man was killed and another was injured.

The Canadian Locomotive and Engine Company, of Kingston, Ont., has been given the contract for the construction of two heavy 10-wheel engines for the Intercolonial Railroad Company. It also has under construction six locomotive boilers for the same road.

Two freight trains on the Wheeling & Lake Erie collided in a snowstorm near Bellevue, O., Feb. 17. Both engineers and firemen and a brakeman were killed, and three other trainmen were injured. The engines were telescoped and four box cars were wrecked.

The tunnel which carries the Colorado Midland Railroad through the Rocky Mountains at Hagerman Pass, Col., has just been completed. The tunnel is close upon two miles long, and it is bored through solid gray granite. Its completion involved over three years' work.

The receivers of the Northern Pacific have reached an amicable agreement with the employees who have been complaining at the reduction of pay which went into effect Jan. 1. The concessions made by the receivers are chiefly in the matter of regulations and not in rates.

The Barney & Smith Car Company, of Dayton, O., is improving its plant so as to be able to turn out 15 freight cars per day and 40 passenger cars per month. A new building has been added which is 800 feet long and 200 feet wide, the full length of which is traversed by a traveling crane.

The Morris & Essex division of the Delaware, Lackawanna & Western Railroad is to be equipped with the Hall rail circuit system of block signals immediately. The present contract calls for only 55 signals, but the entire main line is to be likewise equipped as soon as practicable thereafter.

A bill forbidding the burning of bituminous coal in factories in New York City, Brooklyn and Buffalo has been introduced in the New York legislature, and, if enacted, is to go into effect on July 1 of this year. The prohibition does not apply in cases where 75 per cent. of the products of combustion of such coal are consumed.

General Manager Voorhees states that up to Jan. 10, of the total number of men who left the service of the Lehigh Valley road on Nov. 18 last, 56 per cent. had secured reinstatement in their positions. In regard to locomotive engineers alone, the proportion reinstated was exactly one-half of those who left the company's service.

A dispatch from Port Louis, Mauritius, reports that a cyclone swept that island Feb. 24, doing almost incalculable damage to property, and killing and injuring many persons. A crowded passenger train was blown from the track and rolled down an embankment into the Coromandel River, killing 50 persons and injuring a large number of others.

A Southern Pacific passenger train was ditched and robbed at Roscoe Station, 12 miles north of Los Angeles, on the night of Feb. 16. The engineer was injured by jumping from his engine, and the fireman was shot and killed by the robbers. A tramp was also shot and killed. None of the passengers were injured. The robbers escaped to the mountains with a large sum of money, after shattering the express car with dynamite.

The Milwaukee Malleable Iron Company, which has decided to move to Waukesha, Wis., is to put up buildings of the following dimensions: Main foundry, 225 × 70 feet; carpenter shop, 35 × 35 feet; pattern shop, 35 × 50 feet; machine shop, 36 × 50 feet; annealing department, 50 × 90 feet; shipping and cleaning department, 45 × 50 feet; which in connection with the office and pattern vault, will be placed in a building 225 × 50 feet. The most modern machinery will be employed.

The King Bridge Company, of Cleveland, is preparing plans for an iron drawbridge for the New York Central Railroad Company, which, when completed, will be the largest iron drawbridge in this country. It is to span the Harlem River, and will, with its approaches and other improvements made at that point, cost $3,000,000. The contract calls for the completion of the bridge by next December. It will be 400 ft. long, and when swung will leave a clearance of 100 feet on either side for passing vessels. The lowest point will be 24 feet above the river.

At the Fall Brook Railway shops, Corning, N. Y., combination coaches Nos. 15, 16 and 17 are being remodeled under the supervision of Master Car Builder C. J. Butler. The interior of the cars will be finely fitted up as regular day coaches. Mr. Butler has also prepared plans for two new baggage and mail coaches, numbered 10 and 11. This, together with the ordinary repair work, will furnish abundant employment to the men in this department of the shops until the opening of the spring traffic at least. The extensive fitting up and building of these coaches also evidence the fact that the Fall Brook is more than holding its own in the line of its passenger travel.

Electric locomotives are proving themselves to be well adapted for use in coal and other mines, and they now furnish the motive power for hauling cars in about 30 mines in the United States. They are designed to occupy but little, if any, more space than the cars they haul. With any other method of traction considerable more hight and width is necessary. In coal mines in which there are narrow seams this is especially noticeable, as much rock has to be blasted away to admit of the passage of mules. By using electric locomotives the blowing down of the roof is entirely done away with. The increased speed also permits a larger tonnage to be taken from the same outlet, and with fewer turnouts, switches and cars.

The *Tradesman* of Chattanooga, Tenn., in its review of the industrial situation in the South for the week ending Feb. 19, says that to judge from reports received of new industries in process of formation, of enlargements of plants now in operation, and especially by the increased inquiry for machinery of all kinds, the South is rapidly recovering from the effects of the financial stringency. The week mentioned shows a better record in these respects than for a year past. All branches of productive industry show the same favorable symptoms. Iron producers are in stronger position, with no pressure to sell. The lumber interest, which has been much depressed, is slowly recovering, and the demand for its output is increasing. Forty-three new industries were established or incorporated during the week, together with 15 enlargements of manufactories and 15 important new buildings.

The elevated railroads of New York city carried 8,000,000 more peple during 1893 than during the previous year. The figures for 1892 were 213,000,000 passengers carried, while 221,000,000 passengers were carried during 1893. Twenty new engines were ordered during the year. The number of passenger coaches employed in the service is 1,116, and 75 new ones were added during the last four months. Improvements in the structure continue to be made, and the light 50 and 60-pound rails are being replaced by 90-pound rails. The locomotives consume over 200,000 tons of the best white ash anthracite per year. The coal makes no smoke. Over 3,000 trains per day are run, the exact number being 3,300. The employees number 5,000, and all are paid by the hour. Twelve hours is the longest time any man is required to work per day on the roads. The maximum pay is $3.50 per day. Engineers earn $100 per month.

Leonard's Hydrostatic Buffer.

The buffer for passenger cars that we illustrate on this page is the invention of Mr. A. G. Leonard, who is the private secretary of Mr. H. Walter Webb, Third Vice-President of the New York Central & Hudson River Railroad. Mr. Leonard was, for a number of years, employed in the department of the Superintendent of Motive Power, under Mr. William Buchanan, and the buffer which is the subject of this article is now in use on about 100 passenger cars on the New York Central road, including those on all he through limited trains. The results of its use have been very satisfactory in decreasing the oscillations of the cars when running at high rates of speed.

Mr. Buchanan, while recently speaking of the merits of the device in this relation, said that its operation in causing the smooth running of cars was forcibly illustrated to him by an incident that occurred a short time ago while he was riding on the "Exposition Flyer." The train was running at the rate of about 70 miles per hour, when a lady with a fretful babe arose and began to pace to and fro in the aisle with the child in her arms. Usually such a proceeding would be impossible on such a fast running train, but in this case the smooth and steady riding of the car permitted the lady to walk with apparently as much ease as if she had been in a room at home.

The New York Central first put this buffer on the cars of the "Exposition Flyer," and it reduced the lateral as well as the vertical oscillation to such an extent that it was immediately ordered on the "Empire State Express" train, and its application to Wagner cars has since continued.

In the different views on the drawing the same letter refers to the same parts. Two center cylinders, *E* and *F*, cast in one piece, are firmly secured between the center sills of the car. The cylinder, *E*, is fitted with a ram, *H*, which is forced outward against a cross-head pressing against a spring, *R*, which transmits the pressure to the buffer, *P*. The cylinder, *F*, is fitted with a ram, *J*, which is forced against the pressure-bar, *K*. This pressure-bar is secured to the back end of the draw-head. When pressure is admitted to cylinder, *F*, by the pipe, *O*, the ram, *J*, is driven back and the draw-head is drawn in. At the same time the pressure passes through the port shown to the cylinder, *E*, and forces the buffer, *P*, outward; thus the cars are drawn firmly together. Two side cylinders, *D*, *D*, are secured in the end sill of the car. Each of these is fitted with a ram, *G*, which bears against a cross-head and transmits the pressure through a spring, *S*, to the buffer, *P*. The buffers, *P*, are thus pressed together at three points on their length. The cylinders, *F*, *C*, *D*, *D*, are all connected to the same system of piping, and the pressure is therefore the same in each. The pipe, *O*, is connected to a pump and water reservoir inside the car.

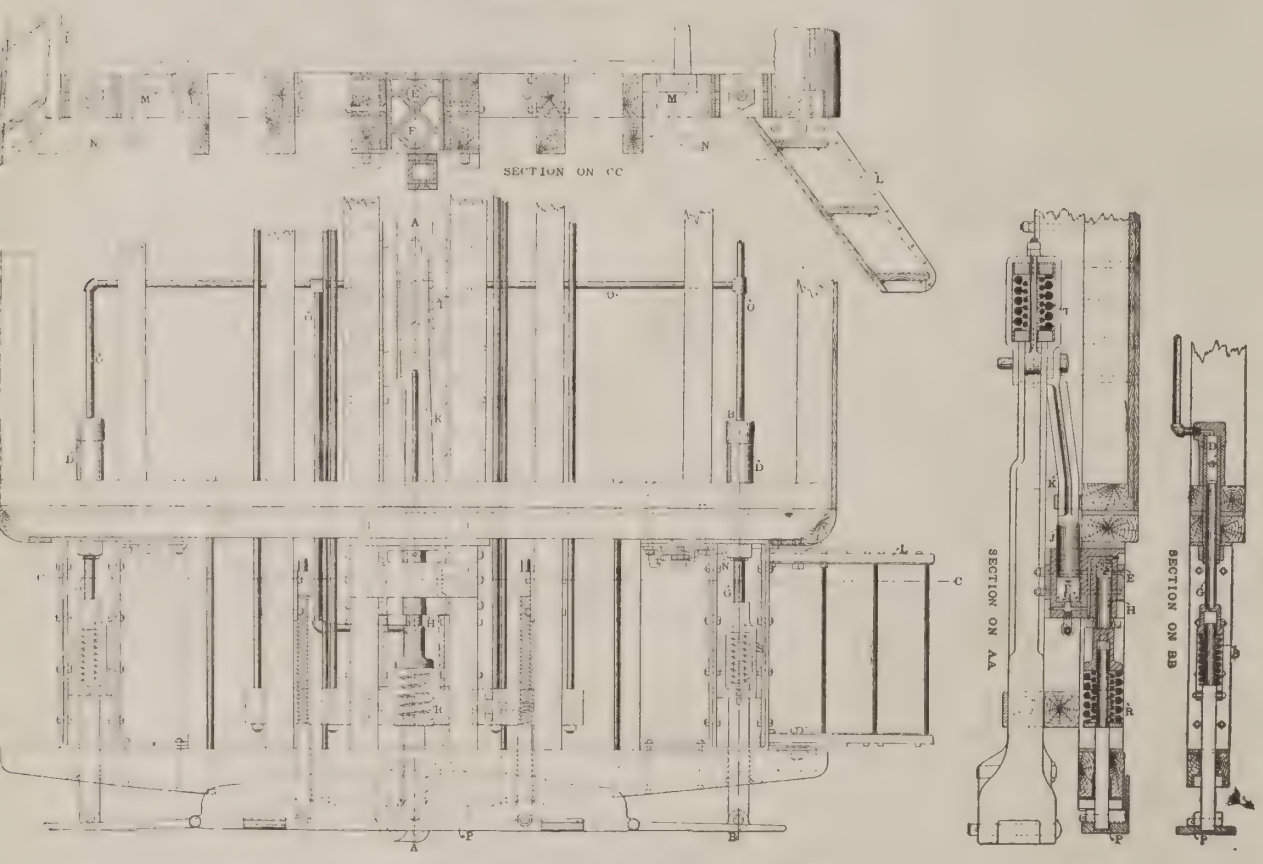
The cylinder *F E D D* being connected as shown by a single system of piping, the pressure per square inch will be the same in each. The pipe *O* is connected with a reservoir and pump placed inside the car. The pipes, cylinders and reservoirs are filled with water or other fluid. In service it is quite desirable that the pressure in the adjacent ends of the two cars be pumped up to about the same amount, which must be sufficient to put the springs under a heavy compression. The pressure upon the pistons is shown by means of gages placed in the cars.

In comparing our system of coupling with the English or European system of coupling, we find in that practice the cars are first drawn together, and the compression of the buffers is accomplished after the cars are coupled, by means of the well known right-and-left screw. This method, however, is slow and crude, and involves the necessity of a man going between the cars. It is, moreover, inapplicable to American automatic couplers.

With the type of car couplings now used for the passenger equipment of this country, the couplers and buffers are usually so arranged that when the cars are coupled, the springs that force the buffers out are placed under compression, thus keeping the buffers together and tending to hold the cars steady. The amount of this compression, however, is limited, since in order to effect a coupling the cars must be driven together with sufficient force to compress the buffer springs enough to allow the couplers to engage. If the springs are very stiff the impact necessary to effect a coupling not only damages the cars to some extent, but also causes disagreeable shocks to the passengers when the cars are loaded.

In those systems in which the coupler and buffer are connected by equalizing levers, if the coupler is pulled forward the motion transmitted to the buffer is in the same direction, consequently the opposing buffers are always pressed together with about the same force. In this case, as before mentioned, the amount of pressure that can be put on the buffers must be limited, since the springs must be compressed by impact as the cars are coupled.

In this system the pressure is let out from the cylinders when the cars are to be coupled, and a coupling may be effected with a slight impact. After the coupling is effected the pressure is pumped into the cylinders by an attendant on the car, and any desired amount of pressure may be put on the buffers. The pressure in the adjacent ends of two cars is pumped up to about the same amount, sufficient to put the springs under a heavy compression, as shown by the gages. If one buffer has more pressure in the cylinders than the other, ths buffer will move toward the car on which there is the smaller pressure. The leakage is very small, and may be replenished by a few strokes of the pump when required. The long buffer plates shown increase the area of friction surface between the buffers, and this, combined with the greater pressure between them, has a marked effect in reducing the oscillation of the cars. It also tends to hold the end of the car up on uneven tracks. In case of a low joint or depression in the track the truck will drop, and with the ordinary buffer the body of the car will follow the truck; and as the truck rises again, the body of the car meets it and produces a shock. With the hydrostatic buffer, however, the friction between the plates is sufficient to hold the end of the car up for the moment as the trucks fall, and a much steadier motion is the result.



LEONARD'S HYDROSTATIC BUFFER.

In rounding curves, as the cylinders on the end of one car are all connected, one end of the buffer is free to move in while the other moves out, the fluid passing from one side cylinder through the pipe into the other as the rams move, and thus serving the purpose of an equalizing bar to maintain a uniform pressure on each end of the buffer.

In connection with this buffer the platform is extended out nearly to the width of the car body; this gives a wider space for the vestibule, if one is used, and increases the strength of the platform by affording an opportunity to put in additional timbers between the end sill of the car and the platform end timber. Or the longitudinal sills may be extended to the platform end timbers, and thus change the construction of the platform from being an attachment to the underframe to being an integral part of the same.

By increasing the width of the platform it becomes necessary to use hinged steps, which can be turned up out of the way when the train is running. The step *L* is pivoted, as shown, and is raised and lowered by the lever *M* and link *N*. When in a station the steps are lowered for passengers. When running they are raised in the position shown on the left hand side of the cross-section, and held in that position by a spring latch.

In addition to its remarkable action in causing the smooth riding of the train, this construction of the buffers and platforms is such as to materially reduce the possibility, in case of accident, of the telescoping and demolition of the cars: the buffer receives and absorbs the shock in the compression of the fluid; while the platform, extending nearly the full width of the body of the car and reinforced by the wrought iron guard, is rendered nearly indestructible. This additional width of platform, together with the movable steps, permits the vestibule to be extended the full width of the car, as stated, thus eliminating the pockets of the old form and reducing the resistance offered by the atmosphere.

A Method of Analyzing Bituminous Coal.

The method described below for analyzing bituminous coal is followed on a large American railroad that uses this kind of coal exclusively. Before describing the method of analysis, the Chemist of the road, from whose report our information is obtained, gives a brief description of coal that we consider of sufficient interest to the readers of the National Car and Locomotive Builder to reproduce in full.

Description of Coal.

Coal is the resultant product of the slow decomposition of wood out of contact with air and under pressure, and varies from lignite, in which the wood fiber can be distinctly seen, to anthracite, which has no visible evidence of ever having been wood. Intermediate between lignite and anthracite is bituminous coal. Bituminous coal does not show wood fiber and is blacker and more dense than lignite; it still contains a large percentage of volatile hydrocarbons and yields coke. Lignite and anthracite do not coke.

When bituminous coal burns, gases are first given off. These consist of volatile hydrocarbons, oxygen, hydrogen, nitrogen and moisture. The residue from the volatile matter is fixed carbon and ash; in many varieties of bituminous coal a portion of the fixed carbon becomes viscid and unites the adjoining pieces into a solid mass. The solid mass thus formed is coke, and burns without smoke and with intense heat.

The value of a coal depends upon the amount of fixed carbon it will yield and the kind of gases given off in the volatile matter. The hydrocarbon gases are the most valuable as heat producers. Moisture, oxygen and nitrogen do not produce heat. The ash is incombustible; and when it is of such a nature that the fire makes it partially melt or become pasty, it makes clinkers.

Thus, for practical purposes a coal analysis should consist of: (1) The moisture in the coal; (2) the volatile matter; (3) the fixed carbon which produces most of the heat, and (4) the incombustible matter or ash.

So far as we have been able to learn, sulphur does not injure a coal for locomotive fuel purposes. The sulphurous acid fumes from the burning sulphur have little or no effect on iron at the temperature at which it comes in contact with it.

Coal is a complex compound of carbon, hydrogen, oxygen, nitrogen, moisture and ash. Carbon is the heat producer; hydrogen also produces heat, but it unites with the oxygen in the coal to produce water, the excess of hydrogen above that required by the oxygen being available for the production of heat.

The water produced by the hydrogen and oxygen in the coal, together with the moisture, has to be heated and evaporated the same as water in the boiler, and of course diminishes the efficiency of the coal. Nitrogen is inert, and the quantity of heat absorbed by it is small. The ash also absorbs some of the heat.

The theoretical evaporating efficiency of carbon is 15 pounds of water per pound of carbon. A fair quality of coal, burned under the best boilers and under the best conditions, will evaporate 9.8 pounds of water per pound of coal. Under ordinary conditions 7½ pounds of water per pound of coal is not bad practice.

Methods of Analysis.

Our analytical process is as follows:

One grain of finely powdered coal is dried in a platinum crucible at a temperature of 215 degrees Fahrenheit till the weight is constant. The loss in weight gives the moisture. The crucible containing the dried coal is covered with a closely fitting lid, and a gentle heat is applied with a Bunsen burner; this drives off the more volatile hydrocarbons: The heat is gradually increased to bright redness to drive off the last traces of volatile matter. The crucible is allowed to cool and is weighed. The difference between the weight found and the weight of the dried coal is volatile matter. The crucible is now heated to bright redness with the cover off. This burns off the fixed carbon, leaving the ash. The crucible and ash are weighed, and the difference between the weight found and the weight of the crucible is the weight of the ash.

We now have the per cent. of moisture, volatile matter

and ash; the sum of these per cents subtracted from 100 gives the per cent. of fixed carbon. Fixed carbon is always determined by difference: it is for this reason that coal analyses always add up exactly 100 per cent.

We do not determine sulphur, for reasons given above.

If the coal is to be used for metallurgical or blacksmith purposes, it is necessary to know the sulphur content, because sulphur makes iron hot short and makes welding uncertain. When it is necessary to make a determination of sulphur, it is reported separately from the moisture, volatile matter, etc. Therefore an analysis in which the sulphur was determined would add up in excess of 100 per cent., a per cent. equal to the per cent. of sulphur in the coal.

The calorimeter tests represent the theoretical number of pounds of water one pound of coal will evaporate from and at 212 degrees Fahr.

The process consists of burning a weighed quantity of coal by means of chemicals, and absorbing the heat generated in a weighed quantity of water. The weights of coal and water are so adjusted that the rise in temperature of one degree will represent the evaporation of one pound of water. Therefore if we get a rise in temperature of 12 degrees it will represent an eveporating efficiency of 12 pounds of water per pound of coal.

The New Tunnel of the N. Y., S. & W. R. R. Under the Palisades.

Daylight broke through the tunnel of the New York, Susquehanna and Western Railroad Company, under Weehawken Heights, for the first time Feb. 7. The object of this tunnel is to enable the company to reach the river front without running its trains over the tracks of other roads. At present the company's passenger trains run over the Pennsylvania Railroad tracks from Marion to Jersey City, and its coal and freight trains over the Delaware, Lackawanna and Western tracks from West End Junction, beyond Marion, to Hoboken. In order to secure its own terminal on the Hudson River, the company, a few years ago, acquired sixty acres of land in the village of Edgewater, about two miles north from Weehawken and opposite 110th street, New York. This land has a frontage of 1,500 feet on the river, and affords ample room for handling a large number of trains daily. Then the tunnel was projected to connect the terminal with the main line at Little Ferry Junction, ten miles from Jersey City and three miles west from the terminal at Edgewater.

The tunnel is 5,072 feet long, 21 feet high to the crown of the arch and 28 feet wide, giving ample room for double tracks. The estimated total cost of the tunnel, including the three miles of double track to Little Ferry Junction, the sixty acres of land, two piers which are being built, and the necessary switches and sidings at the terminal, is $1,700,000. Ground was broken for the tunnel on August 1, 1892, and since then about 900 men have been employed in its construction, while about 150 have been engaged in building the piers, etc., on the river front. The tunnel, the three-mile spur of railroad and the terminal will be completed about June 1.

When the tunnel is completed only the freight and coal trains will be run through it to the river at first, but ultimately ferry slips will be constructed and passenger trains will run through it, and the passengers will be transferred to New York by boats.

The first step in the construction of the tunnel was to sink three vertical shafts, at equi-distant points, from the surface of the Palisades to the grade of the tunnel. These shafts are each 10 feet long and 20 feet wide, the greatest depth being 196 feet. When the shafts had been sunk two gangs of workmen in each began "drifting," or excavating in opposite directions, to meet the gangs which were "drifting" toward them from the other shafts. The "heading," or upper section of the tunnel, is eight feet high, and was bored entirely through rock. Throughout the entire length of 5,072 feet arching was found necessary for a distance of only about 300 feet, the rock being sufficiently solid to serve as a natural arch.

The arching is of brick and cement, three feet thick, which means nine courses of brick laid on edge. The distance necessary to be arched is remarkably small, especially when compared with that of other tunnels under the Palisades. The tunnel of the West Shore Railroad at Weehawken is 4,200 feet long, and about 50 per cent. of it is arched, while of that of the Delaware, Lackawanna & Western Railroad at Hoboken, which is 4,600 feet long, about 75 per cent. is arched. The portals of the new tunnel will be handsomely faced with cut red sandstone.

While the tunnels under the Palisades are of great utility, they become insignificant when compared with many other much longer ones in this country and Europe, which are at a much greater depth. The Hoosac tunnel, in Western Massachusetts, is four and three-quarter miles long, and its principal working shaft was 1,028 feet deep. Early in the work of its construction the heavy timber braces which were used to support the earth and rock during the building of the arches were burned, causing the loss of twenty lives and the obstruction of the tunnel for a considerable time. The St. Gothard Tunnel, in Switzerland, is over nine and a half miles long, and the Mount Cenis Tunnel, in Italy, is seven and one-quarter miles long.

The tunnels of the world are classified as railroad tunnels, which are bored through earth and stone above the level of the sea; subaqueous tunnels; canal tunnels, by means of which the courses of the canals are straightened by boring through hills or mountains; and conduit tunnels, which are used for conveying water by its own gravitation. There are in the world about 1,000 railroad tunnels, which are about 350 miles long; 12 subaqueous tunnels, nine miles long; 90 canal tunnels, 70 miles long; and 40 conduit tunnels, 85 miles long. Approximately there are in the world 1,142 tunnels of all kinds, having a total length of 514 miles.

The Keseling Disincrustator.

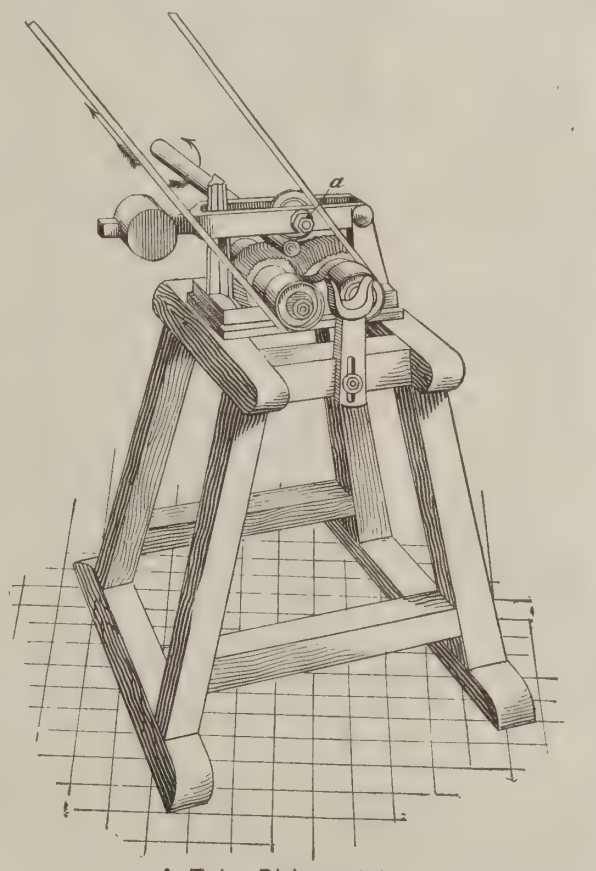
A correspondent in Brussells, Belgium, sends us the following description of a tool for removing the scale from locomotive flues:

When visiting the shops of the Imperial Railroad of Alsace-Lorraine, the engineer of the Schnitz line showed me in operation a small apparatus of extreme simplicity built by Mr. Keseling, of Düsseldorf, and used to remove the calcareous incrustations from the tubes of the tubular boilers.

Watch in hand I ascertained that the time necessary for cleaning a tube is from one to two minutes at most. According to the accounts of the engineer the cleaning was formerly done at Luxemburg by means of hammering, and a man working steadily succeeded in cleaning a maximum of ten tubes a day. If we consider on one hand the great economy of time and on the other hand its extremely small net cost (about $16), without the wooden frame, we must admit that the advantages are great.

The illustration represents the machine in operation mounted on a wooden frame. It is composed of two drums of 7.8 inches diameter put in motion by a belt which communicates a movement of from 400 to 500 turns per minute.

On these drums are mounted two small cog wheels, and between these the end of the tube to be cleaned is placed. Above these two wheels a small wheel is fastened in a forked lever, terminated by a counter poise which presses the tube and keeps it in position. In consequence of the



A Tube Disincrustator.

rapid movement of the two cogwheels the tube advances, and at the same time the incrustation is reduced to powder by the effect of the pressure exercised by the small wheel above.

To facilitate the longitudinal movement of the tube the axles of the wheel fixed in the lever have been given a slight obliquity. To effect this the arms of the forked lever present some clefts permitting the placing of the axle of the small wheel in a slant, and a screw-nut (see *a*) serves to fasten it firmly. The edges of the small wheel describe a series of spirals on the convex surface of the tube.

As the machine produces a rolling friction, and not a sliding, the wear of the grooved wheels (cast iron hardened) is very slight. Experience has confirmed this fact. The device can be mounted on a frame of wood as shown in the cut, or on a table in which there should be an opening through which the powdered deposit can escape, otherwise, it would soon clog the operation of the machine.

According to information furnished by the engineer of the Schnitz line it is possible to obtain very good results by substituting a spring for the balance-weight with which Mr. Keseling has furnished the forked lever.

The Knapp Railroad Car Ventilator Company has been organized in St. Louis. The capital stock is $100,000, and the incorporators are Charles Knapp, C. S. Crane, C. W. Ford and others.

Railroading in 1837.

(From the Wilmington Gazette of Jan. 15, 1837.)

A Trip on the Railroad.

The portion of the Wilmington & Susquehanna Railroad between this city and Elkton is now completed. Yesterday, at the invitation of the president and directors, the stockholders and a considerable number of other citizens of Wilmington took a trip in the cars to Elkton and back again. The locomotive "Susquehanna," built for the company at Lowell, and better known here by the cognomen of "The Yankee," was placed on the road and attached to four superb cars from the workshop of Betts, Pusey & Harlan, of this city. The "Susquehanna" is the most powerful and decidedly the best locomotive the company has yet obtained. The cars are excellent specimens of workmanship, built after the latest models, with a passage and free communication through the entire train, and seats in each calculated for 28 persons, with room for half as many more to stand up and walk from one apartment to another.

About half-past ten o'clock yesterday morning the train was drawn up at the foot of Market street, and our citizens, to the number of 130 or 140, took their seats. This was the first trip of the cars over the road, and there was some little anxiety and apprehension entertained by many of the company at the result of the experiment, and as the chances of some accident or catastrophe, where as yet to the locomotive, cars, engineer and road had not become very well acquainted with each other.

In this respect, all were most agreeably disappointed. As regards speed, pleasure and enjoyment of almost every kind, the experiment was most decidedly successful. We left Market street at thirty-five minutes past ten o'clock, and proceeded very rapidly four or five miles on the road, when some of the gudgeons to the cars became a little heated from not having been worn smooth and adjusted, and it was found necessary to haul up, cool off, and apply a little more oil. We then applied the steam and resumed our course, puffing and blowing along, to somewhere not far beyond what is called McGrann's deep cut, when an incident occurred that frightened some and amused others much more than injuring any one. A sturdy oak, that had not been sufficiently looked to by the workmen and engineers, and which rather to dispute a passage for "The Yankee" and his train, extended a branch some distance into the road which swept the sides and tops of the cars, breaking some twenty or thirty panes of glass, and scattering the pieces with violence enough to draw blood from half a dozen noses that were too prominent to escape a collision. After adjusting the difficulties from this accident, and bestowing proper attention to the wounded by laughing them into a pleasant countenance again, we continued our course to Newark, and arrived opposite the village at twenty minutes to twelve, where we were met and greeted by a number of the most substantial and influential citizens interested in the road.

As it happened here, "The Yankee" was under full headway, and went away whizzing by as though he was not willing the Newarkers should get more than a glimpse of him this trip.

We must confess we had a strong inclination, if possible, to obtain a delegation from Newark to join us as far as Elkton and back again, but we had no influence in matters of steam and locomotives, besides, before we were fully aware of the presence of the Newarkers we were out of sight and the error could not be retrieved.

We arrived at Elkton, a distance of over 17 miles by the route of the road at 12 o'clock, precisely, being an hour and 25 minutes, including all the stoppages, from the time we left Wilmington.

At Elkton we were greeted by a large number of citizens, where we tarried till half-past one, and left amidst the cheerings of hundreds of people who literally lined both sides of the road. We reached the foot of Market street, Wilmington, at half-past two, after stopping two or three times, making the time on our return one hour.

Every one was delighted with the excursion. The route of the road passes through the most beautiful section of the country. It was not a little amusing to see the flocks of sheep, cattle and sometimes horses, as "The Yankee" came smoking along with his train at such unwonted rapidity, take to their heels and escape as if the de'el was to pay. Our country friends generally who reside on the route improved the opportunity of witnessing from their porches the first trip of the cars over the road.

The annual election of Directors of the railroad company took place yesterday afternoon, and among the first acts of the new board will be to decide whether they will now establish a line between Philadelphia and Baltimore by means of stages on the part of the route not yet completed. Should they do so, it will be carried into effect in a few days. It is the expectation of many of our citizens that such will be their determination.

The special police census of the unemployed in New York City shows the number of males out of employment to be 52,592 and of females, 14,6?8, making a total of 67,280. These persons belong to 41,981 families, comprising 206,701 persons in all.

The Pintsch system of gas lighting is to be introduced into 180 cars on the East India Railway, and into 571 vehicles on the Oude & Rohilkhand line.

Repairing Locomotives.

BY J. T. HEFFERNAN.

(*Continued from page* 27, NATIONAL CAR AND LOCOMOTIVE BUILDER *for February.*)

Fig. 66 shows a throttle-pipe connected with the dry-pipe; in this throttle-pipe is shown the throttle-valve *B*. We will now go through the method of fitting up a throttle-valve, and take for our example the throttle-valve shown in Fig. 66. After having been used for some time the valve will leak at either the top or bottom seat, and sometimes along with leaking both the seat and the valve will be found to be cut. If the ridges found in the throttle-pipe or valve are not too deep they may be ground out. In grinding the valve in, use a very coarse emery, and lard oil is preferably the oil to use with emery as it seems to cling and hold together better.

Make a T-formed handle to hold the valve, letting it pass through the stem, making it fast with a nut on the bottom. The arms of the handle should be about 14 inches long so as to give good leverage to turn the valve. Now oil up each seat well and put emery on it, then commence to grind, lifting the valve occasionally and changing it on the pipe. Repeat this operation until both seats come to a fit. We will suppose this valve to have been fitted in when both the valve and pipe were cold, and allowance must be made for the expansion when hot; this can be done by placing a little oil on the bottom and top seats, and use a little fine emery and oil and grind the top seat so as to make it shake a little when down hard on the bottom seat. Very often right near the rib of the throttle-valve, that is, on the seat above the rib, it may be grooved very deep and will take considerable grinding to bring it to a fit. Very often when these grooves are very bad, a quarter-inch hole is drilled in the valve and plugged with copper. If the ribs are cut away immediately undernath the face of the seat, as shown in Fig. 64, it will prevent scoring in a great measure.

In the throttle valve shown at *B*, Fig. 66, the valve has a hole cast through the center of it; through this hole a bolt is fitted to connect with the link of the bell crank; when the nut is fastened down onto the bolt as shown at *A*, the bolt must be loose in the valve, both lengthwise and across its diameter. A thirty-second play between the nut and the valve will be found to be about right. The link *C*, which connects the throttle valve with the bell crank, should be in a straight line with the valve.

The bell crank which works through a lug on the throttle pipe should have motion enough from the throttle lever to allow the valve to open wide on its seat, and when the throttle lever is closed the bell crank should strike the projection *D* on the throttle pipe just as the valve closes. The upper seat having a much larger area than the lower seat the steam has a tendency to close the valve hard on the seat without any strain from the throttle lever. The pins which connect the bell crank with the throttle have keyways punched through the ends in which to put split keys to prevent the keys from working out. These keys had better be made of sheet copper, as it is a metal which does not corrode, and when made of this the keys can always be removed. The joint *E* is a ball joint in the elbow *F*. Grind the throttle pipe into this elbow, and get as wide a bearing as possible on the two, also at *G* where it connects with the dry pipe; the method of fastening the elbow to the dry pipe is by means of a yoke, the lugs of which clamp the brass fitting on the end of the dry pipe. This yoke extends back over the elbow, and through its center it carries a bolt which is screwed up against the lug, which is cast on the elbow. The lugs on the end of this yoke are formed in such a manner that if a strain comes on them they close in on the dry pipe. The hole in the back of this yoke should have a brass bushing screwed into it, and riveted over. Through this brass bushing the bolt should be put. The reason for using this brass bushing is that the iron bolt is less liable to corrode in it than if it were screwed into the iron; in fact, in taking out a set of pipes after they have run a long time it will be found that the bolt is hard to unscrew; and where I have found them in this manner, instead of trying to screw them off I have driven the lugs of the yoke down off the pipe. Of course this will bend the lugs a little, but they can be straightened back very easily, and when taking out a set of pipes time counts.

The elbow is held to the throttle pipe by two bolts, one on each side, which fasten to lugs cast on the elbow and to lugs cast on the throttle pipe. On the upper end of the throttle pipe a safety valve is placed which allows any extra pressure caused by reversing the engine to pass through it without endangering the pipes. On the end of the dry pipe a brass bushing is fastened by two rows of rivets, as shown at G, and at the other connection as shown in Fig. 69. In fitting up these connections the dry pipe should be turned and the brasses turned to a tight driving fit; after drilling and riveting, the brasses should be caulked around the dry pipe so as to prevent any leakage.

On the front flue sheet there is a brass casting riveted around the hole through which the dry pipe passes; this brass collar is bored out to fit the forward connection of the dry pipe as shown in Fig. 69, and the hole should be bored at least one-eighth inch larger than the brass, as where there is a much closer fit than this the lime or impurities in the water work in, and its being such a small space it is hard to dislodge them. If it is one-eighth loose and this sediment does lodge there, shaking the dry pipe at the back end will dislodge it.

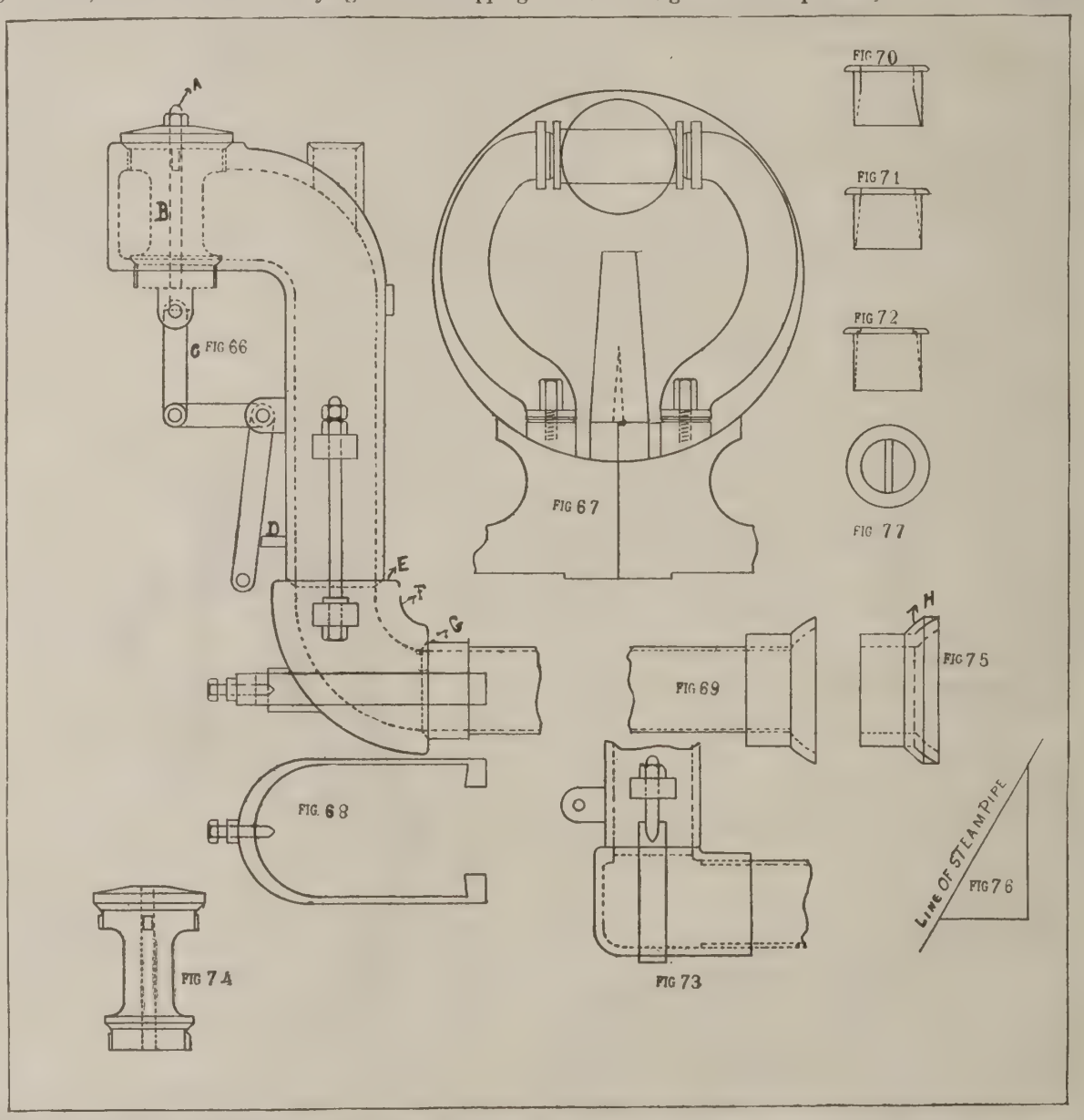
The dry pipe must be ground in every time it is taken out, and this is done by putting the pipe in place in the boiler and turning it by means of a wooden plug driven into the dry pipe. To keep the pipe up against the joint a board is fastened against the front end and through this board a hole is bored in line with the dry pipe, through which is placed a screw which sets up against the plug in the pipe. Very many dry pipes have an offset in them, and these are a little harder to grind than the straight ones. Now instead of grinding in the dry pipe I would favor a ring being used as shown in Fig. 75. This ring can be ground in, both in the pipe and in the ring in the flue sheet. There is no objection to the use of such a ring except that one more joint is required with its use than without it. The ring need not be very thick, not over ¾ inch through. Sometimes a brass ring is used on the "nigger head" to make the joint with the dry pipe, and very often the bearing is turned right on the steam pipe. To connect the steam pipes with the nigger head in the front end brass rings are used, and also to connect the pipe with the joint of the cylinder. These rings should make a good joint, being ground both on the pipe and in the head, also ground in the cylinder or lower joint of pipe. The upper end of the steam pipe receives the ball joint of the ring, and the nigger head receives the straight side of the ring, while the lower end of the pipe receives the straight side of the ring, and the cylinder receives the ball joint. The reason for this is to allow for adjustment on the pipe.

To find the length of these steam pipes and the angle to which the bottom must be planed and also the top, we lay out a circle equal in diameter to the circle of the smokebox, then from the center of this circle we measure the distance from the center of the smokebox to the center of the dry pipe, and about this center we lay out the "nigger head" and ring. Now lay out a center line through the center of the smokebox and dry pipe hole, and from this center line measure the distance of the hole in the cylinder from the center line, and draw a line parallel to the center line which we already have. The face of the upper end of the steam pipe must be parallel with this line. Now from the lower end drop a plumb line down from the center of the steam pipe hole in the "nigger head" and measure from it to the center of the steam hole in the cylinder, then lay a straightedge across the hole in the cylinder and measure up from it to the center of the hole in the "nigger head" and with these two distances form a triangle as shown in Fig. 76. Now the bottom of the steam pipe must lie along this lower line which we have laid out, and can be marked on the pipe by means of a level. In repair work where we have the steam pipes already planed and only require to put in new rings, the length may be determined by measuring with a rod from the center of the "nigger head" to about the center of the steam pipe hole in the cylinder and deducting from this length the thickness of the ring required.

The steam pipe and cylinder are usually ball jointed with the cylinder, but very often a new steam pipe is used or a cylinder put on in a round-house where they do not have a reamer. This joint can be made very easily by using hammer, chisel and file. In laying out for chipping this joint, measure the diameter of the ring on the bevel where you want it to fit in the pipe, and with this diameter lay out a circle from the center of the whole in the pipe and chip it as near as you can to the angle of the ring, using a half round or square file, finishing up with a scraper before grinding. The steam-pipe is fastened to the "nigger head" on the upper end by means of studs with nuts on each end, but for the lower end a bolt is used with a very long head to it which will give room to work a wrench back of the steam pipes. On some roads they do not grind the rings in on the steam pipes, but cement them in. Fig. 73 shows a different form of dry pipe in which the elbow is riveted direct to the pipe, and the throttle pipe held to this elbow by means of a strap passing around the elbow, the upper end of the strap being threaded and passing through lugs cast on the throttle pipe. On some engines a single exhaust nozzle is used, and on others double ones are used. Fig. 67 shows a single exhaust pipe. The exhaust pipes are fastened to the cylinder by a copper joint underneath. The bolts with long heads, as shown on the steam pipes, can be used to advantage on the exhaust pipe. Where the double exhaust pipe is used the exhaust from the cylinders is bound to throw a little to one side of the smokestack, and will in time cut out the side of the stack, while the single exhaust pipe because of its being central discharges through the center of the stack. Where the single pipe is used it is well to have a bridge running about halfway up through the center of it forming the lower half of the pipe into two separate chambers with a single outlet at the top. This will in a measure prevent the exhaust from one cylinder going over into the other. The single exhaust pipe is nearly always used with an extension front, while the double exhaust pipe is nearly always used with a diamond stack

In the matter of exhaust nozzles there is considerable difference of opinion as to which is the best kind to use, some claiming one kind and some another, so in Figs. 70, 71 and 72 we show the three kinds most commonly used. Fig. 70 shows a nozzle which is bored out taper about half its length and straight for the balance of the distance, the object being to discharge the exhaust in a solid volume and not spread it much. Fig. 71 shows a form of nozzle which is bored taper throughout its full length. Fig. 72 shows a form of nozzle which is bored to within one-half an inch of its upper edge, then bored straight to the size of the nozzle required, forming a shoulder from the taper to the straight bore. The object in all exhaust nozzles is to use as large an opening as possible and secure the right draught, and to this end I believe Fig. 72 to be the best form of nozzle, as the steam will be discharged through it and will spread less than through any other form of nozzle. At first glance this does not look reasonable, but actual practice has proved it true. Any one who doubts that an abrupt choking off of the nozzle will tend to throw a solid volume can easily satisfy themselves by trying it with a water nozzle the same as used by any fire engine company. With this nozzle we get a good draught and still use a larger area than with any other kind. The single exhaust pipe is best, as by its use a larger exhaust nozzle can be used.

Nozzles very often gum up from the oil used in the cylinders and require to be cleaned occasionally. Sometimes an engine will run with a certain sized nozzle, then a change to poorer coal will require a smaller nozzle in order to make it steam good; the nozzles must therefore be bushed. This can be done by cutting a sheet of thin sheet iron, bending it round to the size of the hole in the nozzle and driving it in. Very often instead of bushing nozzles we fit in what is called a "bridge," which is a piece of iron made V-shaped on its lower edge and driveu in the nozzle across the center as shown in Fig. 77. Always try to use as large a nozzle as possible, as the freer exhaust we get from the cylinder the less back pressure we have in the cylinders.



In fitting up around the smokebox care should be taken to make all the connections tight so as to prevent the admission of air, thereby causing combustion to take place within the smokebox and making the engine steam badly. A number of devices have been used in the attempt to make an expanding nozzle successful, but most of them have been unsuccessful. There is no doubt that with a good expanding nozzle fuel would be saved, but the trouble is to get one that will work satisfactorily.

Bar Frames for English Locomotives.

Our English friends have at last begun to adopt one of the chief characteristics of American locomotives, bar frames. Some English locomotive builders have built several engines with such frames for light traffic on small roads. One of these is a small four-wheel engine, 2-feet gage, with a wheel base of 3 feet, suitable for plantation or industrial railways, and has bar frames, outside cylinders 6 by 9 inches, a saddle tank and a balloon stack with deflector and wire netting at the top. The plate springs are not equalized. The boiler has 32 tubes 1¾ inches diameter and 4 feet 5⅞ inches long. The firebox is of circular form riveted to an exterior flange pressed out of the front plate of the shell. The grate area is 3.28 square feet; tota heating surface, 73.77 square feet (tubes 64 square feet); boiler pressure, 140 pounds. The engine carries 104 gallons of water and has a coal space of 4.8 cubic feet capacity.

Master Mechanics' Association Circular.

Sanding Devices.

The committee appointed to report on this subject at the next annual meeting of the Association presents the following questions, and earnestly requests the co-operation of members, to enable it to make a complete and useful report.

This is a new and important subject, and any information not covered by the questions, or any drawings and description of improved devices which members may have in use will be thankfully received by the committee.

1. Do you consider the ordinary sand-lever arrangements a satisfactory and economical device for distributing sand upon the rails to prevent the driving wheels of locomotives from slipping?
2. Have you in use any improved device for sanding the track? If so, state what it is.
3. Does the improved sanding device which you have in use effect a saving in the amount of sand used, as compared with the ordinary sand-lever arrangement?
4. Give any data that you may have as to the amount of this saving.
5. Do you consider that the use of a sanding device which distributes a small quantity of sand evenly upon the rails increases the hauling capacity of locomotives or effects a saving in power and fuel over engines equipped with only the usual sand-lever arrangement?
6. Give any data that you may have as to the amount of this saving.
7. Do you notice any perceptible difference in the wear of the tires on engines in the same service, equipped with the improved sanding device, over engines using the ordinary sand-lever arrangements?
8. Do you consider that the use of a sanding device which does not sand the track too profusely but distributes only a small amount of sand evenly upon the rails, reduces the liability of breakage of crank pins and rods, with their usual disastrous results?
9. Does the improved sanding device which you have in use automatically sand the track when the air-brake is applied?
10. Give any data that you may have as to cost of sand per ton, delivered into the locomotive sand box.
11. Give average weight of a box full of dry sand.
12. Give an estimate in tons of the average amount of sand used by each engine on your read in one year.
13. How fine a screen do you consider necessary in order to obtain the best results from the improved sanding device which you have in use?

O. STEWART, F. M. TWOMBLY, L. M. BUTLER, C. E. FULLER, JOHN MEDWAY, H. P. ROBINSON, Committee.

Replies should be sent as soon as possible to O. Stewart, 226 North avenue, North Cambridge, Mass.

Traveling Engineers' Association Circulars.

Best Means of Saving Coal.

The committee of the Traveling Engineers' Association on "What are the best means of saving coal and increasing or holding the mileage per ton at a desirable figure?" desires answers to the following questions. It is earnestly requested that members not only answer the questions herein contained, but in addition give an opinion on the subject, as a whole, and offer any suggestions that they may see fit, as the cost of fuel is a large part of the expense of operating the railroads.

1. What time do you allow in roundhouse for getting up steam on your engines for regular and other trains?
2. Are your hostlers and firemen instructed to keep a light fire in engine to avoid blowing off steam while engine is waiting for train?
3. Are your freight trains always ready to leave on time ordered?
4. What is the average time your engines are waiting for train—
   Passenger.
   Freight.
5. Do you estimate the amount of coal consumed while engine is waiting for train?
6. While on the road, do your firemen exercise the necessary care in firing the engine to avoid blowing off steam?
7. Do your firemen observe the engineer's shutting off points along the road?
8. Do you allow your firemen to put in a fire at shutting-off points?
9. If so, why?
10. Do you dump the fire on your engines at terminal stations?
11. When banking fires on engines, waiting several hours for trains, do you retain fire against front or back end of firebox?
12. Is it your practice to bank fire against the flue sheet?
13. If so, why?
14. In your experience do you find the brick arch a medium for saving coal?
15. Can locomotives on your road be fired successfully without the use of hooks and rakes?
16. What kind of coal is used on your engines?
17. Does bituminous coal used on your engines clinker?
18. By what means do you avoid clinker?
19. What style of grates are on your engines?
20. Give dimensions of air space in and between grate bars.
21. On your road what is the average car-mile per ton of coal on—
   Passenger.
   Freight.
22. On your road what is the average grade per mile? Length of grade?
23. Have you tried the plan of paying premiums to the engine crew showing the most economy in coal?
24. What is your opinion of the premium system?
25. If premiums are paid, should they be given for greater mileage per ton in the month, or for greater improvement made over previous months?
26. Would the last-named plan encourage the poor or indifferent fireman to try to better his record?
27. Does your company employ a traveling fireman?
28. If you do not pay a premium, what course do you pursue to encourage your engineers and firemen to save coal?
29. Do you furnish your engineers and firemen any literature bearing on the subject of combustion of coal in locomotive fireboxes?
30. Is your coal put on the tenders by buckets or chutes?
31. Is your service such that your actual mileage is acquired by hauling train the full miles, or do you have a roundhouse a considerable distance from terminal, and the miles run with an empty engine counted in as actual service with a train?
32. How many miles per hour do you allow engines in switching or construction service?
33. What number of miles do you consider it practical for an engine to run before overhauling, as regards fuel consumption? What is the practice on your road?
34. Have you fast freights? If so, in what proportion to other through freights?
35. Are your engineers called to a strict account for a loss of time on freight or passenger?
   If so, give the minimum time lost that will call for a statement.
36. Is ten minutes' time on passenger or thirty minutes' time on freight considered by your management worth a ton of coal?
37. How many miles do your engines run before the flues are removed for cleaning the boiler?
38. What front end do you use, extension or short?
   Which pattern of the above gives the best results, all things considered?
   Does one require more attention than the other on the road? and will one hold up on steam at the last end of the run as well as the other?
39. Have you any engines built with the firebox on top of frames?
   If so, what results do you notice as compared with the standard box?
40. Do you consider black smoke imperfect combustion?
   Are your engines fired with a view to alleviate it?

Address all communications to M. Mast, Road Foreman of engines, C. & E. R. R., Huntington, Ind.

M. MAST, W. E. CHAPMAN, J. W. SHELDON, GEORGE H. BROWN, P. A. ROSSITER, Committee.

Uniform System of Examining Firemen for Promotion and New Men for Employment.

At the last annual meeting the matter of examining firemen for promotion was discussed at length, and it was the unanimous opinion that there should be a uniform system adopted containing the best methods of examining men when employed and at different times after, before being promoted to the responsible position of engineer. The president said in his opening address at the last convention that railroads are operated nowadays on so small a margin of profit that the difference between a dividend and going into the hands of a receiver is measured by the small economies and savings in all departments. The engineer and fireman can be a large factor in saving, and for the companies to get the full benefit of good service they must commence by getting good material. What is needed is good, bright men that take an interest in their business, and it is the duty of traveling engineers to find the material, then by examinations at stated intervals assure themselves that the men who will be the engineers of to-morrow have not made a mistake in the choice of their profession, or that they are careless and indifferent.

The committee desires each member to answer the following questions, and in addition give the benefit of experience and ideas on the subject.

1. Do you have any system of examination on your road that applies to firemen promoted to switch and road engines and new men hired as road engineers? If you have, please send form to chairman of committee.
2. Is there any qualification necessary other than stated in examination?
3. Are applicants for position of fireman or engineer obliged to exhibit a specimen of handwriting in any other manner than filling out personal record?
4. What is the limit of minimum and maximum age of men employed as firemen?
5. Do you make any distinction in percentage of questions asked and answered properly by firemen to be promoted to switch or road engines?
6. What per cent. of questions must be answered to enable candidate to pass?
7. Do you have any form of certificate that you give to those who have successfully passed the examination? If so, please furnish the chairman a copy.
8. How is examination conducted—by a board of examiners, or one person, and is the one being examined allowed to have one of his associates (one who has passed the examination successfully) present during the examination?
9. In the Air-Brake examination, is it necessary to explain the action of air pump, pump governor, engineers' brake and equalizing discharge valve, triple valve, including quick action feature?
10. What means are provided for men to become informed as to the best practical method of engine running and caring for engines, and becoming familiar with air-brakes, other than every day practice?
11. Do you examine applicants for positions of firemen, in physical defects, such as sense of hearing and color?
12. How do you examine regular employes for color defects and hearing?
13. What is the limit of maximum age of employed engineers?
14. Do you require employed engineers to pass a more rigid examination than firemen, when promoted?
15. Do you use a progressive form of examination for firemen? If so, please furnish the chairman a copy.
16. Do you examine a candidate in the office or in the roundhouse with an engine to look at?
17. If the candidate fails to answer correctly any question about a common breakdown, or is unable to disconnect and block an engine and if necessary set an eccentric, would that disqualify him?

M. M. MEHAN, J. A. HILL, J. E. GOODMAN, W. J. ANTHONY, J. W. SHELDON, W. T. HAMAR, Committee.

Address all replies to M. M. Mehan, 221 West Ridge street, Marquette, Mich.

Double Crewing or Pooling.

The committee on "How can Traveling Engineers Improve the Service when Engines are Double Crewed or Pooled?" desires answers to the following questions. This question was continued from the last annual meeting. The committee requests that traveling engineers not only answer the following questions, but give the benefit of their ideas and experience.

1. State if you pool or double crew engines on your road or not.
2. What method do you use to keep up repairs, and by whom are engines cleaned above running board?
3. What system do you use to keep engines properly supplied with tools?
4. By whom are supplies placed on engines?
5. When and by whom are engines inspected?
6. How often are boiler checks and gauge cocks examined and cleaned?
7. Do you clean fires at intermediate stations for firemen? If so, please state number of miles run, also give your opinion as to the waste of fuel in so doing.
8. Who takes care of the head lamp and signal lamps?
9. Are your engine tool boxes locked and the keys left at the office for the enginemen to get when they take the engines? (This refers to small tools.)
10. Is the box containing frogs, jacks, saw and ax sealed as well as locked, and when the seal is broken a record kept of it?
11. Do you have all steam fittings in cab kept tight by other than engineer?
12. Is the packing of driving boxes and engine and tender trucks governed as much as possible by mileage?
13. Are the firebox flues and front end inspected at stated intervals, or do you wait until *she don't steam?*
14. Are oil cans looked after and kept in proper condition?
15. Are sand boxes and pipes inspected and known to be in proper condition before the engine leaves the terminal?
16. Are rod cups adjusted by shop men, and other automatic oilers inspected, so that engineers are required only to fill them?
17. On double-crewed engines do you try to place men on opposite turns who are friendly and work in harmony with each other?
18. On double-crewed engines do you give each engineer a set of oil cans?
19. Do you think it is practicable or economical to keep an inspector for double-crewed engines?

W. T. SIMPSON, P. FRAZER, WM. CONGER, C. M. BRINSLEY J. O. BRADEEN, Committee.

Address replies to W. T. Simpson, 55 Bennett street, Battle Creek, Mich.

Destruction of Purdue's Engineering Laboratory by Fire.

On the night of Jan. 23 the engineering laboratory of Purdue University, at Lafayette, Ind., was destroyed by fire. The work of this department of the university in the interests of locomotive engineering had made it famous, and its destruction by fire is a matter for regret to all interested in locomotives, although it is understood that efforts are to be made to re-establish it at an early date. If this is done there is no doubt that the experience of the past two years will suggest many improvements in the old plant that will make the new one much more efficient and reliable.

The fire originated in the boiler room and spread with great rapidity. Its progress could not be checked until the larger part of a fine building had been destroyed. The laboratory rooms were burned; the machine room with its 20 lathes, its planers, shapers, drill presses, milling machines, and its large supply of small tools; the forge room with its 32 power forges. and the laboratory for advanced work, which contains Purdue's now famous locomotive "Schenectady," a triple expansion Corliss engine and much other apparatus designed for work in steam engineering, hydraulics, and strength of materials. Nothing in these rooms escaped the fire. Not only was all the apparatus lost, but also a large amount of experimental data. The main portion of the building was also consumed. This contained three stories 50 feet by 150 feet. It was occupied by drawing rooms, recitation and lecture rooms, instrument rooms, offices and a mechanical museum. Some of the furniture and apparatus of these rooms was carried out before the fire took possession, but, as already stated, this part of the building was entirely burned.

The incidental losses by the fire were considerable. Members of the faculty lost books, papers and data; students their instruments and many manufacturers in every part of the country, who, by gifts or liberal discounts, had cooperated in the equipment of the building, lost their representation there.

The Varied Uses of Electricity.

According to the account given by a correspondent, Great Falls, Mont., appears fairly entitled to the distinction of being called the Electric City. At Black Eagle Falls, three miles above the town, an immense dam has been thrown across the Missouri, and hydraulic works and power-houses erected. Not only are the street cars propelled and lighted by electricity from the power-houses, but they are heated as well by electric radiators placed in each car. Elevators, printing-presses, cranes and all kinds of machinery are operated by the ubiquitous force. There are automatic excavators, electric pumps and electric rock-crushers. A not uncommon sight on the streets is a mortar-mixer attached to an electric wire leading down from a pole. The restaurants cook by electricity, the butcher employs it to chop his sausages and hamburger, and the grocer to grind his coffee, and so likewise does the tailor to heat his goose. The subtle fluid is a welcome blessing in every home; the housewives run their sewing-machines and heat their flatirons by electricity; they bake their cakes in wooden electric cake-ovens that can be set away on a shelf like pasteboard boxes. They have electric boilers and broilers and teakettles. What a singular anomaly when one pauses to think of it: that of broiling steaks and heating flatirons through the instrumentality of a waterfall!—*Engineering Magazine.*

Banking Fires.

At the January meeting of the Southern and Southwestern Railway Club, a committee composed of Messrs. C. B. Gifford, G. D. Harris and J. J. Anderson made a report on the best means of banking fires in locomotive fireboxes in order to avoid troubles from leaky flues and strains in firebox sheets. The committee recommended as follows:

"First, in cleaning fires that the blower be used with only sufficient strength to prevent smoke from issuing from the furnace door; that the fire be cleaned as quickly and with as little reduction of steam pressure as possible, and that the pressure be not reduced during this operation by feeding water into the boiler, as such contraction of sheets and flues by cold air drawn in the fire door by use of blower and feeding cold water at the same time must be very injurious to both flues and firebox sheets. In this connection we also consider the brick arch of great protection to flues during the cleaning of fires, especially with locomotives having a long firebox and large grate surface, as the arch retains sufficient heat to quite materially heat the air drawn through the flues before it reaches them.

"In the matter of banking fires, we would recommend banking in the front end of firebox against flue sheet. In this manner, any air entering the firebox is heated while passing over the fire before entering the flues. We consider that if this practice of cleaning and banking fires is followed, and steam kept at about the same pressure, no material injury will occur to flues or firebox sheets."

The Richmond & Danville has ordered three passenger engines of the Richmond Locomotive Works, and five of the Baldwin Locomotive Works. The engines are to be delivered in March.

Metal Underframes for Freight Cars.*

The railroad with which I am connected was opened in 1881. It runs from Norfolk, Va., along the sea coast for some distance south, through a country which is intersected by wide rivers, bays and sounds, and in which, consequently, the air is very heavily charged with moisture. A very few years after the road was constructed it was found that all timber of whatever kind or quality which had been placed in exposed positions, either in the track, on rolling stock or steamboats, was decaying very rapidly. As soon as the fact that the climate was so peculiarly destructive to timber was observed by the officials, they became anxious to avoid the use of material which so quickly deteriorated; and in connec tion with the rolling stock, the Iron Car Company's cars were brought to the notice of the general manager. The result was, that in August, 1888, we leased from that company 50 of their flat cars for a period of five years, hoping by actual experience to determine what benefits might be secured from the use of iron frames instead of wood.

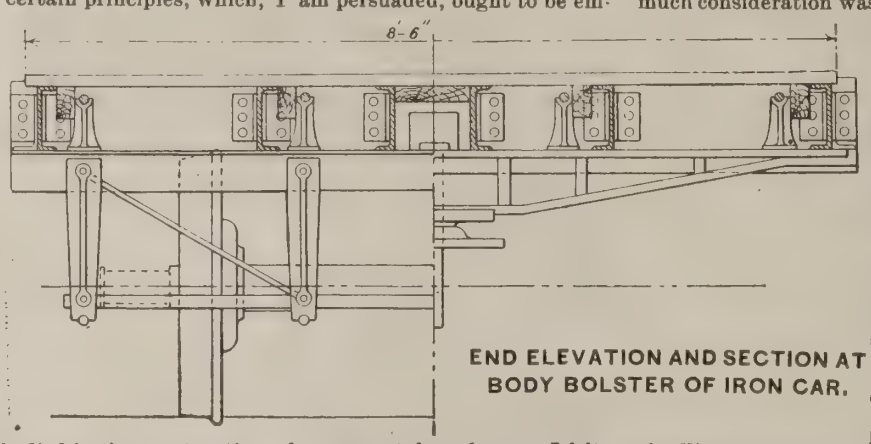
You are probably aware that the sills of these cars are constructed of eight tubes placed to form four sills and designed to carry 60,000 pounds, but they are altogether too weak to support such a load, and when the car is loaded uniformly to its full capacity, the sills assume a sinuous or curved line which immediately shows their inherent weakness; and when the car is loaded heavily at a point about midway between the supports of the sills, then they are certain to bend badly and show far more deflection than wooden sills under a similar load. Another great mistake (the greatest mistake of all) was made by using four sills instead of the six which we are accustomed to use in cars made of timber; it was evidently done to enable the builder to produce a car which would be light compared to the load which it was intended to carry. It was, however, a very grave error to lower its strength so much as to imperil its future for the sake of a few pounds in weight; the absence of center sills necessitated some new design of draft rigging and the unusual step was taken of constructing it so that all the pulling strains were taken directly on the end sills, and all the buffing strains on the body bolster—parts which were not made strong enough to withstand the heavy service on large roads and which consequently are nearly always in a state of collapse; there is also a peculiar arrangement of tail bolt and cotter which gives a great deal of trouble. This draft gear and the means of fastening it to the cars form the most fatal objection to their use, they are the parts which first give out under the heavy strains and they are a constant source of annoyance on our large railroads, at least where heavy cars and big engines are used. In every-day service it was therefore soon found out that the car was deficient in strength in the places named, and that when they failed much difficulty, trouble and annoyance were entailed in repairing them. It was also found that the parts required for repairs were special to this car, had to be obtained from the manufacturers and were difficult and tedious to procure, so that a damaged car often took up room in the repair yard of a foreign road for several weeks, producing irritation in the minds of the officials and giving another serious cause of complaint against the iron cars.

In the *Railroad Gazette* of May 26, 1893, there is an editorial headed: "A Suggested Economy in Freight Car Repairs," in which the writer calls attention to the heavy damages sustained by cars in the yards, and forcibly expresses his opinion that they are unnecessary and could be saved by judicious control. How far the idea upon which it is written could be carried out on our larger roads I do not know. Our railway is a small one, not overcrowded with trains, and we are therefore able to carry out the policy indicated; we have done so for years, every case of damage to cars is investigated, and if caused by the carelessness or stupidity of an employee some punishment is imposed; while, as an incentive to care for the company's property, and to take a personal interest in its protection, quarterly premiums are awarded to the train hands giving the most satisfactory service. The consequence of this watchfulness on the part of the management, combined with the influence of local conditions, has been very propitious to the iron tubular car; it has been operated under the most favorable circumstances, with the result that we are, I believe, the only railway which has made a success of it, and we are very much gratified with its performance, and we are well assured that we have obtained large reductions in the cost of maintenance compared with the cost of cars having timber frames.

With the experience obtained in the use of these cars, and by acting upon the suggestions of others in relation to metal frames, we have designed and built a sample steel car which, we think, is very much superior to the iron car of which I have just been speaking. We believe that we have built a car on which all the weaknesses of the tubular frame are obliterated and against which very few of the objections raised against the iron car can be urged. Indeed, we feel sure that it is strong enough to withstand the strains to which it may be subjected on any of our railroads and that it can be maintained in good repair for an indefinite period with an exceedingly small annual expenditure.

The experimental car which we constructed has six longitudinal sills made of 8-inch steel channel beams, the side and intermediate sills weigh 11½ and the center sills 15½ pounds per foot. The draft gear is placed between the center sills, not below them, the end sills are 12 inches deep, so that a sufficiently large hole may be made for the drawbar. The longitudinal sills are tied or braced together transversely by bolts having distance pieces of gas pipe upon them, and longitudinally by diagonal tie rods fitted with turnbuckles and with their ends strung on the same transverse bolts with the gas pipe distance pieces, thus tying the six longitudinal sills together in each direction. The body bolsters are of the well known plate pattern which have been a long time in successful use, the bottom plates of the bolster being supported by diagonal braces to the center sills. The connections between each sill, and body bolster to sills, are all made by the use of steel angle-irons, 3½ × 3½ × 7/16 inches, and of ¾-inch turned bolts put in a good driving fit. The sills are trussed by four rods, 1⅜ inches diameter, and having 1¾-inch screwed ends with heavy wrought-iron plate washers. The needle beams are steel tees, 5 × 3½ inches, bolted to the side sills; the studs are of malleable iron, the whole truss being made very deep. The draft pockets are intended to be of pressed steel, but in this sample car are forgings, each pocket is bolted very securely to the center sill by 10 bolts, 1-inch diameter, turned and driven in, forming the strongest attachment ever applied to an ordinary freight car in this country, the bolts being able to withstand a shearing strain of nearly 400 tons; the follower plates are made as short as possible, of wrought iron, 2 inches thick; the regular P. R. R. standard draft spring being applied, with a supplementary buffing spring behind horn of coupler. The platform is made in four distinct lengths, each length being held in place by six or eight bolts ¾-inch diameter, so that when these bolts are taken out a whole section of platform can be lifted off for examination, painting or repair of platform or sills.

The designs for this car were made after laying down certain principles, which, I am persuaded, ought to be embodied in the construction of every metal car frame. I felt that, if we adhere to them, we could with safety count upon the service which the car would give us, and that it would be entirely satisfactory.



END ELEVATION AND SECTION AT BODY BOLSTER OF IRON CAR.

These principles were:

1st. That the car should be made amply strong enough to support the weight it was designed to carry.

2d. That only the common rolled sections of steel or plain castings or forgings should be used, except for the draft pockets, and such details as are specials on timber cars.

3d. That no rivets should be used in its construction.

4th. That no holes whatever should be allowed in the flanges of the beams.

5th. That all work should be first class, equal in quality to locomotive work.

6th. That the ultimate weight and cost of the car should be entirely secondary considerations.

The first requirement, "That the car should be made amply strong enough to support the weight it was designed to carry," was understood to mean that it should be quite capable of carrying a load equally distributed over the platform equivalent to the rated capacity.

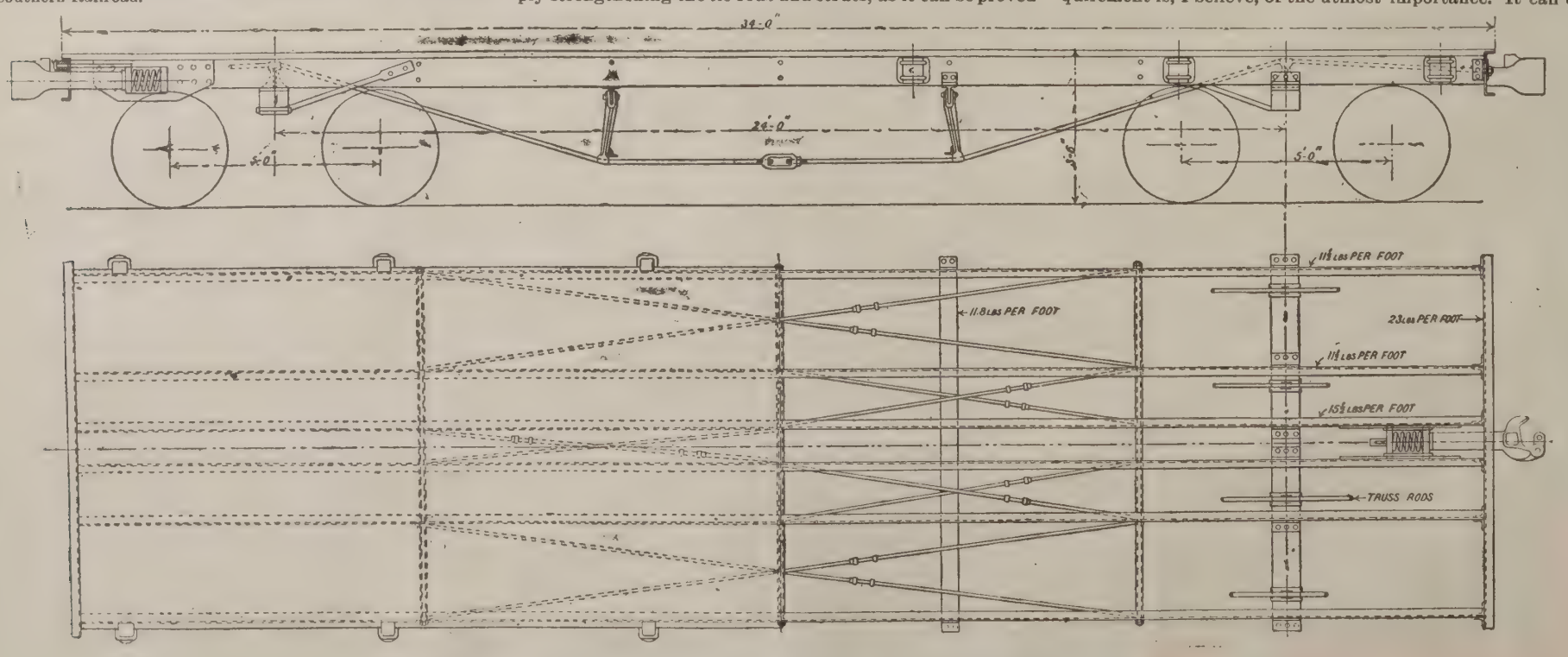
This was carried out by selecting channel irons of such a section that the six sills combined are able to carry with perfect safety a distributed load of 400,000 pounds on supports placed one foot apart. To impress upon you the great difference in strength between this steel car and the tubular car, I must tell you that this weight is 16 times as much as could be supported under the same conditions by the eight tubes composing the sills of the tubular car; and this advantage is mostly obtained by putting the same weight of metal per foot of sill into a better form, the balance of the increased strength being gained by using six sills instead of four. This comparison shows up very vividly the weakness of the sills in the tubular car and explains why the tubes so soon become distorted. In trussing the sills of our steel car, advantage is taken of the space beneath to make the truss very deep. It is 21½ inches below the sills, and its total depth is 28 inches, which is, I think, greater than any hitherto used in car work; the truss-rods are calculated as the tie-rods of a queen-truss, and therefore, perform their proper function of entirely supporting the load between the bolsters, and are strong enough to sustain their share of a distributed load of 80,000 pounds on the car, therefore making this a frame of 80,000 pounds capacity; in fact, the frame can easily be converted into one able to support 100,000 pounds by simply strengthening the tie-rods and struts, as it can be proved that the free ends of the sills which overhang beyond the body bolster, and which are the weakest part of the car, because they cannot be trussed, have a combined strength sufficient to carry their proportion of an equally distributed load of more than 100,000 pounds over the whole platform; and if the truss were made heavy enough, a safe load of 190,000 pounds could be piled up on this car—an enormous load compared to its net weight. You may notice that the struts are inclined to the vertical, so as to bisect the angle formed on the tie-rods, the change from the usual practice being made because it is more correct in theory, and more in conformity with the strains transmitted. You may, perhaps, ask me why I have made a frame capable of supporting so great a weight; I would reply that a car is called upon to resist many heavy strains beyond those required to support its load; it has to stand buffing and pulling strains, corner strains, side strains, torsional strains on side sills, strains reacting through the truck, and many others, all of which have their effect upon the various members, which must be made strong enough to absorb them. Besides that, I think it would not have been wise to use smaller or lighter beams, the saving effected in weight by using 6-inch beams instead of 8-inch would have been only about 600 pounds and the reducted cost—very little, indeed. I merely mention the enormous weight which the car would carry to show what can be effected by using economical sections in the beams and by proper and efficient trussing.

The second principle, "That only the common rolled sections of steel, or plain castings or forgings should be used," needs no explanation, and I think we have succeeded in fulfilling the requirement.

Before laying down the third principle, which says, "That no rivets whatever should be used in its construction," much consideration was given to the question. What is the most desirable, efficient and durable fastening for attaching together the various members of a steel underframe? This, to my mind, was the most important question involved in the details of the car, as upon its successful solution depends the very life of any metal underframe which we may attempt to construct. The question is one which at first sight appears to have only one answer, and that is to use rivets; from the remotest times rivets have been used in all countries for fastening together pieces which were required to be held in the tightest possible manner; we build our boilers, our bridges, our ships with them; and many examples could be pointed out in the practice of other countries, and indeed in our own, where rivets have been more or less successfully used for this very purpose of fastening together details of rolling stock. But I felt that the conditions obtaining in metal underframes in this country were different from the conditions obtaining in other previous structures; I also have had experience with tender frames and freight car trucks, and come to the conclusion that rivets are not reliable unless certain conditions, which are very difficult to fulfill in a metal underframe, are complied with. These conditions are, that the joints or connections between the several pieces should be made large so that many rivets could be used, and that all rivets should be put in by machinery, in order that they may support each other and prevent that first small movement which is so fatal. I know that riveted structures can be pointed out on every side in which rivets prove themselves perfectly good for all time, but I submit that the conditions which rivets are required to meet in boilers, bridges, etc., are altogether different from the conditions they would be required to meet in car work. In the permanent structures mentioned, there is a very large number of rivets and very little vibration; in a car frame, and especially the long car frames of this country, the vibration is very great, and the rivets connecting each joint must necessarily be few; there would be a great number of intermittent stresses put upon each rivet, gradually loosening them one by one. I distincly admit that this would not occur if sufficient rivets could be used, and it is one of the good points of design in the Fox truck that very large joints are made and plenty of rivets used, in contrast to the small number of rivets which are often used in the diamond style of truck, and which are so difficult to keep tight; there are not enough of them, they do not support each other, and in consequence become loose in a comparatively short time. As black bolts are evidently out of the question, the only conclusion which could be reached is that the most desirable, efficient and durable fastening from every point of view would be turned bolts having a good driving fit, the workmanship required being equal in all respects to that put upon our locomotives, which would mean that not the slightest degree of looseness could be found in the structure. The use of such bolts would also include a number of other advantages when the cars are in service and when they require repairs, and finally, it can be easily shown that they would be cheaper and lighter than rivets, because the joints would not require to be so large, nor the fastenings so numerous.

The fourth principle laid down is, "That no holes whatever should be allowed in the flanges of the beams." This requirement is, I believe, of the utmost importance. It can be

* Read before the January meeting of the New York Railroad Club by Mr. G. R. Jougins, Superintendent Motive Power Norfolk & Southern Railroad.



IRON CAR, BUILT BY THE NORFOLK & SOUTHERN RAILROAD.

easily seen that if a hole be drilled through the flange of a channel iron its strength is very greatly reduced; but I believe that much more mischief than the weakening of the beam would ensue. I feel sure that wherever a hole is in the flange that ultimate breakage is certain to result, starting from that hole. This is especially true of steel beams; it would be exactly like nicking a bar of steel, the serious effect of which is so well known, and the beams would act in precisely the same way, subjected, as they would be in car work, to great vibration. Some new ideas in car construction are, therefore, introduced for fastening the platform and underrigging to the main frame.

The fifth requirement, "That all work should be first class, equal in quality to locomotive work," speaks for itself. That the expense would be justified by results I am well convinced, but the extra cost need not be great; the requirement only means that extreme care be taken to make the first few cars with strict exactness, that the parts should be perfectly interchangeable, that the holes should be made an exact size, and the bolts properly turned and fitted. Such work can be done very cheaply; with suitable tools and proper organization, holes can be drilled for a quarter cent. each, and bolts can be finished from the forge at less than one cent each, an increased price over black bolts not worth consideration.

The sixth principle, "That the ultimate weight and cost of the car would be entirely secondary considerations," is, of course, to be understood as within reasonable limits. It was laid down to try and escape as much as possible the temptation to make everything so light and cheap that there might be some doubt about its efficiency; in other words, the dominant idea was to be certain to make everything strong enough, leaving the future to disclose what parts might be made lighter and what braces and details might be dispensed with. The result, so far as the weight is concerned, is certainly very satisfactory; the frame, with platform, weighing only 2,000 pounds more than the frame of the tubular iron car, the total weight (without brakes) being 20,300 pounds.

Respecting the cost, I would say that we intend soon to get some cars made exactly the same as this experimental one. We, therefore, sent specifications to some makers, including the Harvey Steel Car Co., and were agreeably surprised to find that, although the car is an entirely new departure, yet the figures submitted agreed, as near as possible, with the cost which we had estimated they could be built for. We think these figures are very reasonable, and so long as we can get metal car frames made at such prices we shall never desire to buy wooden ones.

The first test of this experimental car was made by placing upon it, as its first load, 147 car wheels, weighing 80,000 pounds, leaving them there for 10 days, and in the meantime moving the car several times through the yard and to the scale track, one mile away. At the end of this time the sills were found to have a total deflection of ⅛ of an inch, and when the load was removed a permanent deflection of ¼ of an inch, amounts which are very small, and which show the great strength and rigidity of the frame.

The car has now been in constant use for fourteen months, and has given very satisfactory service; not one cent has been expended for repairs, and not a single bolt or nut has yet become loose. As our idea in building this experimental car was to discover weak places before ordering a number, we have had it in the shops many times for examination, and can only discover one weak place, that is, a slight deficiency in resistance to torsion of the side sills; they are twisted a little by heavy loads of pine logs, three or four tiers high, which wedge themselves down against the stakes, producing a large twisting movement; but this deficiency can be very easily overcome. We also find that the castings protruding through the end sills for supporting the draw-bar are broken, but the breakage is not significant, and was caused simply by using iron castings instead of steel ones as intended. These are absolutely the only defects which we can find, and they do not affect the principle or ultimate value of the design in any way whatever.

I believe that the advantages to be derived from the use of steel car frames are manifold, and of importance to all railroad companies. It is certain that on our railroad, and in such a climate as ours, we feel well assured that steel possesses great superiority over wood, in strength, cost of maintenance and endurance; and that it is the only material which we could consistently use in the future for frames of all flat and gondola cars, and probably for box cars. With such a frame we should be well prepared for the next demand for increased capacity, and I would feel inclined to strongly advocate that trucks of 80,000 pounds capacity should be placed under these frames, even though it might not be desirable to carry such loads at the present time. I am also deeply imbued with the belief that on nearly every railroad in this country steel frames could be successfully used, and that increased economy, efficiency and durability would follow their adoption. I do not mean to say that other railroads could secure the gratifying results in the use of tubular iron cars which we obtained; but, as a result of our experience, I unhesitatingly express my profund convictions that steel frames can be designed and built which will secure these advantages on any road, that designs will develop for cars possessing greater strength and efficiency as experience dictates, eliminating the weak points, and proving that steel is the only material which ought to be used for the purpose in this age of steel. I am convinced that the cost of repairs could then be reduced to an extremely low figure; there is nothing to wear out except the running gear, nor is there anything but the platform and paint which will deteriorate by age; the period of their life would depend simply on questions of improvement, of heavier weights to be carried, and on the fashions of the time, otherwise the metal car has an indefinite life, great strength and unlimited endurance.

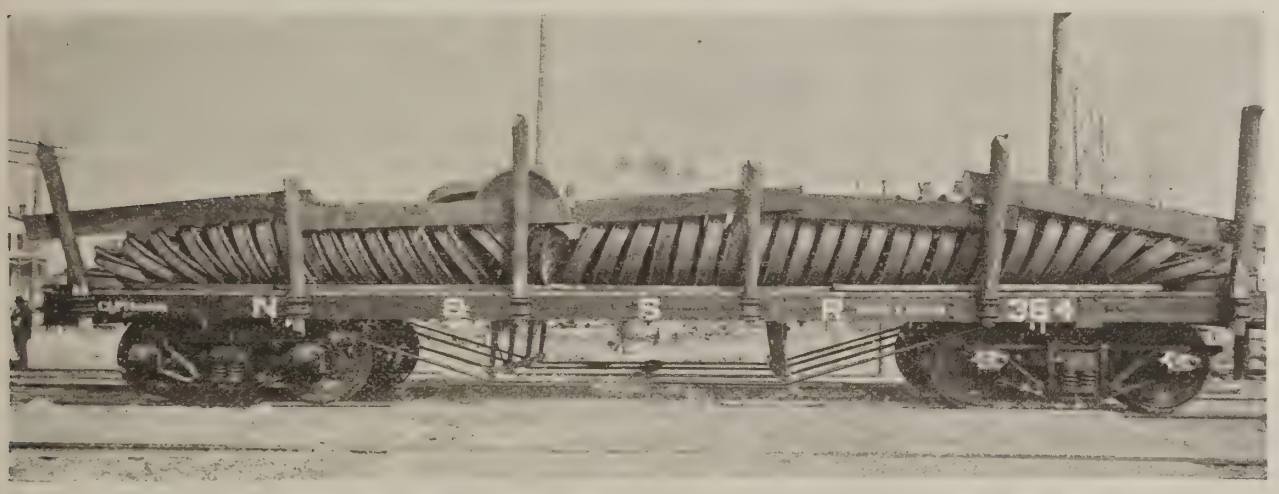
Perhaps the strongest argument which I can present for metal underframes is a copy of the statement which influenced our opinions and determined our conclusions in favor of metal cars. The statement shows the repairs executed from April, 1890, to April, 1893, on the 50 cars which we had leased from the Iron Car Company, and the cost of these repairs. It will be seen that three cars were wrecked; with that exception you will notice the light character of the repairs executed and the fact that absolutely none were required upon the underframes. This good record was made in face of the fact that the cars have during the whole five years been carrying heavy loads, and always run in trains containing 50 or 60 cars. Nor must it be supposed that the frames required repairs which they did not receive; on the contrary, the cars have been always in good condition, and the frames, for all practical purposes, are as good as new. At the end of our lease, in August last, these cars were inspected by Mr. C. W. Walker, Master Mechanic of the Seaboard & Roanoke R. R., and Mr. W. A. Brown, Master Mechanic of the Atlantic & Danville R. R.; their report shows that the only defect which existed in the underframes was one damaged tube or sill. The total cost of repairs to these 50 iron flats for three years, leaving out wrecks, wheels and brasses, has been $163.32, an average of $1.10 per car per annum. I must say, however, that the timber platforms will soon require thorough repairs, and the iron work needs a coat of paint.

For the purpose of contrasting our experience with metal frames with the experience of other people having timber flat cars, I made numerous inquiries with the hope of obtaining the cost of maintenance of such cars, their average life, and the percentage of repairs and rebuildings due to wrecks, but was unable to procure any information from which general conclusions of value could be drawn. The average life of such cars was given as from seven to seventeen years; and in reference to the percentage of repairs and rebuildings due to wrecks, I can only quote what was said by Mr. Barnes at the last Master Car Builders' convention, that it amounts to 6 per cent. on large roads. Therefore, the only statement which I can submit as to the cost of repairs of wooden cars is one for my own road showing cost of maintenance for 50 wooden cars for the same three years. I must say, however, that these timber cars are three years older than the iron ones, and the peculiarly destructive effect of our climate must not be forgotten.

COST OF REPAIRS FOR THREE YEARS—APRIL, 1890, TO APRIL, 1893.

Description of cars.	Wheels and brasses.	Wrecks.	Other repairs.	Total.
50 iron flats.....	$34.85	$208.00	$163.32	$406.17
50 wooden flats.	549.59	1,050.80	2,664.49	4,264.88

This statement shows the total cost of repairs to 50 wooden flats for three years, leaving out wrecks, wheels and brasses, has been $2,664.49, an average of $17.76 per car per annum, seventeen times as much as the iron cars, which, I think, gives a sufficient reason for our preference in favor of those cars, and proves conclusively that metal frames are superior to wooden ones, if only they are built to suit the heavy traffic of to-day and with strength commensurate to the work and abuse to which they will be subjected.



Test load, 147 car wheels, weighing 80,000 lbs. After ten days, total deflection, ⅞ inch. Permanent deflection, ¼ inch.

IRON CAR, DESIGNED AND BUILT BY THE NORFOLK & SOUTHERN RAILROAD.

Master Car-Builders' Association Circular.

Heating Passenger Eqipment.

The committee appointed to report what progress is being made in heating cars by steam or other improved methods, and to review the different plans now in use, requests replies to the following questions which it has addressed to members, to aid it in its report to the Association in convention next June:

1. Do you use automatic pressure-reducing valve on steam pipe at locomotive?
2. What pressure do you recommend for trainpipe at outlet of reducing valve?
3. Do you use automatic pressure-reducing valve on each car?
4. Have you adopted the size and location for end of trainpipe recommended by the M. C. B. Association?
5. Do you recommend the use of iron or brass hose nipples?
6. What is about the average time of service of steam hose on cars?
7. What steam coupling do you use?
8. What do you use for trainpipe cocks?
9. Where do you locate trainpipe cocks?
10. How many cars have you heated by direct steam radiation?
11. How many square feet of direct steam radiation surface do you use for a 50-foot car?
12. Do you use a device for controlling temperature in cars?
13. Do you use a regulating valve operated by trainmen?
14. Do you use an automatic device for controlling the temperature?
15. If so, what device?
16. Have you had good results with automatic devices for controlling temperature of cars?
17. How many cars have you steam heated by hot-water circulation?
18. Do you use jacketing systems?
19. Have you had satisfactory results with jacketing systems?
20. Do you use commingling systems?
21. Have you good results with commingling systems?
22. Do you find any difficulty in controlling the temperature of cars heated by the hot-water system?
23. How is the water of condensation disposed of?
24. Do you have trouble with the water of condensation freezing?
25. Do you experience trouble in having the drips properly adjusted?
26. What is the difference in condensation between direct steam radiation and hot-water circulation?
27. Which system do you recommend?
28. Do you have stoves in cars for use in case of emergency?
29. Do you advise keeping direct steam-heated cars warm at terminals?

W. L. HOFFECKER, GEO. F. WILSON, JOHN HODGE, JAMES MACBETH, A. J CROMWELL, Committee.

Answers to this circular should be sent to the chairman of the committee not later than April 10, 1894.

W. L. HOFFECKER, Chairman.
Asst. Supt. M. P. & E, C. R. R. of N. J., Elizabethport, N. J.

Air-brake and Hand-brake Apparatus on Cars.

The committee on this subject requests that members will, as promptly as possible, give full and complete answers to the following questions:

1. Do you use the Stevens or Hodge system of foundation brakes on your passenger cars?
2. How far from the center line of car do you place your hand brake wheel?
3. What is the diameter of the wheel?
4. Do you attach your brake chain direct to the shaft that the hand wheel is on?
5. Do you increase its power in any way?
6. Do you use for freight foundation brakes the general plans for levers and connections shown on M. C. B. Standard, Plate No. 9, proceedings of 1893?
7. Do you use one or two hand-brake wheels on a freight car?
8. What is the size of the wheel?
9. Do you use the sizes of iron for connections, levers and jaws indicated in Plate No. 9?
10. Do you use the 1⅛ inch drilled holes in levers, jaws, etc., as shown in Plate No. 9?
11. Do you use the standard pin, 1 13/32 inches in diameter, as shown on Plate No. 9?
12. Do you use metal brake beams with air-brakes?
13. Do you use wood brake beams with air-brakes? (a) plain? (b) trussed?
14. When there are cars equipped with air-brakes in your freight trains, do you place them ahead and use the air-brakes?
15. Paragraph S, Section 17 to 23, inclusive, defines the condition airbrakes must be in for interchange. Do you insist on these conditions in receiving cars?
16. How do you make your inspection?
17. If you find cars that do not fulfill these conditions, and you think it necessary to do the work, do you make bill against the delivering road?
18. Should the time (three months) named in Section 18 be extended?
19. Should it be one year, same as Section 17?
20. If cars are found with brakes not complying with Sections 17 to 23, are you in favor of making the necessary work chargeable to owners?
21. Are you in favor of striking from the rules any of the sections above mentioned, and placing them with our recommended practice?
22. Which ones?
23. What are you doing to maintain the brakes after the cars leave the shops?
24. Do you have airbrake testing plants outside of your main shops?
25. Do you have them at receiving tracks, where you receive freight from your connections?
26. Do you have them at outside repair stations, where you repair large numbers of cars?
27. Give description, with blueprints or diagrams if possible, of the plant you use?
28. Outline your system of handling the airbrake inspection of cars received from connections in interchange,
29. Outline system of taking care of defects found.
30. What defects would you remedy if the car contained important freight (under Rule 3, Section above referred to)?
31. What if unimportant or empty?
32. Outline your system of handling airbrake inspection on repair tracks.
33. Do you test every car coming into repair tracks?
34. Would you advocate putting *all* cars into condition called for by Rule 3, or only your own cars, in the present state of rules?
35. Do you allow the ordinary car inspector to make tests of airbrakes at your test plants, or is this part of the work in the hands of a special airbrake man?
36. Do you have any system of marking cars that have airbrake defects and which are not remedied when discovered? Describe it.
37. If a card, do you attach it to cars?
38. Send sample with explanation.
39. Do you have any reports from trainmen covering airbrake defects? Describe them, and send sample with explanation as to how they are handled.

Answers to this circular should be sent to the chairman of the committee not later than April 10, 1894.

E. D. BRONNER, Chairman, M. C. B., M. C. R. R., Detroit, Mich.; PULASKI LEEDS. J. MCGEE, W. P. SIDDONS, WM. MCWOOD, Committee.

DETROIT, Mich., Feb. 14, 1894.

Compressed Air Appliances and Hydraulic Machinery.

The committee on this subject solicits replies to the following questions:

1. Have you in use any appliance for using compressed air or hydraulic pressure?
2. If so, in what operations could such appliances be used so as to reduce the cost of car construction and repairs, and car cleaning in car shops and yards?
3. Please give maker's name of any appliances you may have or are familiar with, and full information on any device you have originated and adapted to such service on your road, together with drawings, sketches, photographs, etc.

It should be understood that the scope of this inquiry is broad, and that the reply should cover the application of compressed air, hydraulic pressure, and either hand power, pneumatic or electric devices, to the movement of material to be worked, or as a motive power to operate machines, or to any device used in car shops and car repair yards to economically operate the same.

Owing to the importance of this subject, we ask your careful consideration and as full information as possible.

J. C. BARBER, WILLIAM GARSTANG, WILLIAM CORMACK, J. R. SKINNER, H. L. PRESTON, Committee.

Answers may be sent to J. C. Barber, Master Car Builder Northern Pacific Railway, St. Paul, Minn.

In the report of the proceedings of the Northwest Railroad Club, published in our last issue, Mr. John Hickey was reported as saying that a car journal bearing with more than 250 pounds pressure per square inch was liable to run hot. The report should have read 350 pounds pressure.

The boiler of a Santa Fe switch engine exploded while the engine was moving at the rate of five miles per hour in the yards at Temple, Tex., Feb. 5. "The crownsheet was blown through a car, making a complete wreck of it." Two men were killed.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

METAL CAR FRAMES.

There has been a good deal of agitation recently of the advantages of steel and iron in car construction. In our last issue we published an abstract of a paper read by Mr. J. D. McIlwain before the Western Railway Club on "Steel in Car Construction," and in this issue we publish a paper read by Mr. G. R. Jougins before the New York Railroad Club on "Metal Underframes for Freight Cars." Both papers were very fully discussed by the clubs before which they were read, and it may be taken for granted that the agitation created by the papers and their discussion has effected a long stride toward the more extensive use of metal in car construction.

The trouble has been that up to the present there has been no very general feeling of the need of a stronger material than wood for the underframing and superstructure of freight and passenger cars, and that until recently the attempts to use iron or steel cars have proved abortive because of faulty construction or design. Also American cars, both freight and passenger, have been passing through a stage of evolution in which it would have been foolhardy to have frozen the main dimensions by the use of any more permanent material of construction than wood. Still another drawback to the very extensive use of metal cars has been their increased cost over wooden cars, which is generally conceded to be about 20 per cent. In recent years legislation and competition have so narrowed the margin of railroad earnings that it has been a struggle with the managements to keep their heads above water, and managers have (in obedience to the well known wishes of the owners) been loath to expend more money than was necessary for present pressing needs, and have been forced to disregard the prospects of large possible future economies. This has not only been a condition of the past, but is one of the present, and it may for a long time continue to be a condition of the future. As long as it continues to exist, the claim that an iron or steel car will last 36 or 48 years, and will in that time save several thousand dollars in decreased cost of repairs, will have but little weight with the average manager who is wondering how he is going to make both ends meet this year.

The foregoing is a statement of the condition of affairs as they exist, not as we think they should exist. There is small room for doubting that a form of construction that will be stronger and lighter than the present wooden car will be cheaper to haul, maintain and inspect. The feeling is general that freight cars have now nearly or quite reached their maximum development, and when there is reasonable certainty that this is the case there will be more serious attention given to making the principal members of their framing of the most durable material. The impression that metal underframes may prove very expensive to repair after being in wrecks is believed to be erroneous. The Master Car Builders Committee on Steel Center Sills for freight cars announced in its report to the last convention that only about three per cent. of the total cost of maintaining cars is expended in repairing wrecked cars. It would seem from this that there is not much chance of the cost of repairing metal underframes, after wrecks, becoming very burdensome. The experience with metal underframes for locomotive tenders confirms the belief that frames of such material will pass through a wreck with less damage than wooden frames, and that if damaged they can be repaired with less cost, or if damaged beyond repair they are still more valuable than a wooden frame would be under the same circumstances.

The Committee reporting to the last Master Mechanics' Convention on the subject of iron tender frames stated that about half the master mechanics who answered its circulars of inquiry were in favor of metal frames. It appears that this is a fair indication of the prevailing opinion of master mechanics on this subject, as about half of the engines recently built by the principal locomotive works are given iron tender frames. It is, perhaps, only natural that such frames should find a more open field in the locomotive department than in the car department, as those in the locomotive department are more used to dealing with metal than with wood, and those in the car department are more used to dealing with wood than metal. Again, the tools in the locomotive department are for the manipulation of metal, and those in the car department are principally for the manipulation of wood. It is easy to see that the progress of the use of metal for car frames must involve a considerable change of tools in car shops; and, what is perhaps still more important and difficult, the training of car builders and repairers in the methods of manipulating metal. As it is probable that the adoption of metal car frames will make slow (but we believe sure) progress, probably first in composite construction and afterward largely for some time to come only for the principal members of underframes, the changes of tools and methods of work in car shops that we have mentioned will in all probability take place so gradually that those who may be affected by them will easily adjust themselves to such changes as occur.

THE MAINTENANCE OF AIR BRAKES.

In concluding its report to the last convention of the Master Car Builders' Association, the Committee on Air Brake Tests surprised those present by calling attention to the carelessness that was common in the matter of placing screens in drain cups and triple valves. Many drain cups were found without screens or other means of filtering the air and collecting the dust and dirt it might carry into the mechanism of the triple valves. It was found that brake inspectors were very careless in this matter, and seldom sought to ascertain the condition of screens in drain cups or triples, or in fact if these had screens at all. A case was cited where twenty triples were inadvertently issued at one shop without any screens, and every one was put in service without the screen. In other cases screens had become misplaced and their condition remained undiscovered for a long time, and ill fitting screens were very common. This carelessness indicated a general lack of appreciation of the importance to the brake mechanism of screening the air of its impurities, and this importance was demonstrated by the committee, much to the surprise of most of those present, by the exhibition of triple screens that were packed perfectly solid with dirt in consequence of the drain cups having no screens.

The chairman of the committee, Mr. Godfrey W. Rhodes, has since continued his investigations, and on another page we publish some of the results of these, which show that the matter of protecting the delicate brake mechanism from the intrusion of dirt and foreign substances is of even greater importance than it appeared to the convention last June. About 16 per cent. (the average of two tests) of the air-brake equipment passing over the Chicago, Burlington & Quincy road was said to be inoperative, or not being used; and while there were many causes that contributed to the failure of this large proportion of the air-brake equipment, it was found that one of the chief causes was the amount of dirt that worked its way through the pipes to the triple valves.

Investigations showed the most surprising variety of foreign substances imbedded in triple screens and sometimes filling an adjacent portion of the pipe. Collections of these showed iron rust, cinder, scale and oil, pieces of coal and iron, slivers of wood, rubber gaskets and grains of corn. Rust from the interior of old pipes and scale from the interior of new pipes were found to be a prolific source of mischief; and this suggests that more attention should be given the old pipes, and that greater care should be exercised to free new pipes of the scale loosened in the interior by shaping them before putting them in place. The inability of the present form of dummy coupling to prevent the entrance of dirt in the hose is pointed out by a test which showed that a hose run in the hung-up position on a passenger train collected a vast quantity of dirt, sand, gravel and dried grass that found final lodgment against the triple screen and in the adjacent pipe. The simple relation of these facts sufficiently emphasizes the necessity of more careful attention being given to the maintenance of brakes in good working order. The fact that officers on a road who are best able to judge should express an opinion that 20 per cent. of the airbrake equipment was inoperative, and that several tests should immediately show that about 16 per cent. was actually not in use, seems to leave no room for argument but that this large proportion of useless brakes should be made useful and effective before any further expenditure is made for new airbrake equipment.

GEORGE W. CHILDS.

"The poor have lost a friend, the rich an example."
JOSEPH JEFFERSON.

"A great life has passed into the tomb." George William Childs, the proprieter of the Philadelphia *Public Ledger* and a philanthropist of world-wide fame, died at his home in Philadelphia, Feb. 3, of paralysis. Mr. Childs was born in Baltimore, May 12, 1829, and was therefore 64 years of age. Like many other men who have achieved greatness in the various walks of life, his parents were poor, and while a boy he received but little "schooling" in the general acceptation of the term. When he was thirteen years of age he entered the United States Navy as an apprentice on board the United States ship *Pennsylvania*. He remained in the service only fifteen months, and then went to Philadelphia under similar circumstances to those under which another poor boy, Benjamin Franklin, once walked the streets of the Quaker City. Like Franklin, he was poor and almost friendless, and like him he was destined to make his mark in a printing-office. He obtained employment in a book store kept by an old Quaker, and did his work so well that, after a year's service, he was intrusted with the responsibility of attending the book auctions, and soon became the regular representative of his employer at the trade sales in New York and Boston. He kept this position four years and saved a few hundred dollars. With this and the more valuable capital of a knowledge of business and the good opinion of his associates he started in the book selling busines for himself, and succeeded so well that an old established publishing firm soon sought an alliance with him. This alliance proved highly successful and in a few years Mr. Childs was able to realize a dream he had long entertained—the purchase of the *Public Ledger*. The field of journalism had the strongest attraction for him, and as might be supposed and as the world knows he achieved in it the highest possible success, the *Ledger* under his able control rising to the first rank of American newspapers, and in the opinion of many holding to the present time the leading place.

With Mr. Childs success in business and journalism meant also great financial success; but he was so liberal with his employés and such a generous giver to innumerable charities (many unknown save to himself and those benefited) that only a modest fortune is left to his widow to use according to his wishes for the welfare of others. In railroad parlance Mr. Childs was "a broad gauge" man, and numbered among his friends great princes and workingmen, noted divines and famous actors and actresses, great statesmen and soldiers, and millionaires and newsboys. He entertained such friends with equal courtesy and consideration, and found qualities in each and all that were worthy of his love. With his demise the activities of a busy life close, but the sting of regret felt by his countless admirers is softened by the knowledge that it was the peaceful closing of a most honorable, successful and well-spent life.

CARRYING SURPLUS COAL ON TENDERS.

A letter from a locomotive engineer to the editor of the *Railway Age and Northwestern Railroader*, published in its last issue, revives a subject that has before been discussed in the NATIONAL CAR AND LOCOMOTIVE BUILDER. It is the common practice of overloading locomotive tenders with coal. The correspondent expatiates principally on the evils and needless expense of hauling around over the road a surplus of two or three tons of coal on each tender, and points out that if only such an amount of coal as it is known will be needed (with a reasonable surplus of about one ton) is carried there would be a resulting economy effected in several different ways. The expense of always hauling an unnecessary surplus of two tons of coal on each engine would be avoided, less coal would be practically destroyed by lying unused in the back of the coal pit and on the rear of the tender for months, the iron of the tank in contact with the coal would last longer, and the cost of tender repairs would be reduced.

The *Railway Age and Northwestern Railroader* in commenting editorially on the subject sees little room for improvement on current practice, and expresses the opinion that the possibility of some time needing the large surplus, even if the probability be remote, justifies its being carried. Doubtless this is the view generally entertained by railroad officers and the enginemen themselves. The writer has run locomotives and has often felt a sense of security and satisfaction in having a heaped up tenderful of coal, a large tank full of water and a large sandbox full of sand. These are the materials the proper use of which make a locomotive powerful and its work effective, and, having "been through the mill," he can sympathize with those who like to have at hand an abundance of the materials upon which the successful performance of their work depends.

It is a question, however, to which we invite the attention of our readers if this feeling that such an abundance is necessary or, rather, desirable has any stronger foundation than mere habit. We have known locomotive engineers who deprecated economical habits practiced by other engineers in the use of supplies, because they "liked to have plenty of everything and if it was found out that less would do—it would *have* to do, and—they liked to have plenty of everything." This was an actual state-

ment, and it illustrates the extreme to which the desire to have at hand an abundance of necessary materials, and to be allowed to freely use them, may lead.

This habit of carrying a uselessly large stock of materials extends beyond the locomotive and the locomotive department and exerts its expensive influence in nearly every department of railroad operating. One of the largest economies that have been effected in recent years in the purchasing department of railroads has been in the cutting down of the amount of material kept in store, when it was found that a uselessly large stock was being carried. This reform was made on some large roads in the face of strong opposition from many much higher in position than the engineer whose remarks are quoted above, but who, in much the same way, "liked to have plenty of everything" at hand. The enforcement of the reform, however, saved on some roads many thousands of dollars annually, and this was accomplished not only by the release of large sums of money that had been tied up in idle material, but also by the more frugal use of such material. An abundance of supply of any commodity, from water to gold, encourages extravagance in its use, and, generally speaking, frugality can only be enforced by a judicious limitation or restriction of supply. Formerly some large railroads kept no record of the coal consumption of their locomotives. Coal was supplied to the engines at chutes as freely as water was at tanks, and no more record kept of it than was of the water. The natural consequence was its extravagant use, which was afterward largely curtailed simply by the adoption of a system of keeping and displaying a record of each engine's fuel consumption. The reform suggested economy to all, and encouraged those who were inclined to be frugal in the use of supplies.

A heaped up tenderful of coal is in every case an encouragement to the extravagant use of that expensive supply. Much coal is lost by falling off the tender when it is overloaded, and to describe this loss we repeat what we said on this point a year ago.*

In taking large tanks of coal the tender is filled heaping full, a hundred pounds or more spilling over the sides before the engine leaves the chutes, and two or three hundred pounds more falling off during the next 20 miles' run. The coal spilt at chutes is generally gathered up and used for some purpose or returned to the chutes. Much of it is stolen, and the value of all of it for locomotive fuel is deteriorated by exposure and abrasion. Together with the cost (for labor) of gathering it up, these losses aggregate fully one-half of the value of the coal spilt from tenders at chutes.

All that spills from the tender while running is, of course, a total loss. That this is a very considerable amount can be proved to any one who will take the trouble to inspect the right of way on each side of the track for 20 miles on either side of a coaling station. If any one mile of this distance is carefully inspected and the weight of the lumps of coal seen lying on the ground is estimated, an idea can be formed of the extent of the yearly loss from the cause under consideration. The coal seldom remains visible as such longer than a year, as exposure to the elements causes rapid disintegration, and the work of repairing the roadbed assists its disappearance; so the coal observed may be fairly considered as the yearly loss.

We have seen stretches of road, quite as long as that mentioned above, that were shamefully well peppered with lumps of valuable coal that were lost to every useful purpose in the way described. A noticeable case of this kind came under our observation in Utah some time ago. The road runs through a desert stretch of country, and the sparse growth of grass left the ground bare to the view. Shortly beyond a coaling station the right of way was so thoroughly and continually peppered with lumps of coal that interest was aroused, and an estimate made of the probable weight of coal lying within any 10-foot belt across the right of way. After considerable observation it was decided that 40 pounds was about the amount, aggregating over 10 tons per mile. The cost of this coal to the railroad company was over $5 per ton, and if the coal observed was but a year's accumulation, it is evident that a sum approaching and possibly exceeding $50 per mile was being spent annually on this stretch of track for a form of ballast that was neither ornamental or useful.

A heavy tender load of coal acts in other ways to increase operating expenses. The heavier the load, although it may be fluctuating, the larger will be the item of repairs to the running gear; and a surplus of coal that is carried on the tender and is undisturbed for some length of time rapidly deteriorates in value as fuel, and rapidly corrodes the iron or steel sheets of the tender with which it lies in continual contact. This last mentioned action is well described by the following remarks of Mr. George L. Fowler, made at a recent club meeting when discussing metal underframing for cars:

"It seems from what has been said of corrosion that the element of time is a very important factor. In my own work, some time ago, there was a bin in which soft coal happened to be piled over a shovel. The shovel was buried under the coal for about six months, another shovel being used continually and being left stuck in the coal whenever it was not actually used for shoveling. The shovel which was in constant use was not worn or corroded, or acted upon in the slightest degree, whereas when the bin was empty at the end of six months, the shovel that was buried in it was entirely corroded. It had gone to pieces. As long as the coal can be carried for a short length of time and then emptied, and the framing cleaned off and the fresh air given a chance to get at it, the opportunities for corrosion are comparatively slight. But if you bury the metal under the coal or allow the drippings of the coal to act on it continuously the corrosion set up will be very rapid."

For the preservation of the metal sheets of the tender from corrosion and to obtain the full heat value of the coal, the full supply of fuel on the tender should be used up every day. This will not be done if a large surplus is carried, as it is difficult to get firemen to shovel coal ahead from the back of the pit or the rear of the tender. To accomplish this and to save firemen unnecessary labor we have before advocated a change in tender construction that will cause all the coal carried to flow by gravity toward the coal gate where it would certainly be used. This would cause a constant circulation of fresh coal in contact with the sheets. This action is obtained in a most excellent manner by the hopper form of tender adopted as standard on the Wabash Railroad, and described and illustrated quite fully in our issue of September, 1892.

In commenting on this form of tender we then said: "And, as with this construction, the practice of carrying a couple of surplus tons of coal on the rear of the tender and in the back of the coal pit is precluded. the expense of uselessly hauling that amount is avoided." What is the expense of hauling this surplus? If a railroad operates 100 locomotives, which each carry an average unnecessary surplus of two tons of coal and run 100 miles per day, the engines of that road will uselessly haul each day ($2 \times 100 \times 100 =$) 20,000 tons one mile. The Interstate Commerce Commission's fourth annual report on the statistics of railways states the average cost of carrying one ton of freight one mile to have been, in 1891, .583 of a cent, and for the previous three years, .604, .593 and .630 of a cent respectively. Taking the lowest figure, for 1891, we see that, if it costs as much to haul a ton of coal on a tender as to haul a ton of freight in a car, the cost of hauling 20,000 tons one mile is ($.583 \times 20,000 =$) $116.60. If this is the daily expense the monthly expense is $3,498 and the annual unnecessary expense is $41,976 on a road with 100 locomotives always carrying two surplus tons of coal.

Perhaps these figures are an exaggeration of the cost of hauling this surplus coal, as there may be many items of expense involved in hauling a ton of freight in a car that are absent from hauling a ton of coal on a tender. But we have seen that the haulage of this surplus coal is expensive in ways that the haulage of freight is not, and it is possible that if the conditions affecting each could be correctly analyzed the difference in the cost of haulage would be found not very great. The subject in its various phases is deserving of more attention than has been given it, and it seems that on roads where coaling stations are situated at convenient intervals the tenders should carry a closer approximation to the amount of coal needed than they commonly do.

* See "Loss of Coal from Tenders," p. 40, NATIONAL CAR AND LOCOMOTIVE BUILDER, March, 1893.

Literature.

Science of Mechanics. By Dr. Ernst Mach. Translated by Thomas J. McCormack. Cloth. Price $2.50. Good index. Pages 534. The Open Court Publishing Company, 175 La Salle street, Chicago.

This book is a translation of the German text written by Dr. Ernst Mach, Professor of Physics in the University of Prague. The translation has been accomplished in an excellent manner, and the book is well printed and substantially bound, and contains 250 illustrations. The work treats mechanics not as a branch of mathematics, but as one of the physical sciences. The subject is handled in a a very practical and thorough manner, and the mathematical illustrations have been made as simple as possible. The book is divided into five chapters, which treat of the development of the principles of statics and dynamics, the extended application of the principles of mechanics and the deductive development of the science, the formal development of mechanics, and the relation of mechanics to other departments of knowledge.

The Iron Founder Supplement. By Simpson Ballard. Pages 400. Price $2.50. John Wiley & Sons, 53 East Tenth street, New York.

As its name indicates, this book is a supplement to *The Iron Founder*, a book previously published by the same author, and treats of branches of the subject of founding which could not be properly treated in the first book. It contains over 200 engravings. Pattern making and foundry equipment of the newest designs receive special notice in detail, as well as the various molding machines of note. Melting in cupolas and reverberatory furnaces occupies a prominent position in the book, being supplemented by an original table of instructions for cupola management which leaves little to be desired. Founding of car wheels, including annealing, as well as the production of malleable iron castings, explaining the theories of chilling and annealing, subjects of deep interest to the molder, are treated at length in plain every-day language.

Northwestern Railway Club.

Steel vs. Iron Axles.

The regular meeting of this club was held at Hotel Ryan, St. Paul, Minn., Feb. 13. There was a large attendance of members and visitors, and papers were read by Mr. George Dickson, of the Great Northern Railway, and Mr. H. L. Preston on the subject for the evening, which was "steel versus iron axles for locomotive and car use." This subject had been continued from the January meeting and the foregoing papers, together with that of Mr. George Brooke, read at the January meeting, were quite thoroughly discussed by the members present. Mr. Dickson's paper took up the record of certain axles which have been in use on the Great Northern road which offered a fair basis for comparison and was somewhat in favor of the steel axles, both for safety, convenience and cost. In the discussion Mr. L. R. Pomeroy took the position that an alteration of the structure of iron bringing about a condition similar if not exactly corresponding to crystallization was caused by vibration, and gave examples of crane chains and spokes of certain wrought spoke wheels to illustrates his position. Some members also advanced the idea that a Muck bar axle is preferable to an axle made from scrap. After an extended discussion the subject was closed for the evening, and the question of the best material for piston rods was quite thoroughly discussed.

The subject for the next meeting was left to the Executive Committee, which has since decided to ask papers on brick arches in fireboxes and care of passenger trains at terminals. The next meeting will be held March 13, at the Hotel Ryan, St. Paul.

A Mammoth Truck.

The modern requirements of trucking service in large cities have resulted in the construction of some immense trucks. The fact that the cable for one of New York's street railroads weighs 60 tons, and had to be trucked through the streets indicates the necessity for very strong trucks. The principal dimensions of one such truck, designed to carry fifty but capable of carrying sixty tons, that was recently built in New York City are as follows: The main beams are 16 by 14 inches in thickness; tires are 9 inches wide and 1½ inches thick. The extreme length of the truck is 40 feet, the extreme width 9 feet, and the wheels weigh 3,000 pounds each. The hub is 24 inches in diameter, and the nut at the end of the axle is 6 inches between opposite faces. The pole is 6½ inches thick, the axles have the same thickness as the pole, and the entire vehicle weighs about 7 tons. Without a load it requires 6 horses to move it, and when carrying its maximum burden it takes about 50 horses to draw it through the streets.

He (from Boston; very musical)—Wagner's works are simply grand!

She (from Chicago)—Oh, you ought to see Pullman's!

It has been calculated that it requires 145 horse power to propel through the water, at the rate of 12 miles per hour, a whale 80 feet long, 20 feet across the flanges of the tail, and weighing 74 tons.

The first piece of apparatus to be received for the new engineering laboratory of Purdue Universisy, now in the process of rebuilding, is a complete car-lighting equipment from the Railway Lighting and Manufacturing Company, of Philadelphia. The apparatus is sent without cost to the university, and its efficiency will be determined by a series of experimental tests.

The plans have been approved and the contract signed for the construction of a new bridge for the Southern Pacific Company over the Mississippi River at New Orleans. The contract has been awarded the Phœnixville Bridge Company and the total cost will be $5,000,000. The bridge will be 10,500 feet long and will have a double track. The main river bridge will be built on the cantilever principle. The bridge will give the Southern Pacific an all-rail entrance into New Orleans.

NOT NATURAL.—"That clock," said the man who was looking through the Senate chamber, "don't call out the hour no way, does it?"

"No," replied the guide.

"Whose property is it?"

"Why, it belongs to the Union."

"To which?"

"To the Union."

"An' don't strike? No, siree. Ye can't fool me."

The Manhattan Elevated Railroad of New York City has just provided itself with an addition to its equipment of 20 new locomotives, which are the heaviest yet put on an elevated road system. They were built at the Pittsburgh Locomotive and Car Works, and are designed to haul a load of five cars, weighing 29,000 pounds each, on a grade of 2.5 per cent. and at a maximum speed of 25 miles an hour. The new locomotives have driving wheels 3 feet 6 inches in diameter, cylinders 12 × 16 inches and a boiler carrying a working steam pressure of 140 pounds. The total weight of the engine is 47,000 pounds, of which 33,000 pounds are on the drivers. They are equipped with the Eames vacuum brakes.

A case of "main strength and awkwardness" in repairing an engine came to light not long ago. An engineer reported a leak in front cylinder head. The casing was removed and the cylinder head tightened. Next trip—same report and same remedy. Again the leak was reported, and the "monkey-wrench machinist" got a piece of gas pipe and another man or two and screwed it down again. The next trip there was the same report. This time they removed the cylinder head and found the copper gasket parted where the two ends had been soldered together, thus making a leak. They also discovered that the violent tightening had resulted in cracking the cylinder head all the way around, over the gasket.

Personal.

Col. H. G. Prout, Editor of the *Railroad Gazette*, has sailed for Europe.

Mr. T. Eldridge has resigned as Master Mechanic of the White & Black River Valley.

Mr. E. M. Hedley, Master Mechanic of the Brooklyn Elevated Railroad, has resigned.

Mr. A. L. Sanger has been appointed Purchasing Agent of the Evansville & Terre Haute.

Mr. J. R. Sample has been appointed General Superintendent of the Evansville & Terre Haute.

Mr. James Helms, Assistant Master Mechanic of the Louisville, Evansville & St. Louis, died at his home in Princeton, Ind., Jan. 25.

Mr. Edward P. Mallinson has been appointed Master Mechanic of the Brooklyn Elevated Railroad, succeeding Mr. E. M. Hedley, resigned.

Mr. William Love has been appointed Trainmaster and Master Mechanic of the Chattanooga, Rome & Columbus, with headquarters at Rome, Ga.

Mr. Isaac D. Barton, late General Superintendent of the New York & New England, has been appointed General Superintendent of the Brooklyn Elevated road.

Mr. M. J. Redding has been appointed Master Mechanic of the White & Black River Valley, with headquarters at Brinkley, Ark., in place of Mr. T. Eldridge, resigned.

Gen. John Echols, Vice-President of the Chesapeake, Ohio & Southwestern, and one of the receivers of the property; has again assumed the title of General Manager of that railroad.

Mr. George Henderson, formerly Master Mechanic of the Montana Central, has been appointed Master Mechanic of the Butte, Anaconda & Pacific, with headquarters at Anaconda, Mont.

Mr. Thomas B. Purvis, Jr., Master Mechanic of the Boston & Albany at East Albany, N. Y., has been appointed Master Mechanic at Boston, Mass., to succeed Mr. W. H. Taft, promoted.

Mr. Charles M. Hays, General Manager of the Wabash Railroad, has been elected Vice-President of the company, to succeed Mr. James F. How, resigned. Mr. Hays will continue as General Manager.

Mr. T. F. Dunaway, Division Superintendent of the Missouri Pacific at Osawatomie, Kan., has resigned to accept the position of General Manager of the Union Pacific, Denver & Gulf Railway, with headquarters at Denver, Col.

Mr. W. D. Stansifer, who has been connected with the supply department of the Great Northern for the past five years, has been appointed Purchasing Agent for the Butte, Anaconda & Pacific, with headquarters at Anaconda, Mont.

Mr. J. Elfreth Watkins, who had charge of the Pennsylvania Railroad exhibit at the Columbian Exposition, as assistant to Mr. T. N. Ely, has resigned from the Pennsylvania Railroad service to accept a position as "Director of the Department of Industrial and Mechanical Art" at the Columbian Museum, in Chicago.

Mr. J. Bond, Division Master Mechanic of the New York, Lake Erie & Western at Hornellsville, N. Y., has been transferred to Susquehanna, Pa. Mr. C. P. Weiss, Master Mechanic at Rochester, is transferred to Hornellsville, and Mr. F. N. Hibbits, Mechanical Engineer at Susquehanna, is made Master Mechanic at Rochester.

Mr. Washington Lavery, Division Master Mechanic of the New York, Lake Erie & Western at Susquehanna, Pa., has been appointed Assistant Superintendent of Motive Power, with headquarters at Cleveland, O., succeeding Mr. Samuel Higgins. Mr. Lavery has been Master Mechanic at Susquehanna for the past six years, and was formerly Master Mechanic at Cleveland and at Galion, O., and later at Meadville, Pa.

Mr. Gavin Campbell, ex-General Superintendent of the Wisconsin Central, died at his nome in Stevens Point, Wis., Jan. 31. He was born in Glasgow, Scotland, April 16, 1836, and entered railway service in 1859 in this country. Mr. Campbell rose in the machine shops of the Lake Shore & Michigan Southern to be Foreman at La Porte, Ind., and Buffalo, N. Y. In 1871 he was appointed Master Mechanic of the Wisconsin Central, and held that position until 1878, when he was made Division Superintendent.

Mr. James G. Hubbard, Division Master Mechanic of the New York, Lake Erie & Western at East Buffalo, died at Buffalo, N.Y., Feb. 13. Mr. Hubbard learned the machinist trade in the Schenectady Locomotive Works, and became connected with the Erie road in 1861. He served as Master Mechanic of the Buffalo & Southwestern for six years until that road was leased to the Erie in 1880 when he became Foreman of Car Repairs of the East Buffalo shops, retaining that position until October, 1892, when he was promoted to be Master Mechanic.

Mr. Samuel Porcher, formerly Assistant Superintendent of Motive Power of the Pennsylvania at Jersey City, has been promoted to be Assistant Purchasing Agent of the company, to succeed Mr. A. W. Sumner, who was made Purchasing Agent on the retirement of Enoch Lewis several months ago. The appointment takes effect March 1. Mr. Porcher entered the Pennsylvania service 12 years ago, beginning work at the Altoona shops. He was appointed Assistant Superintendent of Motive Power at Jersey City in 1888.

Mr. T. A. Mackinnon, General Manager of the Concord & Montreal, has been appointed General Manager of the Boston & Maine, with headquarters at Boston, Mass., in place of Mr. J. W. Sanborn, who has been Acting General Manager. It is stated that Mr. George F. Evans, Superintendent of the Southern Division of the B. & M. will be made Assistant General Manager and that Mr. D. W. Sanborn, now General Superintendent, will return to his old position as Superintendent of the Southern Division, while Mr. John W. Sanborn, Acting General Manager, will resume his former position as Superintendent of the Northern Division.

Mr. Samuel Higgins has resigned as Assistant Superintendent of Motive Power of the New York, Lake Erie & Western, to become Superintendent of Motive Power of the Lehigh Valley Railroad. Mr. Higgins began on the Erie as a machinist apprentice in 1881, and has since filled the positions of Machine Shop Foreman, Division Master Mechanic, and, during the last two years, Assistant Superintendent of Motive Power. It is said that it ordinarily takes about ten years of zealous, intelligent work to attain success in any calling. Mr. Higgins has climbed from the lowest to the highest position in the railroad mechanical department in 12 years. As he is but 34 years old, it can hardly be said that he has yet attained his highest success. The mechanical department of a large railroad presents a wide field for useful activity, and numerous opportunities to advance the science of locomotive engineering.

The Origin of Petroleum.

In a communication to the *Journal of the American Chemical Society*, Dr. Engler discusses the origin of petroleum. He says:

Scientists have discussed very often in the last few years the question in which way petroleum was formed by nature. According to one theory it is generated from inorganic materials during the period of formation of our planet, out of cosmical hydrocarbons, which, in the beginning dissolved in the soft mass, separated from it later on. Mendelejeff assumes that water, entering by fissures and chasms the interior of the earth, came in contact with melting carbide of iron, and so produced in a simple manner oxide of iron and the hydrocarbons of petroleum. Strong objection cannot be made to these two theories from the chemical standpoint; but the composition of the different kinds of petroleum is against them, and geology considers them not free from objections. For a series of years the idea that petroleum was produced from the remains of plants by a kind of a distillation process was most generally adopted, especially by chemists. Chemical and geological reasons are against this theory. From the chemical standpoint it seems quite impossible that the substance of the plants could be split up by distillation into petroleum without leaving charcoal or coke. There would also be a genetic connection between coal and petroleum; but in occurrences of the ordinary kind coal is nearly always absent. If this were really the case, then there ought to be with every oil occurrence, in close connection, a coal bank, which really seldom happens. By a third theory the remains of animals form the raw material from which petroleum is formed by nature. There are many facts proving the decay of masses of animals, which we find now in banks in the crust of the earth in the form of the remains of shells, fishes, saurians, etc. Prominent scientists especially defend this idea on geological grounds. How can the transmutation of animal remains into oil be imagined?

In order to answer this some thousands of salt-water fishes, and also shells, have been distilled under strong pressure. The result was a liquid, containing mostly nitrogenous bases, such as pyridin, which was little or not at all similar to petroleum. I then recalled some experiments of Wetherill and Gregory, who found that the wax found in cadavers, the so-called "adipocere," was nothing else but the fatty residue which remains after the putrefaction of all the other animal matter, especially of the nitrogenous constituents of the cadaver. It is also well known that even fossil bones frequently contain fat. The question now raised was this: Could not the process in nature have been a similar one—should not, first of all, the nitrogenated animal substance have been destroyed, leaving the fat, which was then transformed into oil? In order to prove chemically this possibility, I submitted animal fat (train oil) to distillation—first in a sealed glass tube, later on in a large iron vessel—under a pressure of 25 atmospheres at a moderate heat (300 degrees to 400 degrees Cen.), and to my great delight found that, under favorable conditions, 70 per cent. of the train oil was transformed into petroleum. This equals 90 per cent. of the theoretical out put. Besides the oil, some water and some combustible gas were always formed. The same behavior has been shown by other fats, like butter, the fat of hogs, artificial fats, also the chemically pure glycerids of the fats like tri-olein, tri-stearin, and the free fatty acids. All could be transformed into petroleum by distillation under pressure, when managed in the proper way.

It is a geological fact that we find in nature the remains of antediluvian animals, as shells, fishes, saurians, accumulated in masses. Whether these animals have been piled up in consequence of a natural super-production in special places in the ocean, or by currents, or in consequence of great revolutions of the earth, must be decided by geology; but the remains exist. Now, in what manner do the organic substances of these animals become decomposed? The animal substance consists essentially of nitrogenated material and fat. The former is easily decomposed; the latter is very stable, a fact which has been well known for a long time, and has been shown again by exact investigations. Therefore we find the wax of cadavers in old graves; therefore the fat in the bones of mammals thousands of years old; therefore the fat on the bottom of the ocean recently found. Whether and how far the fat was decomposed in this long period by the water splitting up glycerol and forming free acid—for instance, the fat in the bones of mammals—cannot be answered. Both fat as well as the fatty acids form petroleum when distilled under pressure. We can imagine that such remains wrapped in mud and transported by the currents in the ocean easily accumulate, and later on, under the pressure of sedimentary layers or strata, perhaps under the influence of heat, too, are transformed into petroleum. The formation of petroleum from animal remains has the greatest probability, as we are able now to transform every animal fat into petroleum.

The Southern and Southwestern Railway Club.

The next meeting of the Southern and Southwestern Railway Club will take place at the Kimball House, Atlanta, Ga., on Thursday, April 19th, at 10 o'clock a. m. The subjects for discussion will be:

1st. "Construction of ends of box cars; the cause of and remedy for the bulging out of ends of box cars," with special committee, Messrs. E. M. Roberts, A. G. Steinbrenner, and J. M. Holt.

2nd. "Is the collar or collarless axle the best adapted to general rolling stock service?" with special committee, Messrs. P. H. Shrieber, W. H. Thomas, A. B. Corinth and W. H. H. Price.

3rd. "The relative strength of different patterns of metallic and composite and wooden brake beams under service strains;" with special committee, Messrs. F. H. McGee, George D. Harris and J. T. Robinson.

Messrs. C. F. Thomas, W. H. Hudson and F. H. McGee are expected to report on "The most approved methods for rapidly cleaning soot and cinders from inside of locomotive boiler tubes while engines are in engine houses." Messrs. Philip Wallis, T. W. Gentry, W. Hassman and A. T. Hooker are expected to report on "Soft plugs for crown sheets of fireboxes, best form, and how to keep them effective." The club will take action, and make recommendations to the arbitration committee of the M. C. B. Association, from report of the following committee, appointed to see "What part of the present code of M. C. B. rule it might be advisable to alter in order to better meet the requirements of interchange": Messrs. R. D. Wade, A. G. Steinbrenner, Jas. Cullen, J. M. Holt, W. H. H. Price, R. P. C. Sanderson and S. A. Charpiot.

A Compound Mogul Freight Locomotive.

The engravings on the opposite page illustrate the construction of a compound mogul freight locomotive, built by the Pittsburgh Locomotive & Car Works, it being one of five locomotives exhibited by this company at the Columbian Exposition. The engine is now in service on the Columbus, Hocking Valley & Toledo Railway. Our engravings show the general arrangement of the engine, a front view and section through smokebox, a rear view and section through firebox, and a cross-section through the cylinders. Also the arrangement of the intercepting and reducing valves are shown, and their positions when the engine is working simple and compound, respectively.

The engine and tender is 59 feet 4½ inches long, over all, and weighs 116,200 pounds. The total wheel base of the engine and tender is 41 feet 4 inches, the total wheel base of the engine being 20 feet 10 inches, the driving wheel base 13 feet 2 inches, and that of the tender 15 feet 9 inches. The weight distributed over the six drivers is 100,500 pounds, being 16,750 pounds to each driver. The tender weighs 28,800 pounds when empty and has capacity for 3,600 gallons of water and seven tons of coal.

The high-pressure cylinder is 19 inches in diameter, and the low-pressure cylinder is 29 inches in diameter, the piston stroke being 26 inches. Both piston rods are 3½ inches in diameter. The piston and valve stem stuffing boxes have metallic packing, and the Richardson balanced valves are used.

The boiler is built of steel plates $\frac{9}{16}$ and $\frac{5}{8}$ inch thick. It is $58\frac{7}{8}$ inches in diameter at the smallest ring, and carries

180 pounds of steam pressure per square inch. The circumferencial seams are double riveted, and the horizontal seams are butt jointed with laps and are sextuple riveted. The dome is 30 inches in diameter and 26 inches high. The crown sheet is $\frac{3}{8}$ inches thick and has radial stays. The flue sheets are steel, $\frac{1}{2}$ inch thick, and the boiler contains 232 two-inch iron tubes 10 feet 6 inches long. The firebox is made of steel, the inside plates being $\frac{5}{16}$ inch thick and the outside plates $\frac{1}{2}$ inch thick. It in 9 feet long and $32\frac{3}{8}$ inches wide, and is 72 inches deep in front and 60 inches deep at the back. It has 4-inch water spaces at the front and sides, and a $3\frac{1}{2}$-inch water space at the back. Rocking grates are used.

The above proportions are those of a very powerful engine, and the high steam pressure carried makes these

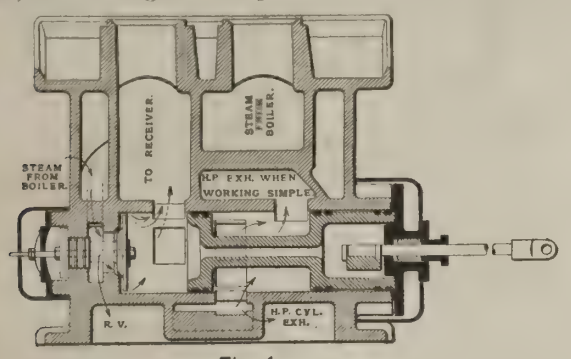


Fig. 1.

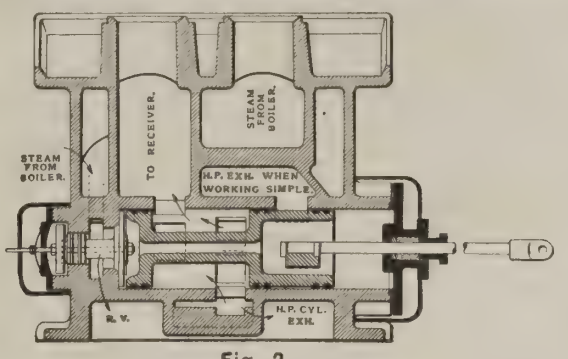


Fig. 2.

opened to the atmosphere as shown. In Fig. 2 the intercepting valve is shown in the position for working compound, with the passage between the reducing valve and the receiver closed, while the exhaust of the high-pressure cylinder is directed to the receiver, by which it passes to the low-pressure cylinder.

To automatically effect the change from working simple to compound, or *vice versa*, an automatic steam reversing cylinder is placed in the cab and is actuated by the movement of the reverse lever. When the l ver is at full stroke the intercepting valve is in the position shown in Fig. 1, which admits live steam to the receiver and low-pressure cylinder, and causes the engine to work as a simple engine, as described. Moving the reverse lever back one or more notches causes the admission of steam to the reversing appliance, which moves the intercepting valve into the position shown in Fig. 2. In this way, by placing the reverse lever at full stroke, or less than full stroke, respectively, the engine is made to work either simple or compound at will. The passage of steam as affected by the operation of the intercepting and reducing valve is shown by arrows in Figs. 1 and 2.

The following table presents some information in reference to a number of the particulars of this engine that are not mentioned in the foregoing description :

DIMENSIONS.

Height, center of boiler above rails	7 ft. 7 in.
" of stack	14 ft. 7 in.
Heating surface, firebox	161 sq. ft.
" " tubes	1,311 sq. ft.
" " total	1,472 sq. ft.
Grate area	24.2 sq. ft.

WHEELS AND JOURNALS.

Drivers, number	6
" diameter, outside of tires	54 in.
Truck wheels, diameter	30 in.
Journals, driving axle, size	8 × 9 in.
" truck " "	5 × 9 in.
Main crank pin, size	6 × 5 in.
Main rod, center to center	7 ft. 1 in.
Steam ports, length	H. press., 18 in.; L. press., 20 in.
" " width	H. press., 1¼ in.; L. press., 1½ in.
Exhaust ports, length	H. press., 18 in.; L. press., 20 in
" width	H. press., 2½ in.; L. press., 3 in.

VALVES.

Valves, greatest travel	H. press., 5 in.; L. press., 6 in.
" outside lap	H. press., ¾ in.; L. press., ¾ in.
" inside lap of clearance	H. press., $\frac{1}{16}$ in.; L. press., $\frac{5}{8}$ in.
" lead in full gear	H. press., $\frac{1}{16}$ in.; L. press., $\frac{3}{32}$ in.

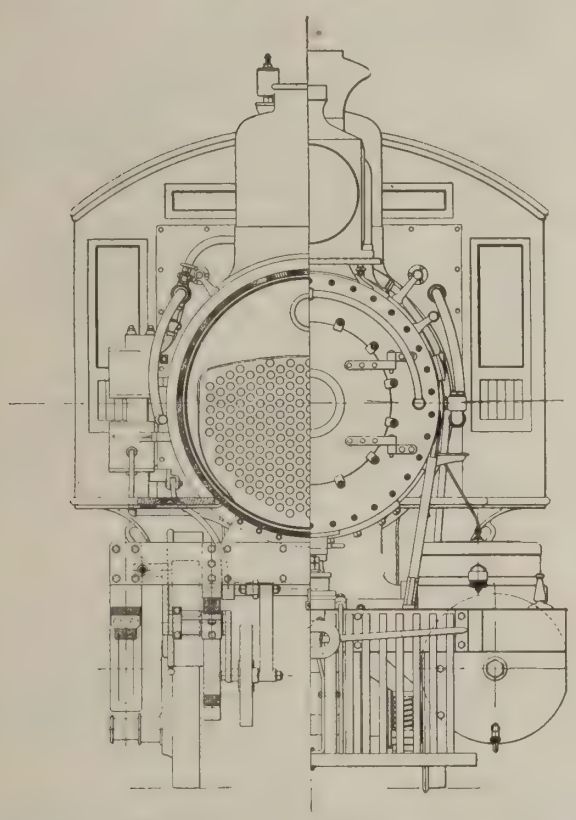
OTHER PARTS.

Exhaust nozzle,	Single
" " diameter	5 in.
Stack	Straight
" least diameter	15¾ in.

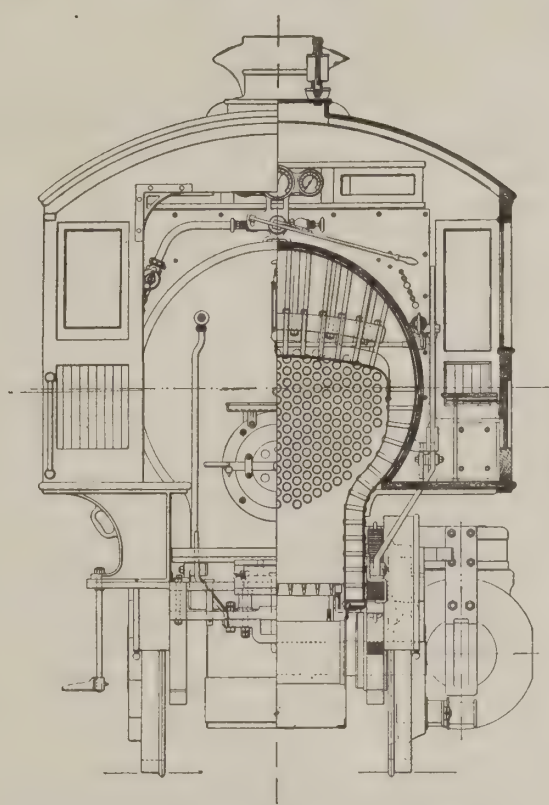
TENDER.

Number of wheels	8
Diameter of wheels	2 ft. 7 in.
Size of journals, diameter and length	4¼ in. × 8 in.
Total wheel base	15 ft. 9 in.
Distance from center to center of truck wheels	5 ft. 1 in.

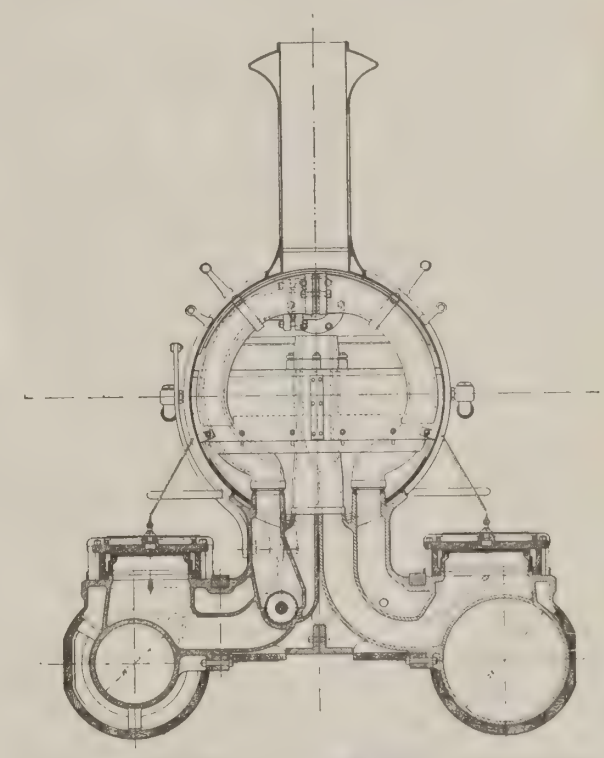
There are a few other special features of construction. Pressed steel is used for the smokebox front and door, and for the sandbox top and lid, and also for the casings of the steam chests, cylinder heads and the dome. The guides and cross heads are of the Laird type, the guides being of steel and the cross heads of cast steel with brass gibs. The connecting rods are steel, I section, and the parallel rods have solid ends. Wood lagging is used on the boiler, dome and cylinders, and is covered with planished iron. The engine is equipped with the A. French springs, a Crosby steam gage, a Williams headlight, Ross-Meehan brake shoes Mack "National" injectors, and the Westinghouse automatic brakes on driving and tender truck wheels.



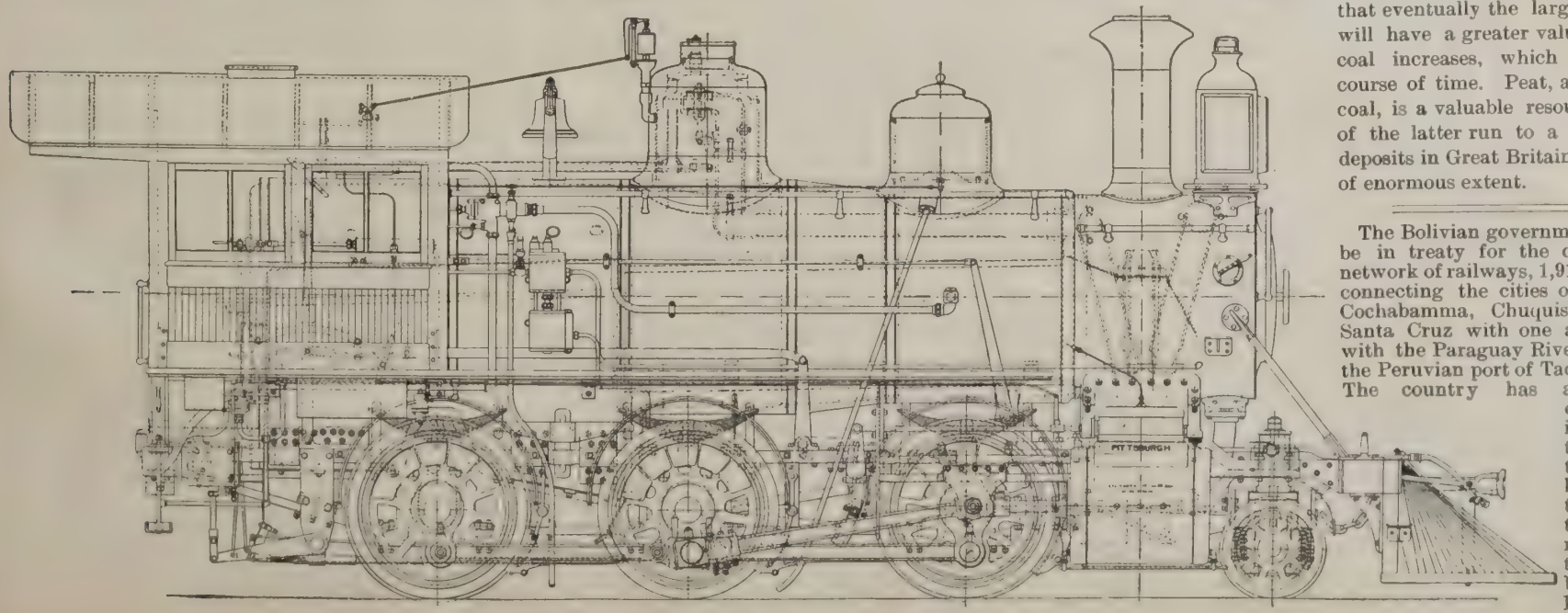
FRONT ELEVATION AND SECTION OF SMOKE-BOX.



REAR ELEVATION AND SECTION THROUGH FIRE-BOX.



CROSS-SECTION THROUGH CYLINDERS.



COMPOUND MOGUL FREIGHT LOCOMOTIVE.

Peat and Its Products.

At the last meeting in London of the Civil and Mechanical Engineers' Society a paper on this subject was read by Mr. R. Nelson Boyd. The economic value of peat was considered —first as a fuel, secondly as to the products from it by distillation, and thirdly as to the coke or charcoal produced. At present the two latter have a value in the markets, as the distillation produces a fair amount of sulphate of ammonia, and the coke or charcoal has a special value owing to its freedom from impurities. It was also pointed out that eventually the large deposits of peat will have a greater value as the cost of coal increases, which it must do in course of time. Peat, as a substitute for coal, is a valuable resource when prices of the latter run to a high point. The deposits in Great Britain and Ireland are of enormous extent.

The Bolivian government is reported to be in treaty for the construction of a network of railways, 1,910 miles in length, connecting the cities of La Paz, Oruro Cochabamma, Chuquisaca, Potosi and Santa Cruz with one another, and also with the Paraguay River on the east and the Peruvian port of Tacna on the Pacific. The country has at present only one line, connecting Oruro with the Chilian frontier, and 240 miles long. It is desired to develop the interior by means of railway connections with Brazil, Paraguay and the Peruvian seaboard.

Communications.

Opposing a Change in Passenger Car Construction.

Editor National Car and Locomotive Builder:

I have read with much interest the articles that have recently appeared in the NATIONAL CAR AND LOCOMOTIVE BUILDER on "Passenger Car Construction," by Mr. Ernest Merrick, advocating the abolition of end platforms. I disagree with the writer of these articles in several particulars.

First, I believe in a strong coach frame. If pine, eight sills for each car, 5 × 8½ inches without splicing. I believe every draw timber should be plated with two ⅝ inch × 7 inch × 16 feet plates of wrought iron, well bolted. I believe in making all end sills in two equal halves 4 inches × 8½ inches, with a bar of iron between the two halves 1 inch × 8½ inches the length of the sill. This plate when all bolted together answers two purposes: First, as a truss to prevent the sill bending down in the center; second, resistance in case of collision, preventing cars or engines passing the end sill. I believe in end platforms because they can be made to resist all and more than the sills beyond end sills or between the two. Oak pieces bolted on the drawbar timbers to the sidearms of platforms, reaching from the face of the end sill to the inside of the railing timber, endways of the wood, can be increased in size to make the platform's strength more than equal the resistance of the sills. These pieces butt against the end sill and railing timber and cannot be shoved under or beyond the face of the end sill, as Mr. Merrick says. The distance of the end sill to railing timber on most of our cars is 30 inches. I believe in end platforms because they provide the best way to secure draw-rigging and hand-brakes. Also a continuous passageway for trainmen and passengers; the easiest and safest way in and out of cars, and the easiest and safest way to couple air hose and safety chains. It is true a platform droops below the end-sill at outer end. This is due to the construction of the car. The crown given the body is carried out in the platform. End platform hoods provide shelter or covering for passengers until they leave the steps. It is impossible to construct a car of wood or iron that will resist the shock of an engine running 25 or 30 miles an hour, backed up with 30 loaded freight cars with 600 tons of freight.

Let us go back to the substantial framing of passenger equipment that was practiced 20 years ago. Give us substantial framework of sills—the rest will take care of itself. Vestibules are a detriment, because the two surfaces of the face plates are coustantly twisting the car caused by the friction of the two plates pressed together by coupling the cars and compressing the spring. Platforms are less safe with vestibules than they are without them, because the railing or end platform timbers are all cut to pieces by mortices, etc., besides the extra weight of iron hanging to the hood or projection over the platform, all secured to a frail woodwork that is particularly found in vestibule platforms. Vestibules are also a detriment because they work a car lengthwise. This is particularly noticeable in Pullman cars. You will see the panels setting down on window sills open at the bottom. The pillars work as the pressure is placed on one end and relieved on the other. Mr. Merrick says that the Pullman vestibule is a strong end structure. This exposes his want of mechanical knowledge. There should be no buffer attached to the upper deck. Steps should always be a permanent fixture, so they can be relied on and always found ready for use, otherwise they might prove traps to cause loss of life, with consequent suits for damages.

The writer speaks of five feet of additional space added to a car's interior by doing away with the platforms. This four-door proposition requires 2½ feet each for the exit of passengers in this proposed design of car. The writer says: "Furthermore, a car with four corner doors will afford a quicker means of escape in case of accident." By this he no doubt intends to have all accidents occur in the center of the car instead of at the end, as is usually the case.

MASTER CAR BUILDER.

A Sad Experience.

Editor National Car and Locomotive Builder:

Some of the drawbacks to the rapidity with which young firemen are advanced to the throttle (with but a limited amount of knowledge of the engine they are to handle) were recently illustrated by a young fellow, who, after firing two and a-half years, was given an engine to run. His first trip was on an "extra," and in the course of the run he decided that it was necessary to "blow her out" a little; so he opened the blow-off cock, and when he thought the boiler was clean enough, he found to his consternation that he couldn't shut off the cock. So the fire had to be dumped, and in a few minutes the young runner had an engine without steam or water on his hands. When the blow-off cock was finally closed the problem of filling up the boiler presented itself. He believed that the boiler would have to be filled through the safety-valve opening, for he had heard of doing so; but when the safety-valve was removed, and he looked down into the hole, he was doubtful if that way led into the boiler; and when he run a packing hook down and struck the throttle-valve his doubts were confirmed. But he was finally persuaded by the conductor and fireman that there was no other way. So they began pouring in the water, carrying it from the back of the tank over the top of the cab. After working a short time he sent the fireman down into the cab to see if the water showed up in the glass, and when the fireman reported none in sight the young runner's doubts all returned, and he wondered where all that water had gone. They kept at it, in spite of his doubts and fears, and after an hour and a half's work, the water began to appear in the glass.

The rest of the trip home his thoughts dwelt steadily on this new experience, and he began to realize that perhaps he did not know everything about an engine. As he pondered he remembered that hundreds of times he had passed engines in the roundhouse with their dome caps off; but he had never interested himself enough to climb up and see what was to be seen and learned there. He had delayed his train five hours, and when he related his experience to the master mechanic the latter was reminded of the theory held by some that every man before being given an engine should spend several months in the machine shop. And he decided to test this theory at once; so he told our young runner that his penalty was three months in the shop, and that he wanted him to put the time in to good account.

S. WHITE.

New England Railroad Club Meeting.

Lubrication of Journals.

The last meeting of this club was held at Wesleyan Hall, 36 Bromfield street, Boston, Feb. 14. President Chamberlain occupied the chair, and announced as the subject for the next meeting, "Some Incidents of Life in Mexico," a paper prepared by Mr. F. M. Twombly, of the New York, New Haven & Hartford Railroad. A committee was appointed to nominate officers for the ensuing year, and to report at the next meeting. The President announced as the subject for discussion for the evening, "Lubrication of the Journals on Rolling Stock, and the Cause of Hot Boxes, and What Can be Done to Obviate Them," to be opened by Mr. F. D, Adams, of the Boston & Albany Railroad.

Mr. Adams said that the causes of hot boxes are various, the chief being excessive load. The size of the journal is an important factor. Formerly the journals were very small. When they got to be 3¼ by 5 inches it was believed they were abundantly large, and railroad mechanics were generally opposed to increasing this size. Finally the M. C. B. Association adopted the 3¼ by 7 inch journal. Since then there have been other increases in the size. The present standard is 4¼ × 8 inches, and is much better adapted to the needs of the present car than the old journals were. The increase of bearing surface now is more than double what it was 20 years ago. But while old cars with small journals continue to be run, and to be overloaded, trouble with hot boxes will continue. Bad fitting brasses sometimes cause hot boxes. Improper packing is another cause. "Occasionally, by the vibration of the box and the jolting of the car over the line, the box will rise a little off of the journal. Just at that moment it may catch a string of waste and draw it over the top of the journal and remain there, and that will most always cause a hot box." The entrance of dirt and grit into the journal boxes is antagonistic to cool running. Mr. Adams had made an investigation of the number of hot boxes occurring on the Boston & Albany road in passenger service for a year. They amounted to 25, two each month. He believed the best remedy for hot boxes is a good tight oil-box that will exclude the dirt and retain the oil.

Mr. Lauder: There are three or four leading causes for journals running warm under our rolling stock. The first and most important one, I think, is getting dust and dirt into the boxes, so that an undue abrasion takes place by reason of sand and other foreign matter getting in between the journal and brass and producing an undue friction that sooner or later will produce heat. I believe with Mr. Adams, that a dust guard that will absolutely prevent dust from getting into the box will cause more freedom from the annoyance and delays caused by hot boxes than any other one thing. It is one of the most difficult matters in the planning and construction and keeping in repair of railway rolling stock, to eliminate this trouble. A set of axles were put under a car, the journals being fitted with the Bemis box. Above everything else to commend the Bemis box is its arrangement for excluding dust. It does that perfectly. Mr. Adams' box, I presume, does it equally as well. In one particularc ase that was brought to my attention, a car running through the "wilds" of Cape Cod wore out four pairs of chilled wheels with one axle; and after having worn out four pairs of chilled wheels, going at least 200,000 miles, three of the journals out of the eight had lost in their diameter less than ⅛ of an inch. Now with the ordinary Master Car Builders' standard 3¾ by 7 journal, with the Master Car Builders' standard brass and appliances, on Cape Cod, I have removed wheels from under the car because the journals were worn out before they had worn out one pair of wheels. This shows the difference in the wear of the journal between a box that does not exclude the dust thoroughly and one that does.

The next feature of importance, in my judgment, is the size of the journals. As we began to interchange cars with other roads, getting an absolute standard was of more importance, or thought to be, than getting the proper size of journal; and the adoption of the 3¾ by 7 inch journal was a compromise between those who wanted a 4 by 8 and those who believed that a 3½ by 6 inch was ample. We found that we could not get the 4 by 8, and therefore we proposed a compromise, and that is how we came to get the odd diameter, and to a certain extent the odd length of 3¾ by 7 inches. That is just halfway between 3½ by 4 and 6 by 8. That is the history of the 3¾ by 7 inch journal. That journal did wonderfully good service until we got our weights beyond its capacity to sustain them. Then we began to have a lot of trouble with hot boxes; and as our weights increased, both passenger and freight, the difficulty increased, until the nuisance of hot boxes, and delays in consequence, became unbearable. Then, some years ago, the Master Car Builders' Association took the matter up again, and approached it in a very much more liberal spirit, and the new Master Car Builders' journal was adopted. That journal is 4¼ by 8. It ought to have been 4½. I am satisfied that 4½ by 8 would have been a much better journal and would have done much better work, and would have remained a standard much longer than the 4¼ by 8 will. Before many years 4¼ will be found to be too small.

I had an experience bearing upon this question of large journals with a locomotive. About a year ago, realizing that faster time and heavier trains were in the near future, I designed and built a locomotive for heavy work and high speeds. The locomotive was considerably heavier than anything we had attempted before, weighing, when filled with water, about 58 tons. This was the weight without the tender. This being an ordinary eight-wheel engine, and the larger proportion of the weight having to be carried by four journals, I put in perhaps an abnormally large driving wheel journal. It was 9 inches in diameter. That engine runs in fast service with less difficulty in the matter of heating the driving boxes than any engine we own, notwithstanding the weights, some eight or nine tons more than the ordinary standard engine. This shows very plainly that the larger journal must be used if you expect to run without the annoyance of hot boxes.

I find it is exactly the same with crank pins on locomotives, and my practice for a great many years now has been to put in what would be considered by some unnecessarily large bearings for the back end of the connecting rods. This is usually the pin that heats, and the larger the pin and bearing surface, especially in its diameter, I find the easier it can be maintained without heating.

The third cause of hot boxes is the quality of the lubricant, especially with journals that cannot be protected from the dust, like driving axle journals and locomotive crank pins. That this dust is a prolific cause of disaster to the locomotive is plainly seen when engines are run "double head." The front engine rarely heats or gives us any trouble; the rear engine is almost invariably hot. This, of course, is caused by the front engine kicking up a dust, which the rear engine gets, there being no way to protect the journals from the flying dust that the front engine has caused. The only remedy for this is to use oil freely. With reference to the quality of the lubricant, I do not think it makes so much difference in a car box, where packing can be used and where dust can be excluded, but in exposed places it is all important that good, heavy lubricating material should be used. If it is not used it is almost impossible to run without the annoyance of heated journals. While the figures might show, in comparative tables made for the purpose, that the cheap oil was doing the work for less money, the increased wear of journals and boxes is not, and in the nature of things cannot at all times be taken into the account. If it could be, there is no question in my mind but what the results given by the better lubricant would justify its use in all cases on a locomotive.

The question of the material for journals also enters into this matter. Some maintain that steel is the proper material for axles, and they cite the fact that it is a perfectly homogeneous material and is always free from seams and other imperfections, and consequently will wear longer and with less liability to heat. That I believe to be true. We are troubled a great deal, when we use iron axles, with the small seams that develop. These are produced when the axle is manufactured by reason of slag or other things getting into the pile and preventing a perfect weld. When the journal is turning it is impossible almost to discover these little seams. After a journal has been run a little and been heated and given trouble, take it out and examine it and you will find perhaps a seam an inch long, the little fellow that has been doing all the trouble. I have found these little seams in the crank pins. Keep it swimming in oil and still it will warm. To cure it we have taken an iron chisel and chipped a little groove, taken that little seam out, carefully tinning it over and filling it with Babbitt metal, and then smooth it off and the thing is cured; showing conclusively that the difficulty was entirely with that little seam in the surface of the pin.

Now with steel you get over that difficulty, but you run into another one. Steel is so fine in its texture and physical makeup, that apparently it does not lubricate as well as the iron. My observation is that steel axles, or a steel crank pin, will heat quicker than an iron one, provided the iron one is freed from these defects that I have described. Generally the reason I have heard given for this is that the material of which the steel pin is made is so much finer that the little cells in it are so small that they won't hold the lubricating material, while with the iron these cells are very much larger and hold the lubricating material, and the consequence is better lubrication.

Mr. ADAMS: I want to refer to another point which may be interesting. Perhaps you will not all agree with me on this, but I think it is an important point to all railroad men, particularly those in charge of the mechanical departments. I have found by experieuce that when a journal does get red hot, if you dash a pail of cold water onto it, it will invariably fracture the journal, and it will break off sooner or later just as sure as you run it.

Mr. LAUDER: As to this question of water on hot boxes, I don't take any stock in what Mr. Adams says about it. In the first place I don't think that is what breaks the journal. I think the journal is cracked by running when it is hot with an immense weight on it. A journal that is run till it is red hot, with such an immense weight on it as this, must necessarily spring badly, and that is what carries a little fracture all around. He is right when he says the journal is fractured clear around sometimes. If the box is jacked up so as to take the weight off the journal, I can see no earthly reason why cooling the journal off with cold water should harm it, providing it is not already cracked. It never has been my practice to run a journal that has been red hot. I take them out, no matter whether they look well or not. A journal that has been red hot should be removed at the earliest possible moment to avoid disaster.

Painting Car Roofs.*

BY J. H. PITARD.

There is considerable diversity of opinion as to the best method of painting new tin roofs. Some painters advocate, as a preparatory step, thorough cleaning with benzine in order to remove the palm oil in which the tin is usually dipped by the manufacturers to prevent rusting until used. Others recommend painting and varnishing the roofs in the same manner as the body.

The latter method, while no doubt durable, is rather more expensive than the requirements of the case would warrant, as the only condition that would seem to justify it is where it is desired to wash and clean the roof at terminals just as you would the body. But I dare say very few roads go to that trouble and expense. Therefore, a good hard-drying oil paint that would protect the tin from exposure, rust, etc., would seem to meet all the requirements in the case and would be much the cheapest in the end, as it could be renewed from time to time whenever the car returned to the shop to be revarnished at merely nominal cost. But its durability would depend upon the manner in which the first coat was mixed and applied, and the method that I have always found to insure the best results is as follows:

First scrape off all resin thoroughly; then take any kind of good mineral paint and mix to a semi-paste with boiled oil, and reduce this with turpentine. Prime the tin with this and allow three or four days, or longer, for drying. After this the succeeding coats should be mixed solely of boiled oil and mineral paint. As many coats as desired can then be applied without danger of blistering or other deviltries. By using this method it is not necessary to remove the palm oil before painting, as the turpentine in the priming serves a double purpose—that of penetrating the palm oil and causing it to unite with the paint, and also facilitating the drying of the priming coat to such an extent that its adhesive qualities are greatly increased, and no amount of natural heat will cause it to blister, which danger is always to be apprehended where the priming coat is mixed with oil alone.

The necessity for mixing the priming coat as described is made apparent when we consider that tin is non absorbant, and therefore to be durably painted the first coat should contain only sufficient oil to make it adhere well to the tin, as an excess of oil in the first coat would require weeks and perhaps months to dry with perfect adhesion. Flaking and blistering, which are so prevalent on some car roofs, could, perhaps, be traced in every instance to the fact that the principle above referred to was ignored in the application of the first coats.

A statement of the earnings of the Southern Pacific Company for the past 18 months, including only the business of the Pacific system as far east as El Paso, shows gross earnings of $52,000,000; operating expenses, $32,500,000. The number of men employed is 16,000, and the amount of wages paid was $20,000,000.

It is hard on a nervous passenger who has fought for a berth in the center sleeper of the train, fearing rear and head collisions, to wake up in the morning and find that all the cars behind his had been switched off to branch lines hours ago.

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* *From The Painters' Magazine.*

Railroading Sixty Years Ago.

(Report of the Superintendent of Graduation, Masonry, and Construction of the Baltimore & Ohio Railroad.)

OFFICE OF THE SUPERINTENDENT OF THE BALTIMORE & OHIO RAILROAD.
ELLICOTT'S MILLS, Md., Oct. 1, 1835.

To Phillip E. Thomas, Esq., President of the Baltimore & Ohio Railroad Company:

SIR: At the date of my last annual report, the graduation, masonry and construction of the Baltimore & Ohio Railroad, and of the lateral railroad to Washington City, were rapidly advancing. I have now the gratification to report that the operations on the Baltimore & Ohio Railroad, then in progress, have since been finished, and that the road was on the first day of December, 1834, formally opened for travel and traffic from the "Point Rocks" to Harper's Ferry; and that on the first day of July last the construction of the lateral railroad to Washington City had been so far advanced as to admit, on that day, of the passage of a locomotive engine, with a train of cars, over it very nearly as far as the north line of the District of Columbia, in the vicinity of Bladensburg, and on the 20th of that month was formally opened for travel to that line. Owing to a disappointment in the receipt of rails from England, the remainder of the line, extending from that point to the Pennsylvania avenue, in the city of Washington, and embracing a distance of about 5 miles, could not be prepared for use before the 25th day of August, on which day it was opened with appropriate ceremony, for the regular conveyance of passengers.

Graduation and Masonry of the Baltimore & Ohio Railroad.—The 6th Division of this road extends from the end of the 5th Division at the "Point of Rocks," on the left bank of the Potomac River, to the bridge of the Messrs. Wager, across that river at Harper's Ferry. The first two miles and ten poles around the Narrows, occasioned by the lower and upper Points of Rocks, and the last two miles, beginning east of Miller's Narrows, and extending along those and Harper's Ferry Narrows, to the bridge at Harper's Ferry, were graduated for the reception of the railway, by the Chesapeake & Ohio Canal Company. The graduation and masonry of the intermediate space, comprehending a distance of eight miles and 119 82-100 poles, were generally commenced about the 15th of July, 1834, and were so rapidly prosecuted that the completion of the railway upon it was effected by the first day of the December following. The quantity of earth removed and supplied, inclusive of rock, on this intermediate space, was 150,224 cubic yards, at the gross cost of $58,993.34, exclusive of contingencies, but inclusive of grubbing, clearing and transportation; or at an average cost per cubic yard of 39 27-100 cents, or of $42.21 a pole lineal, and of $13,508.08 a mile.

This large quantum of masonry is partly contained in a very great number of gothic and common culverts, and a few detached walls, but much the larger portion of it in the following described bridges, all of which were designed by my late intelligent and energetic assistant, Mr. Robert Wilson, except the Carrollton, the Patterson and the Oliver viaducts, which were designed by myself, and that, with a superstructure of wood across the Monocacy River, which was designed by Mr. Lewis Wernwag, its enterprising contractor, viz., the "Carrollton viaduct," over Gwynn's Falls, of two arches of 80 and 20 feet chord respectively.

The "Patterson viaduct," of four arches, two of 55 feet and two of 20 feet chord respectively built across the Patapsco River.

The "Oliver viaduct," of three arches, of 20 feet chord each, over the Frederick turnpike road and Ellicott's branch.

The bridge across the Monocacy River, of three spans of 110 feet each.

One across the greater Catoctin Creek, of two arches of 50 feet chord each.

One over the Frederick turnpike road, and a contiguous branch near Parrsville, of 2 arches of 20 and 10 feet chord, respectively.

One across the West Fork of the Patapsco River, near Marriottsville, of one arch of 40 feet chord.

One across Ballinger's Creek of 1 arch of 30 feet chord.

Four of 1 arch each, of 25 feet chord, viz.: Across Gadsby's Run, Gillis' Falls, Bush and Israel's creeks.

Seven of 1 arch each, of 20 feet chord, viz.: Across Gwynn's Run, Robert's Run, Caton's Branch, a branch opposite the Union factory, Piney Run, the Tuscarora and lesser Catoctin creeks.

One of 20 feet span, superstructure of wood, over the Frederick and Georgetown turnpike road.

One of 1 arch, of 15 feet chord, across Dorsey's Run, near the Avalon works.

One across Clagget's Branch, of 15 feet span, superstructure of wood.

Three of 1 arch, of 14 feet chord, viz.: Over Warfield's Road, Davis' and Marriott's branches.

Nine of 1 arch each, of 12 feet chord.

One of 12 feet span, superstructure of wood, and four of 1 arch each, of 10 feet chord.

Bridge Across the Potomac River at Harper's Ferry.—This heavy work has very recently been put under contract. It is expected that it will be completed within one year. The contractors are, Charles Wilson, for the masonry, and Lewis Wernwag, for the superstructure of wood, both of whom are well known to the company as contractors of skill, energy, and fidelity.

Construction of the Baltimore & Ohio Railroad.—As soon as practible after the superintendency of this branch of the service of the company was confided to me, measures were adopted to obtain a supply of the requisite materials for the construction of a single track of railway from the "Point of Rocks" to Harper's Ferry, and for such parts of a second track as were indispensable as passing places. It was found very difficult to obtain a supply in the short time it was desired. The greater portion of the string pieces are of yellow pine, procured in North Carolina, and partly conveyed by the Chesapeake and Ohio Canal from Georgetown, and partly by the railroad from Baltimore to the "Point of Rocks." The sleepers were procured in the immediate neighborhood of the work. The horse path was paved in such places where the railway was in contact with other roads, and particularly in the street of Berlin, at Weverton, and at Harper's Ferry Narrows, at which latter places its site is also that of the Frederick and Harper's Ferry turnpike roads. The remainder was macadamized in the best manner, with stone of the hardest quality, reduced to particles not exceeding four ounces in weight. Twelve miles and 119 5-10 poles of first track, and 295 80-100 poles of second track and 10 turnouts were laid, at a gross cost of $47,353.49, inclusive of the cost of all materials (except the prime cost of the rails), their inspection, transportation, distribution, etc., and of the cost of the horse path, superintendence, and of all other contingent expenses, which is an average cost of $3,561.25 a mile. But the prime cost of 22 tons of rails, the quantity used on a mile, at $45 a ton, or at $990 a mile, must be added to $3,561.25, which shows the actual cost per mile to have been $4,551.25, inclusive of the cost of nearly, if not all, the turnouts which will be necessary when the second track shall have been laid continuously throughout the whole line. The horse path cost at the high rate of $783.12 84-100 a mile, owing to the inconvenience of obtaining stone of suitable character, and the rapidity with which the work was executed. The second track may be laid at a less average cost.

The graduation of the first division was commenced generally about Oct. 10, 1833; that of the second and third, and first section of the fourth about Jan. 20, 1834; that of the second and third sections of the fourth division about Jan. 1, 1835, and that of the city division about May 1, 1835.

Three of the most difficult and expensive sections of the second division, viz., the first, fourth and eighth, were placed under the management of agents of the company.

With the exception of the "Thomas viaduct" across the Patapsco River, the masonry generally commenced simultaneously with the graduation of divisions. That stupendous structure was begun on July 4, 1833, and completed by the energetic contractor, Mr. John McCartney, of the State of Ohio, on July 4, 1835. The beautiful and imposing design of that viaduct was furnished by B. H. Latrobe, Esq., civil engineer, and the designs of all the other structures on this road were prepared by my assistant, Mr. Robert Wilson, who superintended the construction of all the masonry. The whole quantum built is shown by the last table referred to to have been 46,906¾ perches, of 25 cubic feet to the perch, at a cost of $275,167.21, or an average cost per perch of 5.86^{82}_{100}$.

Construction of the Lateral Railroad to Washington City.—The length of single or first track of railway which has been laid is 30 miles and 107$^{57}_{100}$ poles. There has also been laid of second track a distance of 5 miles and 130$^{43}_{100}$ poles The aggregated length of first and second track is then 35 miles and 238 poles. These railways were partly formed of scantling and partly of logs. Of the first track, or continuous railway, 17 miles and 175 poles were constructed with scanting and 12 miles and 252$^{57}_{100}$ poles were laid with logs; and of the second track, 4 miles and 245$^{97}_{100}$ poles were formed of scantling and only 204$^{46}_{100}$ poles of logs. The scantling track is a little more costly than that made of logs, but is greatly preferable and believed to be more durable. It can, in the first instance, be more accurately constructed, and when out of repair is more easily adjusted than the log track. Besides it does not so frequently get out of adjustment, because of the greater perfection of its system. With the exception of a short piece in Washington the second track is only laid through the several deep cuts, where it answers the purpose of passing places for the cars, and at the same time affords great facilities in keeping the road clear of the avalanches to which the deep cuts are liable.

The entire first track is laid with a deep or edge rail, except that part extending from North Capitol street to Pennsylvania avenue in Washington. Of the second track 300$^{6}_{10}$ poles on the second division and 248$^{7}_{10}$ poles on the fourth division are laid with flat rails, such as are used on the Baltimore & Ohio Railroad; all the remainder of the second track was laid with the deep or edge rail. Where the flat rail was used (and it was only used because there was not a sufficient supply of the edge rail), small strips of scantling, 4 × 2 inches, were first spiked to the scantling which had been laid for the reception of the edge rail. These strips were necessary to allow the rail to be laid over the center of the scantling beneath them, and also to make up the disparity in depth or thickness between the two kinds of rail. It is found to make a very good railway. They can be easily removed when a further supply of the deep rail is obtained, if it should be then thought expedient to do so.

The whole cost of these 35 miles and 238 poles of railway thus laid, and of 12½ turnouts, including the cost of lumber, chairs, screw bolts, spikes, and the cost of all other material (except the prime cost of the rails), inspection, transportation, distribution, workmanship, superintendence and all other contingent expenditures, has been $156,627.86, being at the rate of $13.69⅛ a pole lineal, or of $4,381.96½ a mile. In the above amount the sum of $5.707.43 expended for suitable implements, sheds, and workmanship necessary to straighten the rails and dress their ends is included. The prime cost of the edge rail is assumed at $50 a ton, and 63 tons are estimated to the mile, which makes $3,150 a mile as the prime cost of the rails of a single track. This sum being added to the above gives $7,531.93½ as the entire cost of a mile of single railway on this road, inclusive of the cost of 12½ turnouts, are, for the whole distance which has been laid, viz., 35 miles and 238 poles, the gross sum of $269,220.67.

On the remainder of the second track fewer turnouts will be required than have been inserted; the transportation of the materials will be done chiefly on the railroad, and, of course, cheaper; the graduation which the contractors of the first track were required to perform, will be dispensed with altogether. It may be, therefore, assumed that the construction of it will not cost as much as the first, by at least the sum of $531.96⅛ a mile, leaving as its actual cost the sum of $7,000. The remainder of the second track is in length 24 miles 297$^{14}_{100}$ poles, which at $7,000 a mile will cost $174,499.93¾. This sum being added to the cost of that already constructed, viz., $269,220.67, gives the gross sum o $443,720.60 as the total cost of two continuous tracks of railway, from the Baltimore & Ohio Railroad to the Pennsylvania avenue, in Washington, a distance of 30 miles 107$^{57}_{100}$ poles.

The estimate for two more tracks as far as the New Jersey avenue, about one-quarter of a mile short of the distance to the Pennsylvania avenue, was $432,780.05. The actual cost will therefore probably exceed the estimate, about the sum of $10,940 67. From this excess it would be proper to deduct the cost of straightening the rails, and dressing their ends, an expense not contemplated when the estimate was made. Without, however, subtracting anything on this account it will be found that when the excess of cost in this case, viz., $10,940.67, be subtracted from the excess of estimate over the actual cost of the graduation and masonry before shown to be $67,943.71, the actual cost of all the work has fallen short of the gross estimated cost, the sum of $57,002.44; and if but a very moderate allowance be made for the excess of distance actually constructed over that estimated, it may very reasonably be assumed that the whole actual cost of the road will be less than the whole estimated cost, by the sum of at least $60,000.

Expenditures.—The whole amount expended by me in the service of the company up to this date, and which has been regularly and duly accounted for, has been two millions, four hundred and ninety-one thousand, six hundred and thirty-eight dollars and thirteen cents. This large sum has been applied as follows, viz.:

To the graduation of the Baltimore & Ohio R. R.....	$863,140 74
To the masonry on ditto.....	372,497.01
To the payment of the contingent expenses incurred on account of the graduation and masonry, viz., superintendence, instruments, advertising, etc., etc.....	$40,396.44½
	$1,276,031.19½
To the payment of the right of way and damages generally on that road.....	$26,417.02¾
To the construction of the sixth division of said road, viz.:	
Materials, distribution, etc.....	21,043.56
Workmanship.....	14,531.10
Horse path.....	10,413.03
Contingent expenses.....	1,365.80
	$47.353.49
To the repairs of that road for the six months that that branch of the service was under my superintendency.....	11,647.66
Total expenditure on the B. & O. R. R.....	$1,361,452.37¼
To the graduation of the Lateral Railroad to Washington City.....	664,590.08
To the masonry on ditto.....	275,167.21
To the contingent expenses, incurred on account of the graduation and masonry, viz., superintendence, instruments, advertising, etc., etc., etc.....	$19,475.93
	$959,173.22
To the construction of said road, viz., materials, distribution, etc.....	109,183.43
Workmanship.....	37,108.99
To contingent expenses, viz., superintendence, advertising, etc., etc., etc.....	10,335.44
	$156,627.86
To repairs while under my superintendency.....	3,502.98
Total expenditure on the Lateral R. R. to Washington.....	$1,119,304.06
Total expended on the graduation, masonry, construction and repairs of both roads.....	$2,480,756.43¼
Expended in the purchase of sundry tools, lumber, etc., etc., which were afterward delivered to other officers of the company.....	10,881.69¾
Total expenditure in the service of the company.	$2,491,638.13

An examination of the preceding statement will show that the contingent expenditures on the whole work which has been executed under my direction have not amounted to three per cent. on my other disbursements.

It is very gratifying to me to be able to state that, although the operations of my department have been very extensive for the last two years, no loss, to my knowledge, has occurred to any of the mechanics or laborers employed on the different works, except in a single instance, where a few laborers in the employment of a sub contractor lost a small portion of their wages.

The following extract from my report of 1832 may, with great propriety, form a part of this. The subject is a very important one.

The regulation prohibiting the use of ardent spirits, first adopted with your sanction in 1829, has been steadily and rigidly adhered to, and has had, I am confident, a very beneficial influence upon the work. The contractors so generally acquiesced in this regulation, and complied with this stipulation of their contract so faithfully, that I had only in a single instance to perform the unpleasant duty of dismissing one of them from the service for an infraction of it.

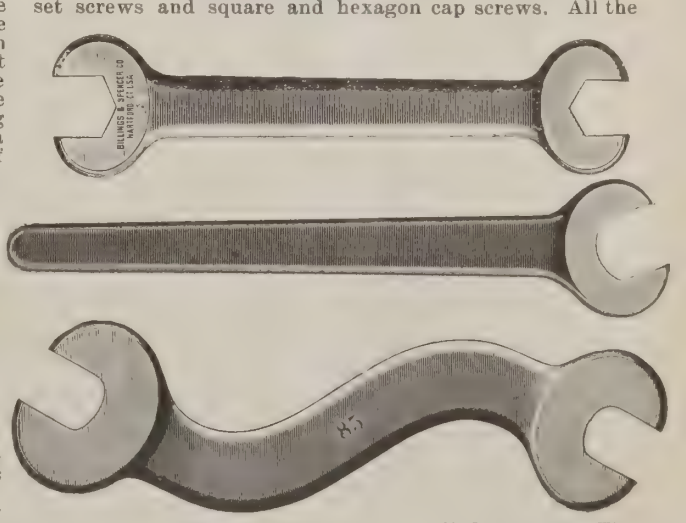
I cannot, however, refrain from again calling your attention to the fact, that licenses are so cheaply and so easily obtained in this State, where the sale of them appears to be only for the purpose of revenue, that grog shops became very numerous in the immediate vicinity of the line, and were highly prejudicial to the laborers, to the contractors, and to the progress of the work; and my opinion remains unchanged that a legislative enactment preventing the vending of ardent spirits within a specified distance of public works could not fail of producing good effects, or rather of preventing much evil."

It is with great regret that I have to state that Jonathan C. Price, a young man of most amiable deportment and of high promise in his profession, died whilst in the service of the company. and not long after he entered it, much lamented by those who enjoyed the pleasure of his acquaintance.

Respectfully submitted,
CASPER W. WEVER.

Drop Forged Steel Wrenches

The wrenches illustrated herewith are samples of those manufactured by the Billings & Spencer Company, of Hartford Conn. This company manufactures straight and angle end and single and double end and S wrenches for the use of machinists and engineers. They are drop forged of steel, and are made for United States standard size nuts, and for set screws and square and hexagon cap screws. All the



wrenches made by this company have milled openings. The straight double end wrench shown is made for United States standard nuts for bolts ⅛ inch to 2¼ inches in diameter. The 15-degree angle end wrench shown is made for standard nuts for bolts from ⅛ inch to 2¾ inches diameter, and the double end S wrench shown is made for square head set screws and square and hexagon head cap screws.

The offices of the Kinsman Block System Company have been moved to the Central Building, 143 Liberty Street, New York City.

The local newspapers along the line of the Canadian Pacific road are loud in their praise of the improvement in the heating of the passenger trains on that road since the adoption of the Consolidated Car Heating Company's commingler system.

Messrs. Thompson & Inness, of 115 Broadway, New York City, will hereafter represent the car-wheel works of A. Whitney & Sons, of Philadelphia. Messrs. Thompson & Inness will be prepared to give all the information desired relative to wheels, axles and castings from these works.

Messrs. N. & G. Taylor & Co., of Philadelphia, are the sole agents for the manufacture of the Baker punch. The tool is intended for sheet iron workers. It will do all kinds of punching on tin and sheet iron, making a clean hole with one stroke of the hand lever. It will punch up to No. 9 sheet iron, and 15 inches from the edge, or in other words to the center of a 30-inch sheet.

Air-Brakes and Their Maintenance.*

BY GODFREY W. RHODES.

I shall invite your attention to some of the defects brakes are subjected to, and to some of the remedies that have been suggested for their better maintenance. On the line which the writer represents many investigations have been made as to brake defects and their cause during the last twelve months. One that has given considerable concern is the amount of dirt that works its way through the pipes to the triple. Exhibit 1 shows 36 of the thimble triple screens recently obtained from two of our repair shops for the purpose of illustrating this report. You will observe they are mostly filled solid with rust, cinder, scale and oil. Some have pieces of coal, another a sliver of wood, another a piece of iron 2 inches by 1⅛ inches, and ⅛ inch thick, still another has a part of a hose gasket squeezed into it. Two not only had dirt in them, filling the screen, but also filling a portion of the pipe. Two extensions have been applied to the screens to hold the dirt in place. These screens are taken principally from C., B. & Q. cars. Among them are some from other lines, viz.: Pennsylvania Railroad, Delaware, Lackawanna & Western and the Merchants' Despatch Transportation Company.

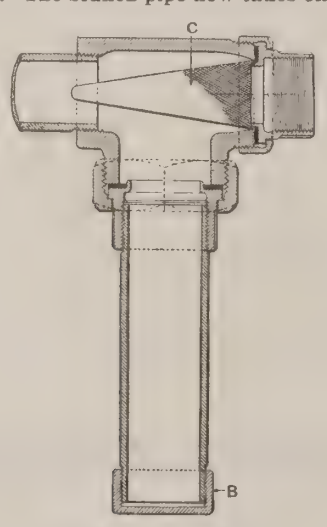
Perhaps a little the worst case that we have ever had our attention called to is that of Exhibit No. 2, which was taken from a Burlington & Missouri box car. The screen is in good order, but solid with dirt and rust. This handful of black, rusty-looking material is not coal or gravel, but an agricultural product. It is corn, probably from the State of Nebraska, and was found in the branch pipe immediately outside of the screen. Exhibit 3 is a short bottle 2 inches in diameter and 2 inches high. It is filled with rust and scale which was jarred off the inside of 8 feet of pipe removed from a refrigerator car. Piping on refrigerator cars is more susceptible to rust than on ordinary box cars, and should receive more attention. Exhibit 4 shows short samples of this pipe. It is 1 inch in diameter, and they are tough-looking samples, in some places being almost rusted through. It may be that for refrigerator cars a galvanized pipe would be the best thing to use. Exhibit 5 is a 2 inch by 2-inch bottle filled almost full with scale taken from 16 feet of new 1¼-inch pipe after it had been bent and hammered and was ready to apply to the car. All new pipe, after being bent, should be carefully tapped with an old bolt or hammer, and afterward tipped on end so that all loose scale may be removed. Before the triple valve connection is made the pipes should be blown out with air pressure. This detail in new car construction is very apt to be overlooked by builders.

These five exhibits would seem to point out strongly:

1st. It is very essential to have screens both at the triples and in the main train pipe.

2d. Having applied the screens, it is equally essential that they should be properly maintained and that the dirt they have collected be removed.

Those who have designed brakes have made provision to readily remove any water which may collect in the pipes, but it is doubtful if the presence of such quantities of rust and dirt was expected. That it was expected the pipes would collect some dirt is clear from the presence of the screens and from the provision of a dummy coupling for the uncoupled hose. It is gratifying to know that these matters are receiving more consideration at the present time. Already our attention has been called to several suggestions. One very good one is that the branch pipe from the main train pipe should connect with the top of the drain cup in place of the bottom. The branch pipe now takes off directly from



Pocket Dirt Collector.

the bottom. If the screen is imperfect or worn out this allows any dirt lodging in the bottom of the cup to drop into the branch pipe. A connection from the top or top side of the cup would remedy this.

A very practical attachment is shown in the above cut. It is constructed of ordinary gas pipe fittings, which can be put together for a very small sum of money, and placed immediately under the main train-pipe screen or the triple-valve screen. The pocket has a cap *B* screwed on the bottom. This pocket is screwed immediately under the screen *C* that it is desired to collect dirt from. The shape of the screen is necessarily changed. As grit and dirt grate against the screen it drops into the pocket away from the air passages. One feature of the attachment is that when the pocket is removed to be cleaned, or for other purpose, the screen can be thoroughly inspected without disturbing the pipe connections.

Three of these devices were placed experimentally on a three-car branch passenger train, running over a gravel-ballasted roadbed, and during the dry summer months collected a lot of dirt which, from time to time, was removed. Exhibit 8 shows three small bottles of dirt collected in this collector during a short test in the fall of '93. The first two bottles contain the dirt collected in 35 days, and the third in 52 days. The third bottle, it will be noted, contains three times as much dirt as the other two. It was on the last car, and the hose was hung in the dummy coupling at all times. The contents are a fine, light-colored sand or gravel, and some dried grass. The contents of the first and second bottles are entirely different. They indicate a fine black powder, doubtless also sand, but more mixed with the scale of the pipe, and less in total quantity. This is exactly what one would expect, viz., that if the dirt is collected from outside, in a case like the three-car train under consideration, where the cars occupy a uniform position, the outside dirt must come in chiefly through the last hose when the cars are switched, and the last triple will consequently get the bulk of it.

It has been claimed by some that this test shows clearly how imperfect a device the dummy coupling is, and that the hanging up of the hose for the purpose of keeping dirt out of the train pipe is not successful; that the dummy coupling is such a flimsy one that, in its hung up position, dirt drops in and falls down the hose, remaining there, whereas, if the hose were allowed to trail or hang down, sand and dirt would have to fall up the hose. We believe the best solution of this question is to automatically close the couplings by hand against dirt when they are uncoupled; failing this, some more convenient way of removing the dirt that collects in the pipes is imperative. Hanging the hose in the present dummy coupling as a remedy is open to much criticism.

Many of the triples, even with this dirt, will work in a fairly satisfactory way, just as the old automatic air-brake did when it was customary to pack the train pipe drain-cup with sponge through which to filter the air. To probe into this question further, the following auxiliary reservoir charge tests were made: First, we got some sand, fine coal and iron rust, and having pounded it well together filled a triple screen as full as we could get it and connected up the pipe. On charging the reservoir, rather to our surprise, we found that the time occupied only exceeded that with a perfectly clear screen by nine seconds. We next soaked the mixture thoroughly with water, then with black oil, and finally put in a new screen. The result of the different tests is as follows:

Test No.	Condition of triple screen.	Time in seconds charging reservoir to 70 pounds.
1.	Dry sand, pounded iron, rust and coal	77 seconds
2.	Ditto, except that the mixture was soaked in water before the screen was filled	98seconds
3.	Ditto, except that the mixture was soaked in black oil before the screen was filled	112 seconds
4.	A new and clean screen was used in this test	68 seconds

All tests were made with a constant pressure of 95 pounds in the train-pipe, and the time was recorded in seconds from commencement of the charging at a zero point in the reservoir till 70 pounds was reached.

The same triple, which was a new one from the storehouse, was used in each of the above tests. After test No. 4 the triple valve was opened and examined. As much as one teaspoonful of dirt was found in the drain cup, and a little fine sand and rust about the triple valve.

There is nothing mysterious about the above test; the charging of the reservoir is through a feed opening in the triple which is hardly $\frac{1}{16}$ of an inch in diameter. The screen may, therefore, almost be choked full and yet have an opening equivalent to that of the feed groove.

Exhibit 10 is the lower portion of three New York No. 1 triples which were probably put in service without screens in the train pipe drain cup. They had triple screens which have not been disturbed. They are practically plugged full of dirt. These were subjected to the test just described, with the following result:

Test No.	Triple.	Time Charging Reservoir to 70 lbs.
5	1	4 minutes 25 seconds
6	2	3 minutes 55 seconds
7	3	3 minutes 22 seconds

A further interesting feature of tests 5, 6 and 7 is that in each case the brake was readily set and released in service application, notwithstanding the presence of the dirt; no emergency feature, however, developed.

A Westinghouse quick action triple was taken off a C., B. & Q. refrigerator car on account of being out of order. An examination showed the screen to be all right, though somewhat coated with rust. Without taking the triple apart it was subjected to a charging test, with the following result, the test being made under the conditions already described:

Charged from 0 to 20 pounds in 5 minutes
" " 0 to 38 " 10 "
" " 0 to 52 " 15 "
" " 0 to 66 " 20 "
" " 0 to 70 " 23 "

This, of course, was very unsatisfactory, and, we will show later, was not as good as charging through a block of pine wood. The triple valve was then taken apart, and it was found badly gummed up and corroded, the feed groove being almost closed with dirt. The packing ring was wiped off and the feed groove opened up by pushing the point of a pencil through it, the whole job occupying about five minutes. The valve was put together again and another test made. This time the reservoir was charged to 70 pounds in 65 seconds.

Test No.	Kind of wood.	Disc No.	Pressure in aux. reservoir.	Time.
1	Red Oak	1	8 lbs.	1 min.
			18 "	2 "
			28 "	3 "
			38 "	4 "
			45 "	5 "
			49 "	6 "
			52 "	7 "
			53 "	8 "
			54 "	9 "
			55 "	10 "
2	Pine	1	29 lbs.	1 min.
			49 "	2 "
			64 "	3 "
			70 "	3 " 38 sec.
3	Red oak	2	23 lbs.	1 min.
			48 "	2 "
			68 "	3 "
			70 "	3 " 10 sec.
4	White oak	1	0 lbs.	1 min.
			0 "	2 "
			2 "	3 "
			10 "	4 "
			12 "	5 "
5	White oak	2	0 lbs.	1 min.
			0 "	2 "
			3 "	3 "
			8 "	4 "
			12 "	5 "
6	White oak	3	0 lbs.	1 min.
			2 "	2 "
			7 "	3 "
			11 "	4 "
			14 "	5 "
7	Pine	2	34 lbs.	1 min.
			60 "	2 "
			70 "	2 " 40 sec.
8	Pine	3	28 lbs.	1 min.
			53 "	2 "
			68 "	3 "
			70 "	3 " 12 sec.
9	Red oak	1	11 lbs.	1 min.
			19 "	2 "
			24 "	3 "
			29 "	4 "
			32 "	5 "

NOTE.—An examination of the disc revealed the fact that the air was heavily charged with moisture. Before any further tests were made all water was thoroughly drained from the air reservoirs. The disc, five days after the test, still showed the moisture driven into it. Pressure in train-pipe, 95 pounds.

In discussing the results of charging the auxiliary reservoirs through screens filled with dirt, it was suggested that air could be forced through wood. To determine this point some pieces of well-seasoned pine, white oak and red oak were procured, and being turned to a given diameter, were sawed into discs, across the grain, of a uniform thickness of ¼ of an inch. These discs were placed in the train pipe connection to the triple valve between two gaskets resting against the faced bearings. The conditions of the test were similar to those already made. The results were as shown in the following table:

An interesting fact in the above tests is that in each of the pine and red oak trials the brakes could be set and released in service, notwithstanding the presence of the wooden block, but the emergency valve would not work. In the white oak tests the brake would not work at all. The triple used was the Westinghouse quick action. In car construction red oak is not infrequently substituted for white oak. Inspectors have difficulty at times in discerning between the two, notwithstanding the fact that one is such a very inferior lumber. The difference in porosity of the two grades, as determined by these tests, might at some time be made use of by lumber experts in settling disputes.

Dirty triples will, of course, largely detract from the brake's principal use, that of stopping trains. Neglect of this matter may entail other expenses on a railroad, as the following instances will show: Recently a C., B. & Q. coal car fitted with air brakes came into a station with every wheel slid flat about 4⅛ inches. On taking down the triple it was found that when the piston was driven down so as to give a full opening, it was so rusted and clogged up with dirt that it stuck and the brakes could not be released by the engineer. The train being long, 48 cars, the stuck brakes were not discovered till the train came into the station. The same fault is liable to occur with any of the present modern triples that are neglected. This is to say, a connection will be made in releasing brakes between the train-pipe and the cylinder when there should only be one between the train-pipe and reservoir. Last month at one of our division terminals our attention was called to a somewhat similar case, where three air-brake cars were cut out of a train on account of slid flat wheels. The pistons were so gummed up that after application they would not work back. All the cars had screens in the train-pipe drain cup and at the entrance to the triple.

Another feature which requires a good deal of attention is the rubber seat of the emergency valve in the quick action triple. Here are some 40 seats that have been removed from triples lately overhauled at our shops. A leak past the emergency valve lets the train-pipe air into the cylinder and to the atmosphere through the leakage groove and pressure-retaining valve. The fault is usually discovered by air blowing through the pressure retaining valve. Most of the seats are soft and pulpy. This is especially noticeable when they are first removed, and is caused by the oil from the cylinders getting to them. Just how long these emergency valve seats will remain in working order we cannot say. In order to better determine this, we have placed a number of new valve seats in some of our suburban cars, and expect to take out a certain portion of them every two months until we arrive at their failing point. We have 11 seats which we have an approximate record from, as follows:

Suburban coach.	Length of time in service. Months.	Days.	Condition.
33	..	14	Very good.
226	4	15	Very good.
694	5	15	Getting bad.
213	6	10	Very good.
205	7	..	Fair.
193	8	4	Fair.
187	9	..	Fair.
223	10	4	Good.
224	10	15	Fair.
180	10	25	Getting bad.
221	11	23	Getting bad.

Each one of the seats was put in new when the cars were in the shop undergoing repairs and had the triple valves overhauled.

There are other brake failures to guard against, such as cylinder packing blowing, pipes and hose bursting and leaking, branch pipe breaking at triple, besides failure of the regular rod and lever connections, the details of which we will not now go into.

The result of these investigations caused a good deal of concern, and the question has arisen that in case we had appropriations for brake fixtures, how could it be most profitably expended, viz.: in purchasing new brakes, or in rendering effective those which have already been purchased? Some of our master mechanics and road foremen estimated that as high as 20 per cent. of the air brake equipment passing over our line was either inoperative or not being used.

Special attention was then directed to the matter by the superintendents, and all defective brakes were reported. Records were taken by careful men showing for the week ending Dec. 16, in Illinois, in six trains out of a total of 171 air-brake cars, 32, or 18⅞ per cent., were cut out. A record taken in Iowa is, perhaps, more accurate. It shows, in seven trains examined, 12 cars cut out from a total of 88, or about 13⅟₂ per cent.

The Atchison road reports that some years ago they had much the same experience, and that it was not unusual in a train of thirty air-brake cars to have ten (or about 33 per cent.) cut out, but that, since the establishment of air testing and repair plants at terminals throughout its system, the difficulty has been almost entirely removed. The most efficient way they have found in handling defective triples is to carry at air inspection points a supply of triples in good order. These are quickly exchanged for those out of order and the car allowed to proceed on its way.

The Southern Pacific, Union Pacific and Northern Pacific railroads report a much less per cent. as defective, and their rules provide that when a brake on a freight car is cut out and allowed to run in service it should have a card stating what the defect is.

From what has been written, it will be seen that when railroads decide to introduce air-brakes under their freight equipment the extra expenditure of money must not be allowed to rest there. Much has still to be done in providing proper facilities and issuing systematic instructions for maintaining them. Further, that with a limited number of brakes on any given equipment an expenditure in the line of making provision for their maintenance may be more effective in actual number of brakes used than the purchase of additional brakes.

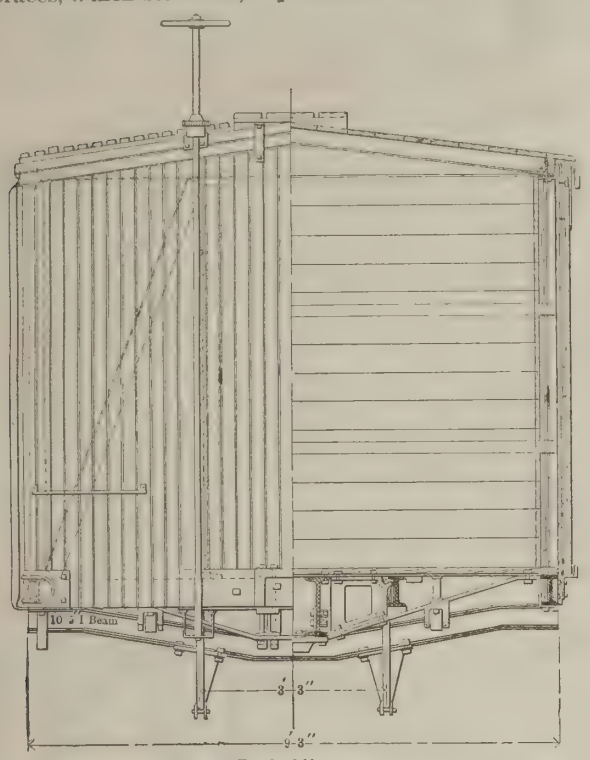
It is confessed that in these days of forced curtailment in expenses the amount of additional work that modern requirements and State enactments impose upon railroads, has been viewed with considerable dismay. The accepted theory is that devices popularly coming under the head of "safety appliances" diminish the cost of operating. The hard fact remains that it costs more to live in a finely equipped mansion than in one that is less pretentious, so it is in cost of maintaining rolling stock. Those who guide the financial affairs of railroads well know that it costs more to maintain a modern sleeping car than a chair car, more to maintain a chair car than a plain day coach, and more to maintain a freight car fitted with modern safety appliances than one without them. If those who bring about such requirements also made the returns for their service commensurate with their additional cost, there would be less anxiety for the final results.

The Madison Car Works Company's plant at Madison, Ill., is soon to be reopened after an idleness of over eight months, thus giving employment to over 400 men.

* Read at the January meeting of the Western Railway Club.

Harvey Steel Box Car.

In our issue for December, 1893, we illustrated and described the steel gondola car made by the Harvey Steel Car and Repair Works, of Harvey, Ill.; and also the truck used under the different forms of steel cars made at these works. In this issue we give space to cuts illustrating the steel box car mentioned in that issue, and a description of which was then given. As before stated this steel car is about 10 per cent. lighter in weight than a wooden car of the same capacity, while it is claimed to be more durable and cheaper to maintain. The side and intermediate sills are 6-inch steel I-beams, 13 pounds to the foot; end sills are 6-inch I-beams, 15 pounds; center sills of 12-inch I-beams, 28 pounds; needle beams of 5-inch I-beams, 10 pounds; bolsters, top plate 10 by ½-inch steel, bottom plates 10 by ¾-inch Glendon steel; side and end plates, door and corner posts, 3½-inch steel tees; carlins, posts and braces, 3-inch steel tees, 6 pounds to the foot. All rods,



End View.

bolts and bars are of Glendon steel. All sections and shapes are standards, and obtainable for repairs. No intricate or unused forms are used in the combination of parts. There is not a piece but what can be shaped over a blacksmith's anvil in an emergency of repairs. Bolts are used in putting together parts usually necessitating repairs. The parts are claimed to be fewer in this car than in the standard cars of the leading railroads, and any part can be removed for repairs as readily as with wood. All molded parts are malleable casting or pressed steel, except journal boxes and bearings. Center bearings, draft stops and corner plates are Schoen pressed steel.

The center sills being 12-inch I-beams, give a vertical strength more than double that of the usual wood construction. The end sills being 6 inches deep, and the center sills 12 inches, one-half of the center sills are cut away at the ends, and project below the end sill and deadwood to the face of the latter. The inside lower flange is cut away enough to receive the pressed steel draft stops, forming a shoulder, back and front, for the latter.

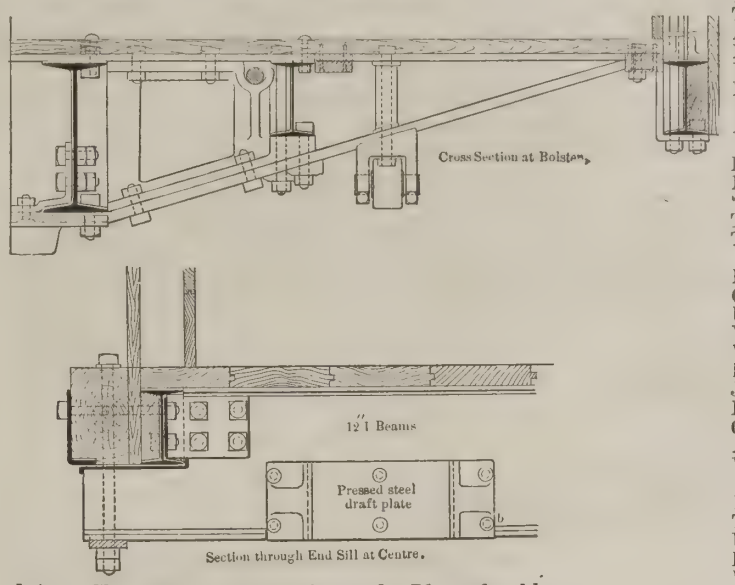
To prevent the driving in of the end sill, in case the drawbar is broken or other causes, a steel plate is riveted to the lower inside flange of the end sill. A lip is turned up behind the end sill and down in front of center sill. This combination makes a very strong draft arrangement, and it is arranged so that double springs in tandem can be used when desired.

In order to add depth between the floor and roof without increasing the height, no nailing pieces are bolted to the top of sills to nail flooring to. The floor is laid on the sills and bolted with flathead bolts, 12 inches apart. For convenience when removing a sill for repairs, this is better than nailing in the old way.

Three cross-tie rods to bind the sills together are used at intermediate points between bolsters and needle beams. Gaspipe is used for spreaders between the sills. The needle beams are shaped to fit the difference in depth of the center and side sills. The upper frame is composed of tees. The side and end plates are tees inverted. There are 12 carlins of 3-inch tees bent to shape of roof. The end of carlins rests on inside flange of side plates fastened with two ⅝ inch bolts; the end plates are fastened to the side plates in the same way.

There are two longitudinal truss rods, 1¼-inch steel, with 1½-inch ends, connected with turnbuckles at the center. Two rods are considered sufficient. They are placed inside of the intermediate sills. The side frame bracing is sufficiently strong and rigid to prevent any deflection of the sides. To hold the posts and braces in their places on the sills and plates, malleable iron pockets are used.

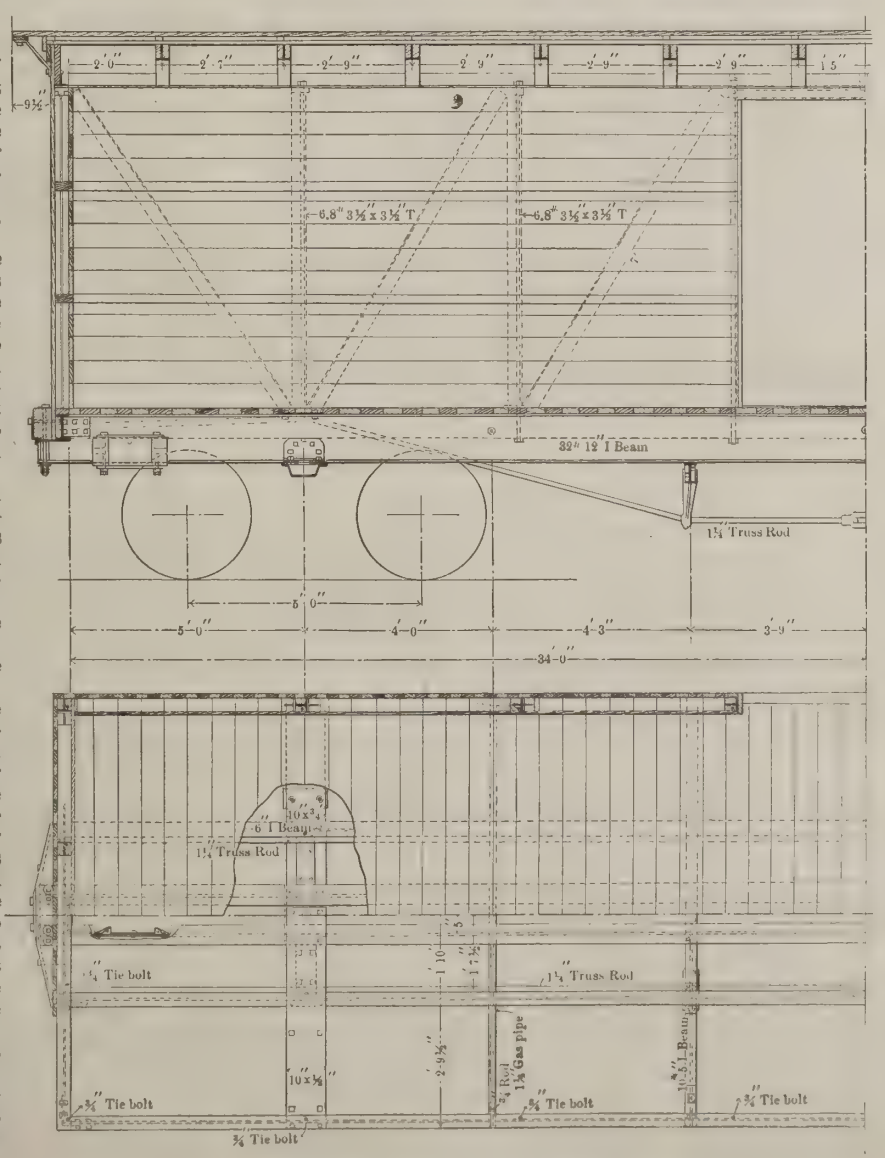
Matched siding is used, as on wooden cars. To fasten same, pieces of yellow pine are used on the sills and plates, and belt rails are employed. This is a strong point in repairs; in case a sill is bent, buckled or broken, and necessitates removal, it is not necessary to remove or cut the siding, but simply to remove the nuts that hold the nailing pieces in place, and spring the siding to clear the sill. This is applicable to all parts when nailing pieces are bolted to the steel, to nail siding, roofing or lining to. The roof boards are laid longitudinally and nailed to yellow pine nailing pieces bolted to rafters and end



plates. Sheet steel roofing is used. If preferable, corrugated or smooth sheet steel can be used for siding. The inside is covered with pine sheathing to the roof, making a perfect protection from moisture or sweating, liable in metal construction. The car is equipped with improved roller side bearings.

The Lunkenheimer Company, of Cincinnati, O., has issued a pamphlet showing photographic views of a six-inch screw gate valve and the "Lunken" renewable seat gate valve, which is one of the latest specialties of this company, and which was fully illustrated and described on page 153 of the September (1893) issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER. On account of the practical construction of the "Lunken" gates, comparison shows that they are simpler, stronger, more compact, and in proportion much heavier than the most expensive, and lower in price than the cheaper gate valves on the market.

The American continuous drawbar has been specified for the following new rolling stock: 1,000 cars for Louisville, New Albany & Chicago; 500 for the Lake Erie & Western; 800 for the Baltimore & Ohio Southwestern; 1,200 for the Baltimore & Ohio, and 1,000 for the Choctaw Coal & Railway Co.



PLAN AND SIDE ELEVATION.

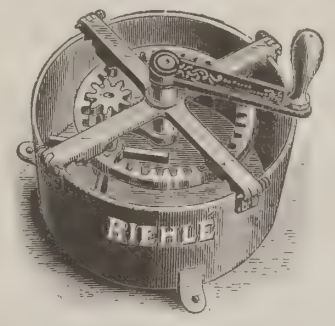
The Car Heater and the Traveling Public.

A steam heated car does not usually awaken poetic fancies, but the following lines were composed by Haines D. Cunningham, a well-known newspaper correspondent, who is now an official of the Legislature of the State of New York. The car which was the inspiration of their composition was equipped by the Consolidated Car Heating Company, and the Sewall is the steam coupler referred to therein. The following is but a part of the poem:

Give me of your steam, O Engine,
Of your blue and sissing vapor,
Singing hot within your boiler,
In your big, black, bulbous boiler.
I would build an iron pipe-way
To the cars that trail behind you
To the cars that rock like cradles
As they roll along the railways.
I would warm the traveling public,
When it journeys in the winter,
Keep its feet warm and its legs warm,
Fit the cars with safest heating
As they roll along the railways."
And the engine, full of ardor,
Ever sissing, ever singing,
Made reply to the Car-Heater:
"Take my steam, O deft Car-Heater,
Take my blue steam, superheated,
To the cars that trail behind me,"
Then the deft Car-Heater builded
Iron pipe-ways from the engine,
Close along the sides he laid them,
Underneath the seats and cushions,
Where the traveling public's feet are,
Where its legs are intertwined,
From one car unto the other
Joined he them with rubber tubing,
Pliant to the swing and swerving,
Of the coaches round the short curves,
And a clasp for quickly coupling*
Wrought he on the tubes of rubber.
So the engine's steam goes sissing,
Hot and blue among the pipeways,
Through the tubes that join the coaches,
Underneath the seats and couches,
Keeping warm the traveling public
When it journeys in the winter.
All the stoves were banished straightway,
All the danger from their embers,
All the roasting in the end seats,
All the freezing in the middle,
And cremation in the smash-ups.

Improved Cement Mixing Machine.

The accompanying illustration shows a handy apparatus for mixing cement. It consists of a substantial bowl of cast brass, fitted with cross arms, easily removable, which furnish a bearing for a center crank shaft. The hand crank when rotated transmits its motion to a short crank in the bowl. This crank carries a paddle which circles in the material in the bowl; at the same time, a pinion on top of the paddle shaft engages with a fixed annular gear, which cause the paddle to rotate on its axis; the combined move-



Cement Mixing Machine.

ments thus given to the paddle mixer produce a thorough distribution to all parts of the contents. This mixer is constructed entirely of brass, except the hand crank outside, which is japanned. When ready to empty the bowl, all the working parts can be removed in a moment by drawing out a couple of pins.

In all testing laboratories an appliance of this kind is needed for mixing batches of cement in a regular and uniform manner, where work of this kind is to be done.

The dimensions of the machine are as follows: Diameter of bowl, 10 inches; depth of bowl, 5 inches; extreme height, 11½ inches; length of handle, 6 inch crank. It is manufactured by Riehlé Bros. Testing Machine Co., Philadelphia, Pa.

Change of Corporate Name.

At the last annual meeting of the stockholders of The Glidden & Joy Varnish Company, it was decided to change its corporate name to that of The Glidden Varnish Company. This has been done and a copy of this amendment to its charter has been duly filed with the Secretary of State of the State of Ohio. There has been no change whatever otherwise in the company's affairs.

At the directors' meeting of same date the following officers were duly elected, viz.: F. H. Glidden, President; F. A. Glidden, Vice-President; F. K. Glidden, Secretary and Treasurer; Jos. F. Glidden, Superintendent.

Messrs. Jenkins Brothers, of 71 John street, New York City, manufacturers of the well-known Jenkins valves and "Standard" packing, have issued a price list and catalogue of the articles they make. The pamphlet describes and illustrates the large variety of valves of every description made by this firm. Varieties of packing, gaskets, washers, steam traps and many other useful accessories to steam engines are also included in the output of Jenkins Brothers. Improvements have recently been made in several classes of these articles, that are calculated to enhance their excellence.

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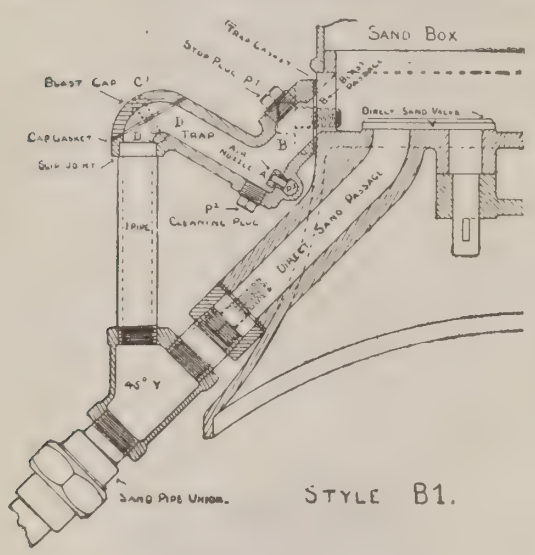
* The Sewall steam coupler.

Leach's Improved Track-Sanding Apparatus for Locomotives.

The original form of this apparatus had no provision for sanding the track profusely in case of collision or other emergency, and was generally condemned on that account. In the improved apparatus the usual sand-lever is retained and may be used whenever desirable. By reference to the accompanying sketch, which shows one form (Style B1) of the device, it will be seen that the trap is bolted to the outside of the sandbox, where it may be readily got at for inspection and repairs. The trap receives its supply of sand through the independent passage *B* directly from the sandbox. By means of the air blast through the nozzle *A* the sand is blown out of the trap through the passage *D*, which connects with the sand pipe at *Y*. It will be seen that the direct sand valve *V* may be operated by the sand lever in the usual manner.

Another and by far the most common form of trap is bolted to the sand box lug in the same manner that the sand pipe flange is usually attached. The lug is extended to provide two openings from the sand box to the trap, one for direct sanding by means of the lever, and the other for the blast feed. Either form of trap is applicable to old as well as new sand boxes.

The compressed air for operating the device is taken from the main reservoir connections and is controlled by a feed valve properly constructed for light feeding, and placed in the cab convenient to the engineer. For ordinary feeding a very small amount of air causes the sand to "flow" upwardly through the passage *D*, and over the bridge of the trap. A plug P^1 is provided so that the flow of sand from the box may be stopped by a bit of waste placed in the passage *B*. The plug p^2 may then be taken out and the trap throughly cleaned of stones or other foreign substances. The cap C^1 receives the wear of the sand blast and may be cheaply replaced when worn out. By removing this cap, access is had to the blast nozzle *A* which may be taken out with a small socket wrench, provided for the purpose.



TRACK SANDING APPARATUS.

The simplicity of construction and operation and convenience for inspection and repairs have been the cause of the remarkable success of this device, about 1,600 locomotives being now equipped with it. Its utility is demonstrated by the fact that its use saves more than one-half the amount of sand used by the ordinary sanding arrangement. The waste of sand in itself is of little consequence. Pulling trains over an unnecessary quantity of sand on the rails is what wastes fuel-money, power, tires and rails. The patent on this improvement is numbered 512,833, and dated Jan. 16, 1894, and is owned exclusively by Mr. Henry L. Leach, recently Division Master Mechanic of the Fitchburg Railroad at Fitchburg, Mass., and whose present address is Room 45, Mason Building, 70 Kilby street, Boston, Mass.

A Good Heating System.

The Buffalo Forge Company, of Buffalo, N. Y., is meeting with much success in the introduction of its "Fan" system of heating and ventilating buildings. In our last issue we published some details of large railroad offices and shops that had recently been equipped with this system. Information has since reached us of the performance of this system in public schools under very trying conditions. The schools of Salt Lake City are using six different systems of heating. Recently the school authorities made a test of the efficiency of the systems without the knowledge of the respective representatives of the manufacturers. The Lincoln School, equipped with the Buffalo Forge Company's "Fan" system, carried off the laurels. The temperature in the nine rooms during the entire day varied only two degrees, one from the other, and to accomplish this result only 700 lbs. of slack coal were used, at a cost of less than $1. The outside temperature was close to zero, and some of the other systems failed to keep all the rooms of the schools in which they were used sufficiently warm. None of the other systems burned slack coal, and the value of the fuel each of them burned was from three to four times in excess of what the "Fan" system consumed.

Later, a school at Lehi, Utah, was equipped with the "Fan" system, and writing under date of Feb. 1, the Board of Trustees say that they were guaranteed 70 degrees in zero weather, "but with the outside temperature 14 degrees below zero the plant maintained an average temperature in all of our six rooms of 78 degrees—the lowest being 76. As to the economy of the plant, we use on an average 450 lbs. of coal per day, which, at $3 per ton, makes the cost of heating and ventilating our school building 11 cents per day per room, containing from 55 to 60 pupils each."

A New Block Signal.

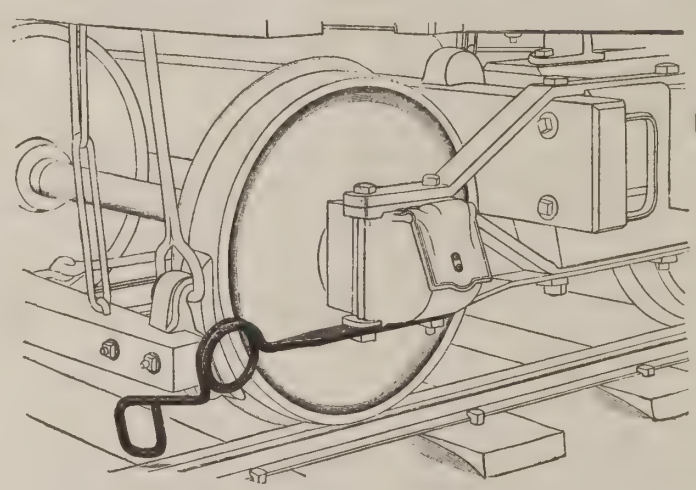
The Young & Willever Automatic Mechanical Railroad Block Signal Company, of Philadelphia, Pa., has placed upon the market a new block signal which is operated by moving trains only.

As the engine enters a block the semaphore is set to danger. As the last car of the train leaves the block, it sets the semaphore to safety, showing that the block just vacated is clear, and thus it continues through any number of blocks that may be in succession. These blocks may be any reasonable length. Every block is complete within itself, and is equally adjustable to single or double track. Switches, interlocking or otherwise, are operated with the same facility as the semaphore. For instance, a train entering a block, when the engine sets the semaphore to danger, at the same time would close all switches that might be placed within the limits of said block.

It is claimed that disturbances of the elements have no deterrent effect upon the operation of the signal. Should any of the mechanical parts break or become disconnected the semaphore is set to danger. This signal is both audible and visual, an alarm gong being attached to the signal post, connected with a lever at a suitable distance from the post, which is depressed by the wheels of the engine and every car. The depression of this lever causes the gong to give an alarm, calling the attention of the engineer to the fact that he is approaching a signal. Those who desire a full explanation of the operation of this signal should communicate with the company named at 204 Walnut Place, Philadelphia.

Clark's Car Wheel Fender.

The accompanying cuts illustrate Clark's car wheel fender and its application to the truck of a passenger car. These fenders are also designed for use on switch engines and locomotives, and their purpose is to prevent the body or limbs of any one who may fall on the track from being run over by the wheels. This device is constructed of one piece of spring steel, so designed as to be placed close above the rail and directly in front of the wheel. The bottom is formed into a loop placed obliquely to the rail, thus effectually preventing any body or limb passing under the wheel, the tendency being to remove it to the outside of the track. The coil is designed to provide, with certainty, for an ample lateral yield in case of the fender striking a fixed obstruction, thus permitting the safe running of the car. In railway rolling stock these devices can be applied without any change in the mechanism of the cars, etc., being attached by bolts now in use. As illustrating the practical use of the device it may be said that instances are on record of the saving of lives of switchmen who had fallen on the track in the face of an approaching switch engine equipped with these fenders. In each instance the men were thrown clear of the track without serious injury. These fenders are manufactured by Mr. F. H. Clark at Springfield, O. Mr. Clark has offices at No. 1267 Broadway, New York, and in room 709 Rialto Building, Chicago.



CLARK'S CAR WHEEL FENDER.

A Large Order for Machine Tools.

The Pond Machine Tool Company, of Plainfield, N. J., for whom Manning, Maxwell & Moore, 111 Liberty street, New York, are the sole sales agents, have just been awarded the contract by the Ordnance Department of the United States Army for the manufacture of gun lathes and other machine tools required in the construction of steel breech-loading rifle cannon of 12 inch to 16 inch caliber. The order consists of three lathes for boring and turning guns, one lathe for turning and finishing these guns, one machine for threading and slotting the guns and the rifling machine. This company has previously furnished to the Ordnance Department 23 large gun lathes and two rifling machines for the manufacture of breech-loading rifled cannons of 8 inch to 12 inch caliber. In the previous large contract awarded the Pond Machine Tool Company, the time for completing the work was four years, and the firm finished it nearly two years ahead of the time allowed, and no doubt the satisfaction given in the execution of the previous contracts, both in regard to the quality of the work and the time of delivery, favored them in the decision of the award of the present contract. The lathes are to be built from designs by the Ordnance Department, and all the detailed drawings and patterns will have to be made by the Pond Machine Tool Company. The lathes are to be erected at the army gun factory at Watervliet Arsenal, West Troy, N. Y. The firm has 18 months' time in which to complete the contract. The amount of the order is over $200,000.

Distribution of Rotary Snow Plows.

A representative of the Leslie Brothers Manufacturing Company, of Paterson, N. J., states that they expect to build three Rotary snow plows for the Russian government and one for Japan soon. There are now 70 of the Rotary plows in use, of which the Northern Pacific has six, the Great Northern six, the Union Pacific six, the Canadian Pacific eight, the Southern Pacific four and the Chicago & Northwestern five. The Chicago, Rock Island & Pacific has three, the Denver & Rio Grande three, Atchison, Topeka & Santa Fe one, Philadelphia & Reading one, Burlington, Cedar Rapids & Northern one, Fremont, Elkhorn & Missouri Valley one, Rio Grande Southern two, Spokane Falls & Northern one, Everett & Monte Cristo one, New York Central & Hudson River one, Minneapolis & St. Louis one, Milwaukee, Lake Shore & Western one, Oregon Railway & Navigation Co. two, Colorado Midland one, Chicago, Milwaukee & St. Paul two, Chicago, St. Paul, Minneapolis & Omaha one, Minneapolis & Pacific one, Chicago, Santa, Fe & California one, St. Paul, Minneapolis & Manitoba two, Duluth, South Shore & Atlantic one, and the Rome, Watertown & Ogdensburg one.

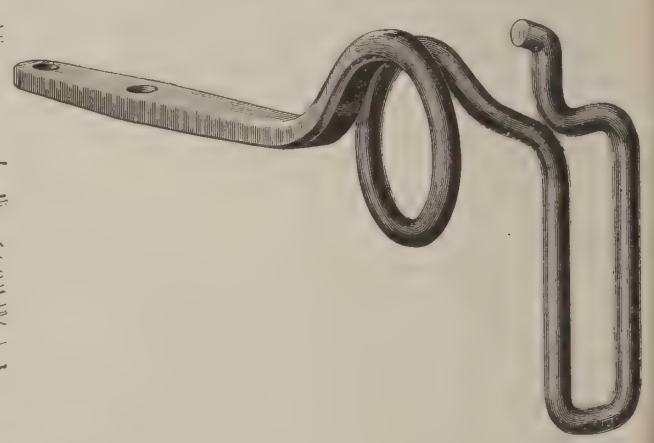
Riehle Bros. Testing Machine Co., Philadelphia, have closed a contract with the patentees for the exclusive manufacture of the Riehle-Anderson patent track jack. This jack has been indorsed by some of the leading practical railroad men in the country, and will, no doubt, meet with a large sale.

Our Directory.

Brooklyn Elevated.—Franklin Fisher, Superintendent, and E. M. Hedley, Master Mechanic, have resigned. Isaac D. Barton is appointed Superintendent.

Evansville & Terre Haute.—A. L. Sanger is appointed Purchasing Agent; J. R. Sample is appointed General Superintendent.

Chesapeake & Ohio Southwestern.—Vice-President John Echols has resumed the title of General Manager.



Boston & Albany.—Thos. B. Purvis, Jr., Master Mechanic at East Albany, has been transferred to Boston.

Chattanooga, Rome & Columbus.—Wm. Love is appointed Trainmaster and Master Mechanic with office at Rome, Ga.

Wabash Railroad.—Chas. M. Hays is elected Vice-President.

Boston & Maine.—T. A. Mackinnon is appointed General Manager, Geo. F. Evans is made Assistant General Manager, D. W. Sanborn, General Superintendent, becomes Superintendent of the Southern Division, and John W. Sanborn, Acting General Manager, resumes his former position as Superintendent of the Northern Division.

White & Black River Valley.—M. J. Redding is appointed Master Mechanic, with office at Brinkley, Ark., in place of T. Eldridge, resigned.

Butte, Anaconda & Pacific.—George Henderson is appointed Master Mechanic, with office at Anaconda, Mont. W. D. Stansifer is appointed Purchasing Agent, office same place.

Union Pacific, Denver & Gulf.—T. F. Dunaway is appointed General Manager with office at Denver, Col. John McCormic and M. F. Egan are appointed Superintendents, respectively, at Denver and Trinidad, Col. J. K. Painter is appointed Superintendent at Sterling, Col.

New York, Lake Erie & Western.—Samuel Higgins, Assistant Superintendent of Motive Power, has resigned and is succeeded by W. Lavery. J. Bond, Division Master Mechanic at Hornellsville, succeeds Mr. Lavery as Master Mechanic at Susquehanna, and C. P. Weiss, of Rochester, succeeds Mr. Bond at Hornellsville. R. W. Hibbits succeeds Mr. Weiss.

Lehigh Valley.—Samuel Higgins is appointed Superintendent of Motive Power with office at Wilkes-Barre, Pa.

Great Northern.—A. J. McCabe, Superintendent at Leavenworth, Wash,, has resigned.

Cleveland, St. Louis & Kansas City.—C. N. Pratt, Superintendent, has resigned.

Missouri Pacific—M. F. Bowles is appointed Superintendent at Osawatomie, Kan., vice T. F. Dunaway, resigned.

Georgia Railroad.—Wm. S. Brand is appointed Acting Superintendent, vice S. A. Hemphill, resigned.

Baltimore & Ohio.—Thos. Fitzgerald is appointed Superintendent of Philadelphia Division with office at Baltimore. J. Van Smith is appointed Superintendent of Trans-Ohio divisions. John F. Spurrier is appointed Superintendent of the Baltimore Division.

Employment.

WANTED.—Position as Foreman Car Painter. Experienced and capable; Familiar with both day and piece work systems; Good designer of ornamenting and lettering. Excellent references. Address WELTON, care of NATIONAL CAR AND LOCOMOTIVE BUILDER.

Wanted, situation as Foreman Boilermaker, or as inspector of boilers, by a man of large experience in either position. Best of references. Address KENNEDY, care of NATIONAL CAR AND LOCOMOTIVE BUILDER.

NATIONAL CAR AND LOCOMOTIVE BUILDER

APRIL, 1894.

CONTENTS.

A new metal, named powellite, has been discovered in Idaho.

The Cleveland, Lorain & Wheeling is in the market for 1,000 cars.

The Delaware, Lackawanna & Western is in the market for 10 passenger cars.

The Philadelphia & Reading is running all its shops on full time, 10 hours per day.

The Southern Pacific car shops at Sacramento are building 150 refrigerator fruit cars.

The Metropolitan Elevated R. R., of Chicago, has ordered 100 passenger cars of the Pullman company.

Specifications for a large number of new freight cars have been prepared by the Delaware & Hudson.

The Mobile & Ohio has ordered 100 refrigerator cars of the Mt. Vernon Car Company, of Mt. Vernon, Ill.

The Lewis Foundry & Machine Co., of Pittsburgh, Pa., with a capital of $200,000, has been incorporated.

The Delaware & Hudson road is making plans for the establishment of a complete block system on its lines.

The Pittsburgh Locomotive & Car Works are erecting a new carpenter and repair shop to replace an old structure.

Twenty-five passenger cars are being built for the South Jersey R. R. by Harlan & Hollingsworth, of Wilmington, Del.

The Chicago, Milwaukee & St. Paul has equipped all of its line between Chicago and Council Bluffs with block signals.

Work has been begun on the construction of the Chicago & Southeastern Railroad, which is to run from Anderson to Muncie, Ind.

The Armour Refrigerator Company has placed an order for 50 refrigerator cars with the Wells & French Car Company, of Chicago.

All the departments of the Brown & Sharpe Manufacturing Co. are in full operation now, employing 825 men ten hours a day and six days a week.

The Haskell & Barker Car Works, of Michigan City, Ind., have secured orders for 1,500 cars, and have resumed operations after six months' idleness.

The Engineers' Society of Western Pennsylvania has moved its headquarters from Pittsburgh, Pa., to the Carnegie Library Building, Allegheny, Pa.

The Manhattan Press Clipping Bureau of New York City gathered 4,200 editorial references to the late George W. Childs, and only three of them were unkind.

Fifty refrigerator cars have been ordered of the Missouri Car & Foundry Company, for delivery in May by the Swartzschild & Sulsberger Packing Company.

The date of the meeting of the biennial convention of the Brotherhood of Locomotive Engineers at St. Paul, Minn., has been changed from May 16 to May 9.

The Newport News & Mississippi Valley road was placed in the hands of a receiver, March 20. Mr. Edmund Zacher, of New Haven, Conn., was appointed Receiver.

The gross earnings of 123 railroads for the month of February were $32,454,502, a decrease of $4,654,203, or 12.54 per cent., as compared with the corresponding month in 1893.

The New York Central will make extensive improvements at Syracuse early in the spring. A new station is to be erected, and the streets that cross the tracks are to be depressed.

The Mexico, Cuernavaca & Pacific is having four passenger cars built by the Jackson & Sharp Company, and is in the market for two ten-wheel freight locomotives and 50 freight cars.

It is expected that the new shops of the Great Northern at Hilyard, near Spokane, Wash., will be in operation April 1st, although not running in all departments before the end of May.

The cargo of a ship that recently sailed from Wilmington, Del., for Rio de Janeiro consisted of five locomotives, 25 passenger cars, 180,000 feet of lumber, 6,000 cans and 50 kegs of oil.

The Jackson & Sharp Company, of Wilmington, Del., has received a contract for 40 cars for the Dairy Company of Pennsylvania, to be used in the milk trade on the Lehigh Valley Railroad.

The New York, Susquehanna & Western has ordered one passenger and two consolidation freight engines of the Rogers Locomotive Works. They are to burn culm, and are to be delivered in June.

Large shops have been built at Lenoir, Tenn., by John H. Bass, of Fort Wayne, Ind., for the manufacture of Bass cast iron wheels. The shops will employ about 300 men when running to full capacity.

Plans have been made for building a new roundhouse at Laramie, Wyo., on the Union Pacific. Its cost is estimated at about $65,000. The machine shops at this point are to receive improvements on a large scale.

The entrance to the West Point tunnel of the West Shore road was blocked by a landslide March 21. Over five tons of rock and clay rolled down from the embankment. All trains due had passed and no one was injured.

Severe weather prevailed throughout the Northwest between March 12 and 22. The first through train in 10 days arrived at Portland, Ore., March 22. It took the postoffice employés 48 hours to distribute the delayed mail.

About 50 different kinds of woods are used in the United States in building cars. A dozen varieties, such as ebony and rosewood, are carried in samples by the large lumber dealers, but are seldom called for in car construction.

Another species of rainmakers has appeared on the horizon. A Frenchman claiming that water is held in the clouds by electricity, proposes to discharge it and cause rain fall. Some of his experiments are said to have been successful.

A line of railway, 150 miles in length, now being built between Caracas and Valencia, in Venezuela, will be one of the most difficult and costly enterprises of its kind in existence. The route involves the construction of 60 tunnels and 52 bridges.

The Johnson Steel Works, of Johnstown, Pa., which have been idle since Jan. 1 for repairs, resumed operations March 12, employing 2,000 men. It is announced that these works will be removed to Cleveland, O., where a $3,000,000 plant will be erected.

The New York Central & Hudson River R. R. has recently received from the Schnectady Locomotive Works an engine similar to the "Chief of Racers," No. 999. The New engine is No. 888, and the building of another engine of the same class is contemplated.

The Union Depot at Denver, Col., was totally destroyed by fire shortly after midnight March 18. It was consumed in less than an hour. It was the most handsome and costly depot structure west of Chicago. It was built of stone about 12 years ago, and was about 800 feet long.

The Wells & French Car Company, of Chicago, is building 100 cars for the California Fruit Transportation Company. The cars will have the contracted chilled wheels made by the Wells & French Company. They will have wooden brake beams, the Sharon steel trucks and the Hutchins roof.

The Braddock Wire Works, of Rankin, Pa., turned out 254 tons of wire rods in 12 hours on March 10. This beats the world's record by 11 tons, the Joliet Wire Works having previously worn the belt for turning out 243 tons in the same length of time. The demand for wire is largely increasing.

The Minnette Club, of Chicago, an association of West Side business men, has offered to pay $100,000 for the Ferris wheel, which still stands in the deserted Midway Plaisance, and move it to Garfield Park as a permanent attraction. Mr. Ferris said it would cost $100,000 simply to move the wheel.

The provisional committee for the aid of the hungry in New York City has applications of carpenters, machinists and painters and other workmen for positions. The committee requests that all who can furnish odd jobs or permanent work for any of these to communicate with the committee at the Hotel Imperial.

The worst storm of the winter swept over the Northwestern States March 21 and 22. It was characterized by low temperatures, strong winds and a heavy fall of snow that played havoc with everything in general, and railroad traffic in particular. In Wyoming, Nebraska and the Dakotas all trains had to be abandoned.

The Boston & Albany is going to build new car shops during the coming summer in West Springfield, Mass., and abandon the old shops at Springfield, which have been in use nearly 50 years. The new shops will be built of brick, 314 × 412 feet, and will be one story high, with a second story at one end for the upholstering department.

The bids for the purchase and removal of the World's Fair buildings were opened March 10. The bid generally considered most favorable was $15,160 for ten buildings. The highest general bid was $15,025 for the Agricultural, Transportation, Electricity and Mines and Mining buildings and Machinery hall, Dion Geraldine bid $10,000 for the Manufactures building.

The heaviest shearing machine ever made has just been completed at the Park Grove Iron Works, Glasgow. It is intended for shearing iron and steel plates up to two inches in thickness and six feet six inches in width. The tool weighs 112 tons, and is driven by two engines with cylinders 20 by 24 inches. It will be used in the new works of the Glasgow Iron & Steel Company.

A measure intended to give the Pennsylvania Railroad an entrance into New York City was introduced in the New York Assembly March 22. It provides for the construction of a bridge over the North River at New York. The New York terminus of the bridge is to be between 117th and 118th streets. The measure provides for two spans, which are to be 160 feet high.

The boiler of Lehigh Valley engine No. 468 exploded March 8, killing three men. The engine was employed as a pusher, and at the time of the explosion was awaiting the arrival of a northbound freight train which it was to help up the 60 foot grade from Tannery to Summit, on the top of the mountain. The engineer happened to be in the telegraph office receiving orders, and was uninjured. He claims that there was an abundance of water in the boiler.

It is reported that the General Electric Company, of Lynn, Mass., has signed contracts with the Cataract Electric Company, of New York, for supplying the latter with $100,000 worth of machinery. This is to supply the electric power by which it is proposed to propel the boats on the Erie Canal from Buffalo to Albany. The Cataract Company will procure its power from Niagara Falls and the General Electric Company will furnish the motors and wire the canal. The Westinghouse Company, it is understood, will furnish some of the generators.

A $1,500,000 contract has been awarded to James Stewart & Co., of St. Louis, Mo., for the construction of a drawbridge and belt railway at St. Paul, Minn. The bridge will be at South St. Paul, six miles from the city. Its length will be 2,200 feet, and it will have four 150-foot spans, and one draw span of 480 feet. The bridge and belt road will be operated by the Burlington, Milwaukee & St. Paul and Chicago & Kansas City railroads. It will afford a direct entrance to the packing districts of South St. Paul, and will effect considerable saving in switch charges.

The Pennsylvania Railroad Company has purchased the Washington Hotel property at the northeast corner of Madison and Canal streets, Chicago, and will obtain possession of the premises on May 1. It is stated on reliable authority that the company designs erecting a large and handsome general office building on this site, and that negotiations are in progress for the Norton mill property adjoining on the east. Should this be acquired the company will construct a mammoth building extending from the river to Canal street, with connecting arches over the railroad tracks.

The California International Midwinter Exposition.

BY HOWARD STILLMAN.

The Midwinter Fair at San Francisco is situated much in contrast to the recent World's Fair at Chicago. The surroundings are very different and have not the immediate water front advantages that made the Chicago Fair so famous. However, critics have stated that for picturesqueness and perfection of landscape effects this exhibition in Golden Gate Park has never been excelled. Grand views may be obtained of the Golden Gate entrance to San Francisco bay and the portions of the city from the hills in the vicinity of the Fair, or from the tops of the buildings on the grounds.

The Fitch wheel, a small edition of the Ferris, also commands a good view. An excellent view of the harbor and Pacific Ocean, as well as of the peninsula and country adjacent to the bay, can be obtained from the "Bonet" electric tower when completed, the same not yet being in operation. This tower measures 272 feet in height, and on its top is placed the powerful search light used at the Columbian Exposition.

The main buildings of the exposition are arranged around a quadrangle laid out as a park, with trees and flowers, at the center of which rises the electric tower before referred to. The area of the California exposition covers nearly 200 acres and includes more than 70 structures.

The principal buildings and dimensions are as follows: Agriculture and horticulture, 400 × 190 ft. Mechanical arts, 324 × 160 ft., with annex 250 × 45 ft. Administration, 40 × 60 ft. with dome 135 ft. in height. Fine arts, 132 × 60 ft. with annex 132 × 43 ft. and the main or Manufactures and Liberal Arts building, 462 × 225 ft. with annex 370 × 60 ft., giving the latter a ground area of 130,000 square feet. To the number of these buildings have been added special county buildings in which to particularize the products of each section of the State; also many of California's neighboring States have erected structures of their own, these and county buildings maintaining to the exposition much the same relation as the State buildings to the Columbian Exposition.

The German village, Hawaiian, Japanese and Chinese buildings, Cairo Street and numerous side attractions are much as maintained at Chicago, also the Vienna Prater. There are cafes and restaurants ad libitum. Many of the exhibits are distinctively Californian, and to delight the heart of the old Argonaut is a genuine mining camp in full operation after the style of the days of '49.

Those in quest of information as to railroad appliances will find little to interest them excepting in the display of the Southern Pacific Railroad Company, which consists of their largest modern compound alongside the little old "C. P. Huntington" Engine No. 1. A Pullman day coach with one of the original Sacramento Valley passenger cars, also a modern furniture car built at their works with an old box car of former days. No other exhibitions of railway appliance of magnitude are contemplated.

Though not on as grand a scale as the Chicago fair, yet there is much to see in this midwinter exposition, and it certainly is very creditable to the enterprise of the Pacific Coast. Having no such population to draw from as near the center of the continent or farther east, the fair is of such size in proportion to the population of the Pacific Coast that it is a matter of serious doubt as to how finances are going to come out.

The means have been raised by public subscription to carry out the enterprise, and daily admissions have thus far averaged about 13,000. It is expected to close June 30, and is well worth a visit from anyone coming to the coast or vicinity.

Nothing but Common-Sense.

I once worked in a little shop in the country, in which not a man knew anything about a steam engine. Waterwheels turned the shafting around. The nearest steam engine was a good 10 miles away. One day the proprietor of that steam engine came to the shop and said he was badly fixed—engine wouldn't turn over. Man must go right out in the wagon to see what was the matter. Joe went out, stayed over Sunday, and came back smiling. When Joe explained how he fixed up things, his explanation was something like this: "When," said Joe, "that piston wanted to get moving on in one direction, the valve ought to let steam behind it to move it. I fixed it," said he, "that way, and it seemed to go all right."—*American Machinist.*

It is announced that William A. Boland has purchased from the Industrial Improvement Company, of Boston, the stock of the Allentown & Bethlehem Rapid Transit Company, of Allentown, Pa. This company controls several electric roads connecting Allentown with 10 or 12 of the principal towns in the Lehigh Valley, Pa. The Allentown Electric Light Company, with a capital of $300,000, is included in this purchase. It is understood by the purchase of these properties that a consolidation will be made with the Allentown & Lehigh Valley Traction Company. This will establish, practically, a monopoly of all the street railways in the Lehigh Valley.

This is a world of compensations—men who lack long heads generally have long faces.—*Truth.*

Master Car-Builders' Association Circulars.

Wheel and Flange Gauges.

In order to aid the committee on the above-named subject in preparing its report for presentation to the convention, members are requested to answer the following questions as promptly as possible:

1st. Is the present wheel and flang gauge, as adopted by the Master Car-Builders' Association, satisfactory?

2d. If not, what changes would you recommend?

3d. Has the road department on the road with which you are connected made any objections to the present gauge?

J. N. Barr, Thos. Anderson, T. Sutherland, Jos. Townsend, Thos. Fildes, Committee.

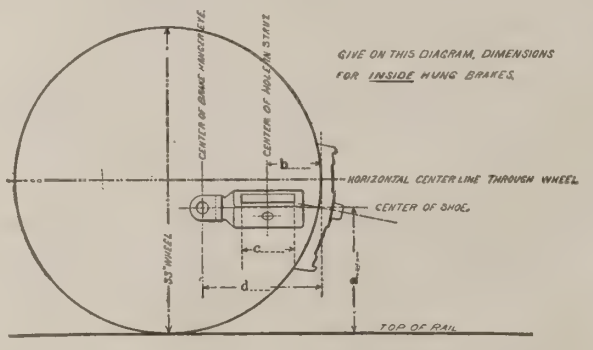
Please address your reply to Mr. J. N. Barr, Chairman, Superintendent M. P., Chicago, Milwaukee & St. Paul Railway, Milwaukee, Wis.

Milwaukee, Wis., March 14, 1894.

Brake Beams.

The Committee on the above named subject has addressed the following circular to members of the Master Car-Builders' Association, and requests answers to the following questions as promptly as possible, to enable it to make a complete report to the Association in June:

1. Are you using the Christie brake head with iron brake beams on freight cars?
2. If so, please state name by which the beam is known in the market.
3. Please state name of manufacturer.
4. State distance from center to center of brake heads.
5. State size of brake hanger eye.
6. State size of lever pin hole in strut.
7. Have you adopted the Master Car-Builders standard of 40° angle of brake lever from the vertical?
8. If not, what number of degrees from the vertical have you adopted?
9. Do you hang the beam described inside and between the wheels, or outside of the wheels?
10. How many cars have you equipped with this beam hung outside?
11. How many cars have you equipped with this beam hung inside?
12. Is your present standard outside hung brake beams or inside hung brake beams?
13. What is the total number of freight cars in your equipment?
14. Please fill in the dimensions "*a*," "*b*," "*c*" and "*d*" on the accompanying diagram, filling one diagram for outside hung beams and one diagram for inside hung beams.*



15. It was developed by the Committee on Brake Beams last year that for inside hung beams the height of the center of the shoe from the rail varied from 12½" to 16½", and for outside hung beams this height varied from 8½" to 16"; therefore, please state how much the construction of your truck would permit you to change the height as given for dimension "*a*" on the diagram, in order to enable the Committee to ascertain a height which could be generally adopted for inside hung beams and for outside hung beams.

16. Please add any other points than those covered by questions above which you think it would be well for the Committee to consider, it being their object to recommend a standard height for beams measured from the rail to the center of shoe, and a standard location for the brake lever pin hole and brake hanger eye as measured from the center of the shoe horizontally to the center of the two holes.

E. D. Nelson, J. H. Rankin, John Bean,
Committee.

Williamsport, Pa., March 10, 1894.

Please send replies to E. D. Nelson, Superintendent Motive Power, Pennsylvania Railroad, Williamsport, Pa.

Repairing Locomotives.

BY J. T. HEFFERNAN.

(*Continued from page* 38, National Car and Locomotive Builder *for March.*)

Engine Trucks.

In this paper we will treat on engine trucks. At first glance it may look as though there is not much about an engine truck to be explained. Let us have a look and see the duties which we put upon this truck. In the first place we arrange it to carry a considerable portion of the weight of the engine, but much less weight than we put on the drivers. Now let us take an engine running. The truck is leading, and unless it is properly designed and constructed there always exists a great chance of accident. Suppose anything should get loose on the truck with the train running at high speed, there would be great chances of ditching the train. Again, if the truck wheels are not set square they will have a tendency to climb the rails, and when running onto a joint of the track they make strike the joint in such a way as to climb the rail. If the center of the truck does not come fair with the center casting of the engine it will have a tendency to throw the truck to one side of the track and the drivers to the other, making trouble both for the truck and for the drivers. If the truck is not set central it will have a tendency to crowd the wheels to one side of the track, and of course to do this it must throw the boxes hard up against the hubs of the wheels, causing them to heat and giving no end of trouble.

* Two similar diagrams accompany the report.

Fig. 78 shows the standard swing center truck, one that is used on very many eight-wheeled engines, and generally goes by the name of a four-wheeled swing center truck. This paper shows three styles of trucks which embody all the principals of truck building. Of course there are a great many forms of trucks which differ from the styles of truck shown, but a careful study of these will teach the right principles of truck construction and repair. Fig. 79 shows a truck with a wrought iron frame *A*, which embraces the whole form of the truck and is generally made of 2-inch by 4-inch iron. To get the length of this frame we must first determine what is the distance of our truck wheel-base, in case it is not given on a drawing, but is left to us to determine. We can do this by measuring from the centre of the cylinder saddle, or from where the centre casting is placed to the front and back of the cylinder, allowing distance enough so that the wheels will clear the heads, that is, clear the heads in a vertical line. It is a rare case that this will be left with the workman, as nowadays there are standard lengths for all wheel centres, and for new building the dimensions are planned out by the draughtsman, and in repair work we have the old centres to go by.

Now we will suppose that we start in to build a truck. We assemble all the parts necessary to it, wheels, boxes, equalizers, springs, spring hangers, etc.; it is well to have the main frame planed up, the pedestals and boxes should also be planed. Our first move is now to find two parallel lines, *BB*, *CC*. Find these lines from the centre of one rail of the frame laying out over to the other side. Right here we may as well speak of the distance these two lines should be apart; we will see at a glance in Fig. 79 that the boxes fit in the pedestals, and when in place should have about $\frac{1}{16}$ play between the hub of the wheel and the box. One-sixteenth of an inch is about the right amount of play, that is $\frac{1}{16}$-inch on each side. Now to find these lines and the distance they should be apart, measure the thickness of the flanges of the truck box and then from the edge of the truck box to the centre of the pedestal, taking double this amount plus the ⅛ inch added for clearance from the distance of the hubs of the wheels. This should give the proper distance between the lines *BB* and *CC*.

Having these center lines for the pedestals, our next move will be to find the line *DD*, through the center of the truck, from which to lay out the swing center; we are now to find two lines, *EE* and *FF*. At right angle to the lines already found we will get the line at the forward end of the truck, that is the line *EE*. Lay out from the end of the truck the given distance that this line is to be from the end of the truck and put a fine center mark on the line *BB*. Now take a straight edge that will reach across the truck frame, bringing one edge of it up to the center mark on the line *BB*, and square it across either by laying out with the trams or by using a square from the line *BB*. I rather prefer the use of a square than a tram for getting this line *EE*. Of course when we have the straight edge across we can prove it up from the line *CC*, as well as from the line *BB*. Now, if we use ordinary care in doing this the chances for making any errors are very small indeed. In the center mark at the intersection of the lines *EE* and *CC* we have the center of the forward axle, and our next move is to find the center for the rear axle. Set trams to the required distance of the truck-wheel base and tram back from the centers already found, and make a prick-punch point where the lines meet. Now we have our centers for our axles, our next move is to get the centers for the center casting. Find the center between the axles on the line *BB*, and also on the line *CC*, and draw the line *GG*. Should the wrought-iron center frame, *II*, be composed of two braces, instead of one saddle, we must lay it out right on the frame of the truck.

Perhaps here we had better explain how to lay out the saddle where it is in one forging. The center casting, *J*, Fig. 78, comes from the machine with the center bored out, and as a rule, with the holes for the swing bolts also bored out the distance apart we generally aveh the links which hold the center casting to the saddle. We lay these out and have them drilled the proper size, having oil holes also drilled in them. When it is decided to have the saddle set down over the frames of the truck, we measure the distance between the rails of the truck and lay this distance out on the saddle, having first found the center line through our saddle, so that after the saddle is planed a center line through it would be in line with *G G* when it is fitted to the truck. If there are bosses forged on the saddle, lay out in the center of them to receive the swing bolts. The distance apart for these bosses will be given on a drawing for this class of engine. Having these holes drilled we find the center through the saddle which should come on the line *D D* when the casting and the saddle are in place on the truck. Now bring the saddle to the frame of the truck, fit it on and lay out the bolt holes from the saddle through the truck frame, centering the saddle so that the center line of it comes on the center line we have found for the truck. When we have the saddle in place, lay out the two center braces *K K*. In case they fit over the frame of the truck at the ends, lay them out by holding them up in place against the saddle and scribing on the under side of the brace where it is to fit on the truck frame. After having them planed bring them back, fit them and lay them out for drilling before removing the saddle. We can lay out the holes for the pedestal braces where they fit on the truck frame so that when we send the frame to the drill press we can have all the necessary holes drilled in it. When designing the pedestals for a truck of this kind, they should be made interchangeable with any similar truck, then in case of an accident, by which pedestals get broken, they can be

replaced from stock and no trouble experienced in putting them in.

Supposing that we have our truck frame back from the drill press, we are now ready to lay out the pedestals and pedestal braces, and we will find it a little more convenient in doing this to just turn the frame over bottom side up, and transfer our center lines to this face. We now lay the eight pedestals in position, setting them a distance apart from their center lines equal to the size of the box. It is always well to allow the box to be about $\frac{1}{32}$-inch free in the pedestals, and when laying them out there are several ways to make this allowance, but there is one way which I prefer: Where we first found our center lines for the center of our boxes we must always have an oil hole drilled through. Lay this hole out very carefully and have it drilled exact to the laying out, so that when we turn the frame over the center of this hole is the center of our boxes; then when setting the pedestals on the frame we can have a template as shown in Fig. 88, which is a piece of boiler plate made $\frac{1}{32}$-inch full of the size of the box, and with a plug in the center of it which fits into the oil hole of the frame. This at once does away with much measuring and also saves trying the boxes up in place. After laying out the holes of the pedestals, send them to the drill press and have them drilled. While they are being drilled, bolt up the saddle and get to work reaming the holes; and when the pedestals are finished bolt them in years wrought iron pedestals are used the most. There is little if any difference in the manner in laying this truck out from the one already explained, so we will not go into the details of it, as the principles shown in Fig. 79 also stand good for Fig. 81, the principal thing being to have the center casting in the center and the wheels in line with each other.

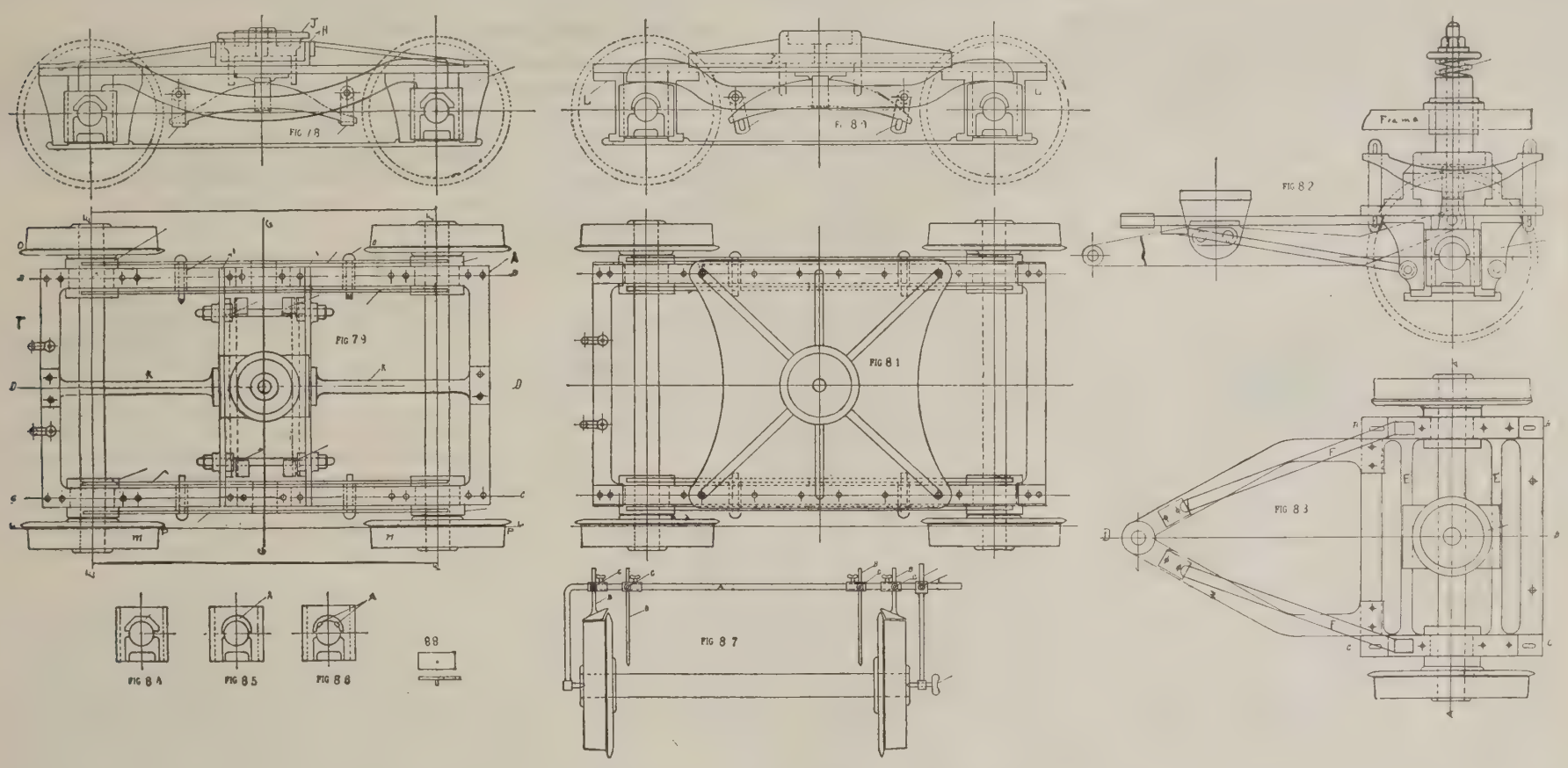
A truck may tram the same from the center of axles and still not track well. One can readily see how this may be, for, if the wheels are not set in line with the truck, or along the line *LL* they will have a tendency to climb the rail instead of running along freely with the rail. Supposing the wheels *M* and *N* to be set forward about $\frac{1}{4}$ inch they will still tram from their centers the same as the other side, but, instead of rolling free on the track, the flange *OO* will run against the rail when going ahead and the flange *PP* will run against the rail when backing.

Fig. 82 shows what is called a pony truck. This form of truck is used under mogul and consolidated engines. The spring gear of this truck is connected by means of an equalizer to the springs of the forward driver. To lay this truck out we first take the frame, which is a wrought iron forging, and find a center line on it, *A A*. From this center line we lay out two center lines, *BB* and *CC*, which are our centers for laying out the pedestals from. After having these two lines we find a line for our center casting, *DD*, which also answers for the center line of the guide yoke.

room enough to take the wheels out without taking off the pilot. In the trucks shown in Figs. 79 and 81 new wheels are also occasionally needed. In putting in a new pair of wheels in these trucks, remove the two pedestals on the side that it is desired to roll the wheels out, jack up the engine to take the weight off the truck, and also put a jack in the pit and take the weight of the equalizers off the box. Then the wheels can be rolled out freely without disturbing but very little of the truck. Of course this applies to putting in just one pair of wheels without running the truck from under the engine, but if the bad pair happen to be the forward ones and the pilot has to be taken off, it is a little handier to run the truck out from under the engine.

About jacking up an engine: In case the engine has driver brakes, disconnect one shoe on each side, for if you don't, and you have to jack the engine very high, you will either raise the driving wheels up or else break some part of the brake gear. Always put jacks at the back end or else put blocks of iron between the driving box and the frame to take the strain off the back springs. Only disconnect the pedestal braces from the pedestals of the wheels which you wish to remove.

In the matter of truck boxes, Figs. 84, 85 and 86 show the kinds used. Fig. 84 shows a brass fitted into the box and held in place by two ribs cast on the brass, fitting into recesses cored in the box. This form of brass is very often



position on the frame with temporary bolts, again using this gage to set them by. Now, before commencing to ream on these holes, lay the pedestal brace in position and also the cross braces which help to stiffen the lower end of the pedestal, and mark them off for planing and drilling. After reaming the holes, fit in the bolts and fasten the pedestals to the frame.

This is about as far as we can go without turning the frame over, so we bring in the two wheels, put the boxes on them, after having first tried the brasses on them, and drop the truck frame right in place. It would be well to put some little blocks on top of the boxes, so as not to let the truck frame go clear down. Our next move should be putting the equalizers in place. The distance between the holes for the spring-hangers we will suppose to have been given and the holes already drilled. In case no distance is given for the holes we can take the length they should be apart from the spring, drilling them a little longer than what the spring measures, so that when the truck is loaded the hangers will stand about plumb. Drop the equalizers onto the boxes now and put up both springs and hangers, being sure to always put a thimble in between the hangers. Now raise the truck frame up a little and take out the blocks, then lower the frame and put up the pedestal braces, also the cross braces, and put the center casting in position, connecting up the links and bolts. In the drawing a nut is shown on each end of these bolts, sometimes there is just a key-way punched in the end of these bolts and a key used. The bolt should be made fast in the saddle so as not to work, thereby letting all the wear come onto the links; likewise in the center casting the bolts should be fast, for the link is the cheapest part, and when the holes do become worn they can be bored out and bushed, and new links substituted. These links, being made of iron, should be case hardened. They get, as a rule, very little oil, so the bearings should be amply large. Where, instead of a saddle, single braces are used, they may be fitted up in very much the same manner. At the forward end of these trucks is shown two shackles to which the safety chains are connected.

Fig. 80 shows a somewhat different form of truck. This is a rigid form of truck, the weight and principal strain being taken up by the large center casting *K*, Fig. 81. Sometimes a cast iron center is used and the center casting fastened to it by links, the same as shown in Fig. 79. It is rather an open question which is the best form of truck, the rigid center or the swing center, but there is no doubt that both trucks have their proper places. Instead of using cast iron standards, wrought iron standards *LL* are used. In fact, in engines which have been built during the past few

This truck is sometimes made with a rigid center and sometimes with a swing center. Of course the laying out for the swing center would be done the same as we proceeded with Fig. 79. In laying out the rigid center we locate the two braces, *E E*, so that when the center casting is bolted fast to them, the centre of it will be at the intersection of the lines, *A A* and *D D*. In laying out the pedestal braces of this truck it is a good plan to turn the truck frame over and mark them off the same as in the truck already described. This being a single pair of wheels if the center casting is laid out central between the hubs it would have a tendency of itself to roll along fair with the track, but on the back end it is connected by a guide yoke to a brace on the frame which has a bearing on it for the pin in the yoke to work on. Now if we have the line, *D D*, square with the center of the axle, we must lay out this yoke so that the center of its pin-hole must be along this line. It is easily seen that moving this hole to one side of the center has the same tendency on this truck to make the wheels climb the rails as setting the wheels out of center in the trucks shown in Figs. 79 or 81. To lay out this yoke we will suppose the hole for the center pin to have been drilled, then find the center of it and clamp the two ends onto the truck frame, and move the yoke until the pin hole comes in line with a straight edge laid along the line, *D D*, of the frame. Having set the yoke, scribe it where it fits on the frame, and have it planed out so that it fits over the frame. Now we must make sure that the brace which couples up with this yoke is also central, and we can try this brace and prove it up by measuring from the frame. This yoke has two braces, *F F*, connecting it with the pedestal. Now, looking at Fig. 82 we can see that the centers bearing on the yoke should be level when the truck stands plumb. The equalizer which connects the spring gear of the truck with the spring gear of the forward driver has its center bearing in a casting which bolts to the underside of the cylinder saddle. It has two holes in it so that the leverage between the truck and driver may be varied. It is a very common thing to use coil springs on this style of truck, instead of a flat spring as shown. Along with the flat spring shown, there is a coil spring also used, which is adjusted by means of a nut on the bolt which connects with the equalizer. In case the engine is a little low in front it can be raised by screwing up on this nut, which compresses the coil spring, or by putting in clips between the gib and the flat spring.

Truck wheels very often need renewing. To do this job with this form of truck, remove the pilot, jack up the front of the engine and take off the pedestal braces, and roll the defective wheels out and replace them with another set, using the same boxes if possible; in some engines there is

lined with anti-friction metal, and where it is intended to run the brass in contact with the journal it would be most too expensive to bore them out, so instead of boring they are generally ground out by means of a lap. This lap is made with an iron center through a piece of hard wood, which is turned round and is covered with leather, and this leather in turn is covered with emery, and is generally made about three feet long so as to give plenty of wearing surface. Of course boring and fitting down into place is much the better way. Fig. 85 shows a box with a brass liner fitted into it. This box is slotted out to receive the liner, and after the liner is forced into place and the cellar is fitted in, the box is bored out. Fig. 86 shows the same style of box, with the exception that the journal instead of coming in contact with the brass is brought in contact with two strips of babbitt metal about 1¼ inches wide; and it is surprising how well a box of this kind will wear, running for a very long time before the babbitt wears out. As the brasses wear down, in these different styles of boxes, it leaves a distance between the cellar and the axle. This distance may be filled up, as we explained in another article (on driving boxes),* by fitting pieces on the sides of the cellar or by drilling holes and babbitting it up to fit close up to the axle.

Very often through some accident an axle becomes bent. Now it is quite a little job to take the wheels to the lathe and try them. Fig. 87 shows a tool which will be found very handy for trying wheels. The drawing shows it up very clearly. *A* is the main bar of the tool. On this there are four adjustable heads, on each of which is shown gauges *BBBB*, which are adjustable up and down and held in place by the set screws *CCCC*. To take in axles of different lengths, make one end of this rig adjustable. Fit the rig to the center of the axle to be tried and roll the wheels along the track for a revolution or two and watch the gauges. If the axle is bent the fact will be declared. This would be a very good tool for car repairers to try axles with. After running for some time, the boxes will wear in the pedestals. To take up this wear, pin pieces onto the box and then plane them off so as to again fit in the pedestals. These pieces should not be less than ¼ inch thick. In a truck, as shown in either Fig. 79 or Fig. 81, should both flanges of the leading pair of wheels have a tendency to wear sharp, or the wheel in any way wear more than the after pair of wheels, jack up the engine and turn the truck around. Truck boxes should be made thicker on one flange than on the other; then after they have worn to considerable lost motion against the hubs, turn the boxes around. Collars on engine-truck axles are very much in the way when it is necessary to pack cellars, etc.; and for all the good they do might just as well be left off.

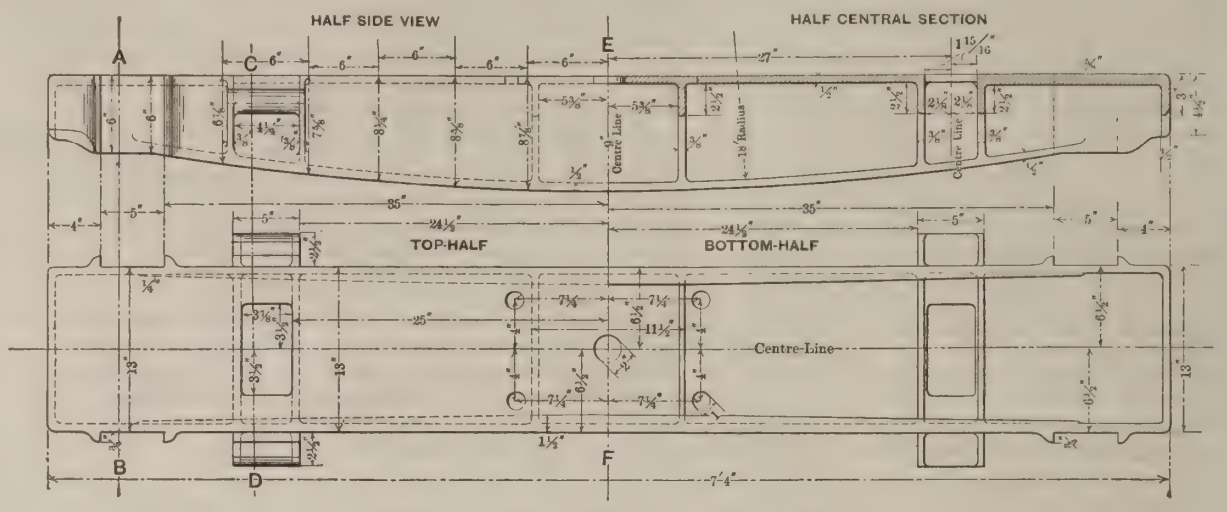
*See page 113, NATIONAL CAR AND LOCOMOTIVE BUILDER, July, 1893.

Steel Car and Tender Truck Bolsters, Missouri Pacific Railroad.

A year ago, in our issue for April, 1893, we briefly described the basic cast-steel truck bolster designed by Mr. M. B. Schaffer, Master Car Builder of the Missouri Pacific Railroad. The bolster has been adopted as standard on the Missouri Pacific road, and has been largely used in renewals and new work. Its construction is such that it can be used in the ordinary form of trucks with arch bars without changing the arch bars or journal boxes. In fact it can be used to replace wooden bolsters without making any changes in the ordinary form of trucks.

Since our previous mention of this bolster there have been some improvements in its construction and in its apparent field of usefulness. It was originally designed for freight car trucks, but the Missouri Pacific Railroad has, with some modifications in its construction, applied it to locomotive tender trucks with very satisfactory results.

We present herewith engravings showing the general arrangement and details of construction of this bolster in its various forms, and of the car and tender trucks to which it has been applied. As used in both car and tender trucks, this bolster dispenses with the necessity of using top and bottom bolsters, as in wood and composite construction. Ordinarily, the top bolster is made straight upon its top surface, but in this case, there being no lower bolster, the top surface can be made concave to the car from four to seven inches deep, thereby giving an opportunity for increasing the depth of the transom on the car, should builders so desire, in order to secure additional strength. This avoids the well known weaknesses of wooden bolsters and the objections to their use. As the car is kept free from the side bearings, the trucks are left free to follow the track most easily; instead of being compelled to sometimes run crossways of the track, causing sharp flanges, rail wear, a rough riding car with all that implies, and sometimes derailments that are attributed to other causes.



Bolster of Basic Steel for Tender Truck.

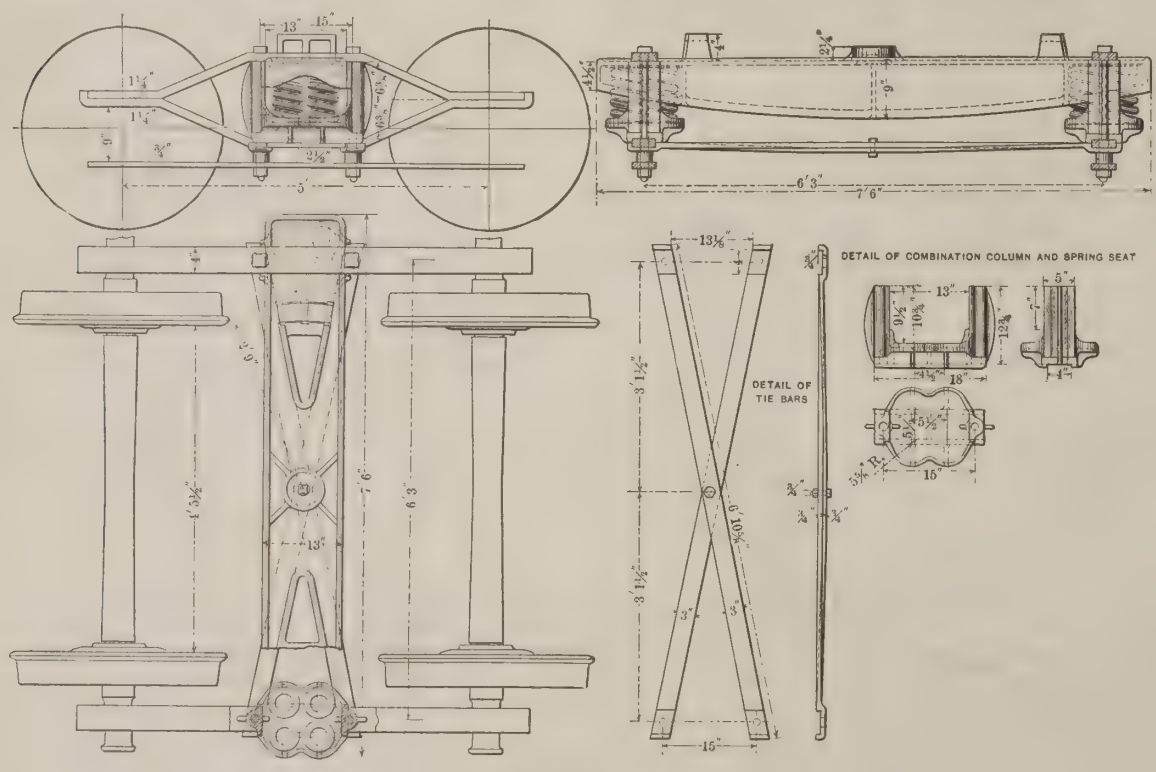
That the bolster is amply strong is shown by the fact that on those made for tender trucks 150,000 pounds load has caused a deflection of only ½ inch and a permanent set of less than $\frac{1}{16}$ inch. This cast-steel bolster has promoted the employment of a new feature in car or tender trucks, which permits the use of a movable or swinging side bearing—a steel casting made in T form with the horizontal part of the T turned down and the ends of this supported by hangers, hung from the lug on the side of the bolster, as shown in the side view of the tender truck. This side bearing moves very easily, for the pressure of one finger will swing it from side to side when unloaded, so it is evident that when loaded it swings freely.

The Missouri Pacific road has been using a tender truck constructed as shown by our engravings for about three months, and the results have been most satisfactory. There are no indications of sharp flanges appearing on the wheels. Mr. L. Bartlett, Master Mechanic of the road at St. Louis, says in a letter to us on the performance of this truck: "There is no grinding of the flanges of this truck when it strikes curves, although we purposely allowed the load to be carried upon the side bearing on the present one to determine the effect. So far as we are able to judge at present, it will make no difference whether the load be carried upon the side bearing or upon the center plate. The truck moves equally free in every case.

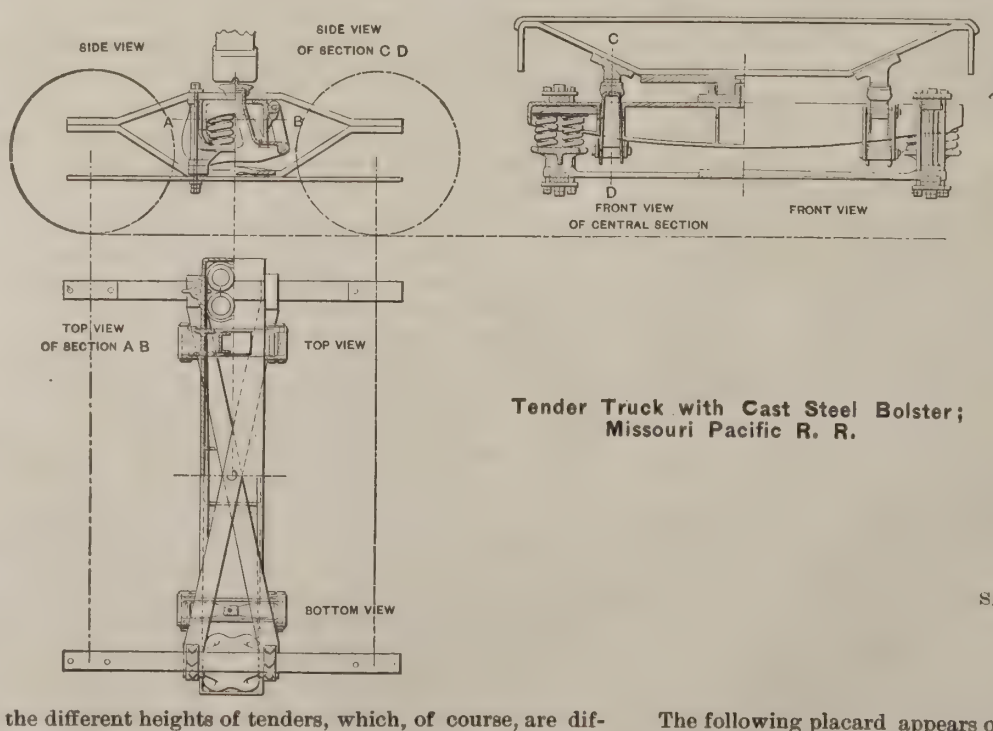
"The construction of the truck is of the simplest indeed. There are 12 bolts through the archbars, and in tender trucks four additional ⅞ bolts are put on the outside of the bar to protect the main bolts through the column guide of springseat. This makes 20 bolts only in the entire truck. Allowing very little or no play between the upper and lower sidebearing, the rolling of a car or tender is almost eliminated, causing the cars or tenders to ride steadily.

"The great consideration, so far as I can understand, is to get a truck that will swing or accommodate itself to the curves without that constant straining of the truck frame due to the load being on the side bearing. While this may wrench the car frame it certainly wrenches the truck frame a great deal more, and to obviate this the swinging side bearing was designed.

"We feel we have the safest, cheapest and as near a perfect truck as can be made in using the arch-bar type. Certainly, so far, I have seen nothing that compares with it. The cost of the truck will be slightly more than an ordinary car truck, at least where we use the movable side bearing, $10 will cover this difference, and, while the first cost may seem larger to the builder or railroad company, the saving in repairs to such a truck will more than compensate the difference in the first six months of its use. The center-plate of the tender truck is made loose, in order that we may line up between the plate and bolster, to suit the different heights of tenders, which, of course, are different to suit the different sizes of driving wheels. In car trucks, the center plate is cast upon the bolster and remains fixed."



Freight Car Truck with Cast Steel Bolster, Missouri Pacific R. R.



Tender Truck with Cast Steel Bolster; Missouri Pacific R. R.

New England Railroad Club.

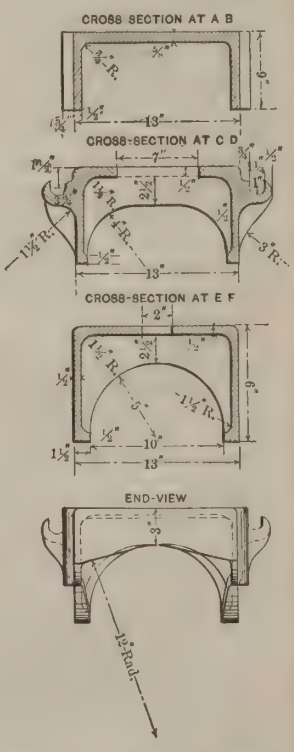
The regular monthly meeting of this club was held at Wesleyan Hall, 36 Bromfield street, Boston, on the evening of March 14. The principal feature of the meeting was the reading of a paper by Mr. F. M. Twombly, of the New York, New Haven & Hartford Railroad, on some incidents of life in Mexico, describing his experiences in that country for a couple of years while in the employ of the Mexican Central Railway. Mr. Twombly describes some very interesting experiences, and in well chosen language vividly portrays the customs, habits and character of the people in Mexico that he came in contact with.

The Memphis Car and Foundry Company.

Mr. E. A. Nixon, formerly Assistant General Freight Agent of the Jacksonville Southeastern Line, has been appointed Traffic Manager of the Memphis Car and Foundry Co. This company is the successor of the Litchfield Car Co., and is erecting a new plant at Memphis, Tenn., with a capacity of 20 freight cars per day, and with a wheel foundry which will finish 250 carwheels per day. The nearness of Memphis to the Southern timber and iron regions gives it a large natural advantage over Northern cities, and with 20 years of successful experience at Litchfield, Ill., the officers of this company are sure to do some car building that will give their plant an enviable reputation.

An expensive wreck was caused on the New York, Lake Erie & Western, March 15, by a mammoth bowlder which rolled a mile down the the mountain side, five miles east of Hancock, and lodged in the edge of the roadbed, pushing the double tracks out of shape. A track-walker who heard the noise of the rock descending and learned the danger flagged a regular freight train approaching from the east. While he was flagging the westbound train an eastbound extra freight, with 64 cars, came around a curve and striking the obstruction was wrecked, and 22 of the 64 cars were piled up behind the engine; most of them toppled into the river. The engineer, firemen and brakemen jumped and escaped injury. The rock, estimated to weigh 170 tons, had to be blasted to get it out of the way.

In order to avoid setting fire to the pampas by sparks from its locomotives, the Buenos Ayres Great Southern Railroad has been experimenting successfully with petroleum as a locomotive fuel, the intention being to substitute petroleum for coal, if practicable.



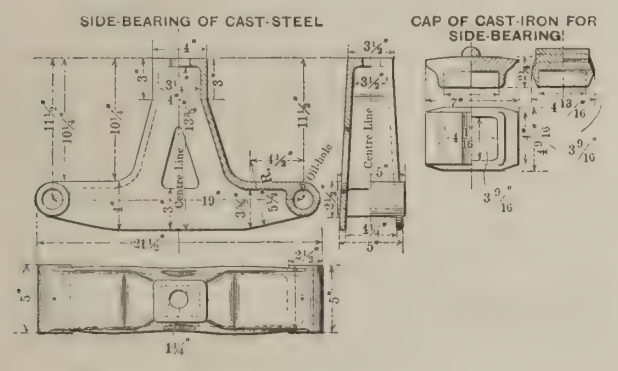
Sectional and End Views of Steel Bolster.

The following placard appears over a clock in a railway station in Iowa: "This is a clock; it is running; it is Chicago time; it is right; it is set every day at 10 o'clock. Now keep your mouths shut."

New York Railroad Club.

At the February meeting of this club a resolution was adopted approving of the report of the Master Car Builders Association Committee fixing standard sizes for catalogues and specifications. This report was published and the filing case proposed by the committee was illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER for February. Mr. R. A. Parke read a paper on "The Vertical Influence of the Counterbalance." The paper was inspired by the experiments that have been made at Purdure University respecting the counterbalance of locomotive driving wheels while running at high speeds. Mr. Parke's paper undertakes to give a mathematical solution of the problem of properly counterbalancing locomotive drivers, and was well received by the meeting and prompted considerable discussion of the general subject of counterbalance. Professor Goss, of Purdue University, was present and briefly described the method pursued in his investigations to ascertain if locomotive drivers were actually lifted from the rail at any point of their revolution while running. The test as described by Professor Goss was as follows:

A length of $\frac{3}{8}$-inch gaspipe, to serve as a guide for the wire, was secured in front of the wheels which were to be experimented upon, and when the desired speed was obtained, an 18-foot length of small annealed wire was fed through under the wheel. It was found that for the rear drivers, at a speed of about 59 miles an hour, a short length of this wire would retain its full diameter. This is assumed to be the speed at which this driver lifts, and not 40 miles, as has been stated. At 63 miles an hour, we have obtained from the rear wheel a length of full wire of between four and 5 feet, showing that the wheel was off the rail for nearly one-third of its revolution. The main driver has never been shown to lift at any speed that we have been able to attain.



Details of Tender Truck with Cast Steel Bolster; Missouri Pacific R. R.

Wires that have passed under the wheel have been carefully measured and their thickness plotted on an enlarged scale. Beginning at their thinnest part, these show a gradual increase in thickness to a point where the wheel leaves it, and a sudden reduction of thickness where the wheel returns to it, showing conclusively that the rise of the wheel is gradual and its descent quite abrupt. It occurred to me that such a calibration of the wire would give a basis for calculations which would show the total rise of the wheel and also the velocity of its descent; that is, the curve obtained by plotting the wire would define the motion of the wheel for some particular instant, and thus furnish a starting point for mathematical work. But at this point I met difficulty in duplicating wires. For example, wires obtained from the right rear wheel, at 59 miles an hour, would sometimes be of full diameter for a length of only a few inches, and sometimes for a length of a foot or two, showing that either we were unable to determine the speed with sufficient accuracy, or, what probably is true, that the rocking of the engine tends to vary the pressure of the wheel upon the rail entirely independent of the action of the counterbalance. That this is true has been made pretty clear by putting wires under both rear wheels at the same instant. There will sometimes result a considerable length of full wire from one side and almost no length of full wire from the other side; again results will be reversed.

Another very interesting thing that has been shown is the presence of minute and extremely rapid vibrations in the wheel. In order that definite effects impressed upon the wire might be connected with definite phases in the motion of the wheel, a light nick was made across the face of the tire with a sharp chisel. This nick leaves a little projection upon the wire. Now, where there is one nick in the wheel, there will sometimes be two projections upon the wire, the distance between them varying from an eighth to a quarter of an inch, showing that the wheel actually struck the wire two distinct blows within the space indicated. A quarter of an inch on the wire at 60 miles an hour corresponds to an interval of time of about $\frac{1}{4000}$ part of a second, which may be taken as representing, approximately, the time of vibration.

Professor Goss said that the wire used was of annealed iron, that the results obtained were with a cut-off of 6.6 inches, a wide-open throttle and 130 pounds boiler pressure; and that the nicks made upon the wire were in line with the counterbalance on the heavy side.

In a paper on "Lubrication," read by Mr. H. Rawlings before the Birmingham (England) Association of Engineers, the following conclusions were reached:

The best lubricants are the following for usual conditions met with in practice: Under very great pressure, with slow speed, graphite, soapstone, tallow and other greases; under heavy pressure and high speed, sperm oil, castor oil and heavy mineral oils; under light pressure and high speed, sperm, refined petroleum, olive, rape and cotton seed; ordinary machines, lard oil, heavy minerals and other vegetable oils; steam cylinders, heavy mineral oil.

Annual Report of the Chicago, Burlington & Quincy Railroad.

The annual report of the Chicago, Burlington & Quincy Railroad Company for the year ending Dec. 31, 1893, shows:

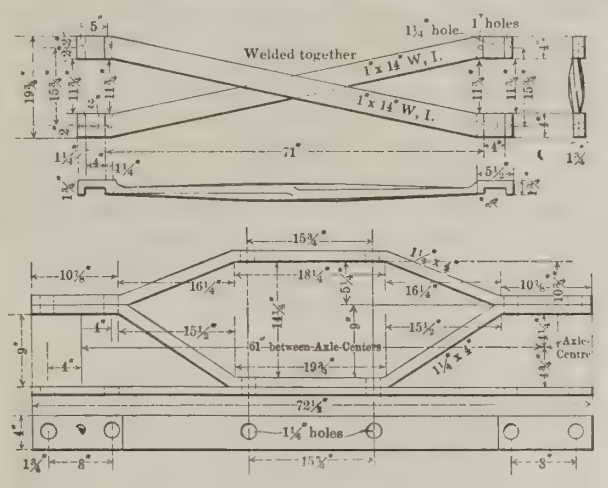
	1893.	Changes.
Gross earnings	$31,042,699	Dec. $1,959,424
Operating expenses	21,224,503	Dec. 823,742
Net	9,818,466	Dec. 1,135,682
Other income	1,771,092	Inc. 489,275
Total	11,589,558	Dec. 225,642

The loss in freight was due mainly to loss in tonnage. Rates were about the same as in 1892. Operating expenses were mainly reduced by temporary economies, postponing, where it could be done without impairing safety and efficiency of the service, expenditures which should have been properly made. In the year five per cent. was divided on the stock.

It is unnecessary to say this is not a satisfactory state of things, and while it is in part due to hard times, that by no means tells the whole story. Western railroad troubles are chiefly due to unfair statutes preventing transportation on business principles.

Northwest Railroad Club.

The Northwest Railroad Club met at the Hotel Ryan, Tuesday evening, March 12, and discussed a paper presented by S. L. Bean, Master Mechanic of the Northern Pacific, on "Brick Arches in Locomotive Fire Boxes." E. A. Williams, Master Mechanic of the M., St. P. & S. St. M. Ry., was unable to be present, and his paper on "The Care of Passenger Trains at Terminals" was not read as announced, but will be presented at the next meeting of the club.



ARCH, TIE AND CROSS BARS.

New Schedule of Pay on the Philadelphia & Reading.

A new schedule regulating the pay of firemen and brakemen has been adopted on the Philadelphia & Reading R. R. The maximum rate of pay for all firemen in the company's service will be $2.10 per day or per trip of 100 miles or less. The maximum rate of pay for all frieght or coal train brakemen, or brakemen employed in the shifting service, will be $2 per day or per trip of 100 miles or less. The maximum rate of pay of all passenger train brakemen will be $1.80 per day or per trip. All existing rates of pay for firemen or brakemen amounting to less than the above rates will stand as at present. Proportionate allowances will be made for trips over 100 miles in freight-train service, and the same allowances in regard to overtime as provided in existing schedules, excepting that no rate for overtime will be allowed any firemen over 21 cents per hour or any brakemen over 20 cents per hour. Flagmen on all freight and coal trains will be paid the same rate as brakemen, but will be given preference over brakemen in promotion.

The Pittsburgh Locomotive & Car Works are building two 10-wheel locomotives for the Valley Railroad of Ohio.

Western Railway Club.

Shop Tests of Locomotives—Maintenance of Air-Brakes—Steam Distribution for High-Speed Locomotives.

At the February meeting of this club a resolution was adopted expressing the club's appreciation of the good work done by Mr. Willard A. Smith, as Chief of the Transportation Department of the Columbian Exposition. A committee, consisting of Messrs. George Gibbs, David L. Barnes and John W. Cloud, made a report on "Shop Tests of Locomotives," in which the advantages of such tests were expatiated on. The following-named subjects were mentioned as among those that could, perhaps, be more accurately investigated by shop tests than in any other way: Front-end arrangements, the utility of petticoat pipes, defective plates and the best shape and diameter of stacks; economy of evaporation at different rates of combustion; economy of throttling steam vs. working more expansively; economy of compounding; effect of raising steam pressure upon the economy of simple and compound locomotives; economy of steam at various speeds and loads; effects of changing lap, lead and travel of valves, port length, and the use of Allen valves; power consumed in internal friction by different types of locomotives; counterbalance and water circulation in boilers. The report stated that the apparatus for carrying out such tests would necessarily be similar to that employed at Purdue University.

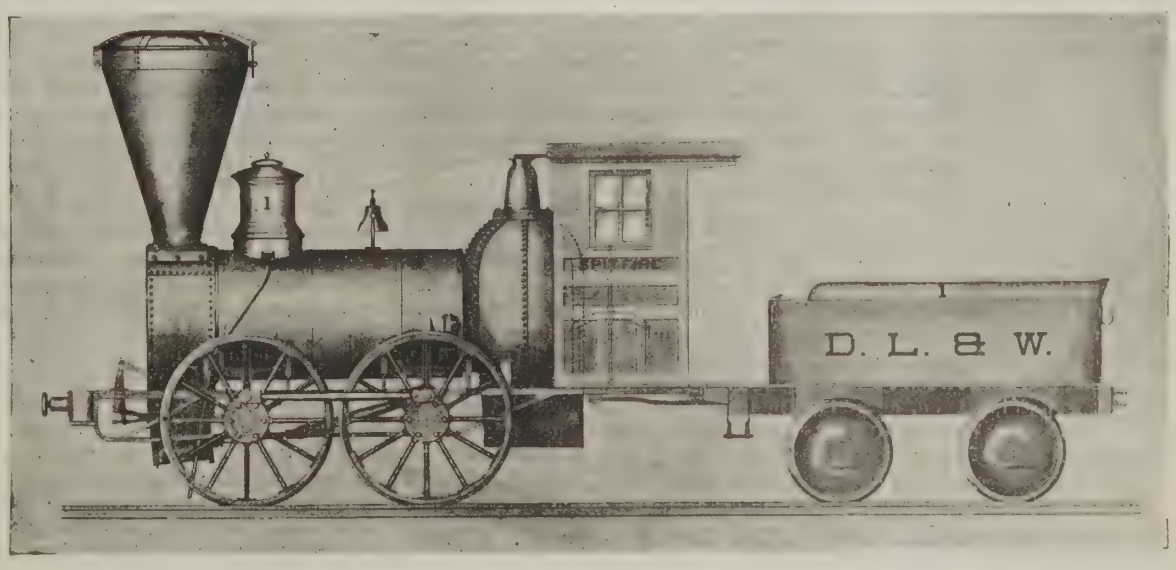
Prof. W. F. M. Goss, of Purdue University, in speaking of the work of locomotive testing in which he has been engaged, said: "Many problems have been taken up in the nature of side issues to us. We have felt that the great thing was to determine, with great accuracy, the process that is going on in the cylinders. We have bent our energy to that. Some other investigations have been taken up as side issues, and have only been pursued to a slight extent."

A committee was appointed to present the matter of shop tests to the General Managers' Association of Chicago, and ask co-operation in arranging for a locomotive to be placed at Purdue University for testing purposes.

The paper read by Mr. G. W. Rhodes at the previous meeting on Air Brakes and Their Maintenance was discussed at considerable length. The discussion showed considerable diversity of opinion relative to the best position of air brake hose when not coupled up. Mr. C. H. Quereau, Engineer of Tests of the C. B., & Q. R. R., read a paper on Steam Distribution for High Speed Locomotives. A review of this paper is presented in our editorial columns.

The First Locomotive on the Delaware, Lackawanna & Western.

The accompanying illustration shows the first locomotive owned and operated by the Delaware, Lackawanna & Western R. R. The engine was known as the *Spitfire*, and but very little of its construction, work and history can now be learned, as it was destroyed some years ago. It was built for the Philadelphia & Reading R. R., in 1838, by Braithwaite and Erricsson, of London, England. It was purchased of the Philadelphia & Reading by the Delaware, Lackawanna & Western, and was used for hauling the material used in the construction of the road.



The "Spitfire." First Locomotive on the Delaware, Lackawanna & Western.

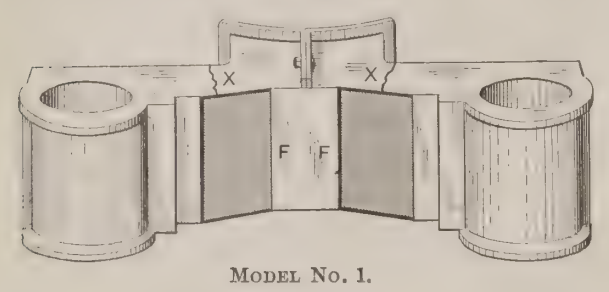
The engine had inside connected cylinders 10 inches in diameter with a stroke of 15 inches. The valve gear was of the old "hook motion" type. The engine had four wrought iron driving wheels. The boiler was 36 inches in diameter and eight feet six inches long. The firebox was round with a spherical top, and the boiler contained copper flues one and one-half inches in diameter and eight feet two inches long. The date of this engine's service and a glance at the smokestack make it unnecessary to say that the fuel used was wood. At the time of the purchase of this engine by the D., L. & W. its gage was four feet eight and one-half inches, but this was changed to broad gage, or six feet, which was then the gage of the Delaware, Lackawanna & Western

Designing of Locomotive Frames.

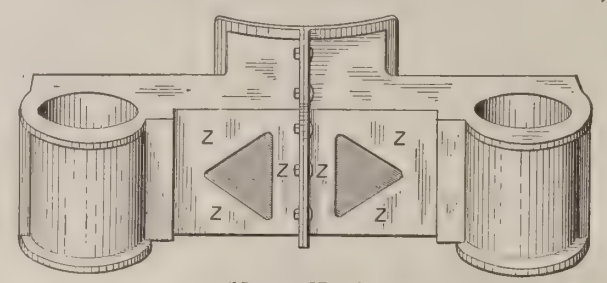
The following is a portion of the report of the Committee of the Southern and Southwestern Railway Club on the best methods of securing cylinders, smokeboxes and frames. The portion of the report that treats of these methods was published in the February issue of the National Car and Locomotive Builder, and the portion that appears in this issue treats of the designing of single and double bar frames from the front pedestal to the bumper beam. The reasons for considering the designing of this part of the frames in connection with the subject of securing cylinders, smokeboxes and frames, are that if there are any weaknesses about the form or fastenings of the parts which will allow them to work or bend, loose and broken cylinders are sure to follow.

The Design of Single Bar Frames from the Main Pedestal to Bumper Beam.

It is of the utmost importance that the cylinders and main axles should be rigidly and firmly connected. This is too often not the case, the result being that not only the frames break but the cylinders themselves become loose, cracked and broken. The strains to which the front sections of the engine frames are subjected are, first, the direct pull and thrust produced by the steam in the cylinders; second, the lateral bending partly due to the side strains on the engine when curving, when the front portion of the engine is suddenly thrown sideways by the action of the front truck having to turn the rear portion of the engine laterally from the direction which it has a strong tendency to maintain when running at a high speed. Side strains are also produced by the swaying or wriggling motion of the engine which is inseparable from the use of outside cylinders, even when the best proportions are maintained in counterbalancing. Third, vertical strains and bending produced in the frame bars by the presence of the equalizers and springs, by inequalities in the truck, by the sudden lifting of the front end of the engine in running on the elevation of curves, and by the internal strains set up in the frames themselves on account of poor design. While the iron of the frames is subjected continually to the above mentioned strains, it is also subjected to severe blows and jolts which



Model No. 1.



Model No. 2.

will search out the weak point if there is one about the frame, and hammer at it until a fracture is produced. Bad counter-balancing is also a very fruitful cause of such trouble. In designing an engine frame every effort should be made to take up the main strains in the frames by a good distribution of the metal in direct tension compression, or shear. Opinions are divided as to whether it is better to allow the engine frames to bend slightly, or whether they should be absolutely rigid. Your committee thinks that for heavy engines rigidity is absolutely essential. The best modern designers of stationary and marine engines devote their best efforts to obtaining an absolutely solid and rigid bed-plate connection between the cylinders and the main shaft or axle, where the power is developed. It seems as if this would be still more necessary with locomotives where the advantage of a firm stone foundation cannot be obtained. No amount of care and forethought in designing the frame and fastening to the cylinders will prevent broken saddles, unless the saddle, which is actually the bed-plate and foundation of the locomotive, is itself properly designed to withstand the strains to which it is subjected.

To get a better idea of the strains on this portion of a locomotive let us refer to Fig. 37, which shows a plan of the frame and cylinders, with portion of boiler outlines dotted in. There is nothing but the strength of the cylinder saddle to hold the frames in position as regards one another. There is no diagonal bracing, and the tail bar and the cross braces at expansion plate and guide yoke, as well as the bumper beam, as will be seen at once, can do little or nothing to prevent the longitudinal side movement of the frames one to another. When curving, the wheels on the outer rail travel over a greater distance than those on the inner rail, one side of the engine has to slip on the rail, and it depends on the condition of the rail which side does slip, but usually the wheels on the inside slip. They are forced to slip, because they are held in an improper position as regards the rail on which they run, by the frames and the opposite side of the engine, where the wheels are holding. If the adhesion of a heavy engine is taken, at, say, 18,000 pounds, the adhesion on the one side will be, say, 9,000 pounds, and this is about the force which compels the frames to hold the inner wheels back and slip them, or break their adhesion to the rails. The force must then be transmitted from one side to the other through the saddle, tending to twist, wrench or crack it at the weakest point, where the frames and cylinders are secured together. Then if the engine is slipping, and caught on one side on sand, the one side which is on sand is jerked ahead, the moving parts on this side are arrested directly by the grip of the wheels on the rails, while the momentum on the other side has to be stopped through the axle and through the saddle, causing similar strains, the cylinder being forced ahead as shown exaggeratedly in Fig. 37, causing heavy wrenching strains on the saddle. When an engine is reversed on sand, very heavy twisting strains of this kind are thrown on the saddle, as the engine slips, grips and slides. Those who have ridden much on heavy locomotives cannot fail to have noticed that the back end of the boiler switches sideways on the frames, especially if only held to the frames by loose-fitting expansion links, without slide pads at the rear end. Foot plates work loose, back head braces work loose and break off the studs fastening them to the boiler head by this side swinging, and when the engine gets to slipping and wriggling on a slippery rail, the rear end of the boiler swings as shown in Fig. 37 by the dotted lines, like the heavy end of a pendulum swinging from the cylinder saddle. Of course the movement is small (not much more than $\frac{3}{16}$ inch), but the strains produced in the saddle castings by even this movement of the boiler must be very great. Reference to Fig. 37 will show that the metal in the cylinder saddle is very poorly distributed to withstand all these strains, there being no diagonal stiffening except in some cases that which is afforded by the bottom ribs *FF*, the center portion being only a square box with parallel internal compartments.

To further illustrate the weakness of the ordinary form of cylinder saddle, the committee begs to submit herewith two models of cylinders, which have been roughly constructed out of drawing paper. In both of these steam ports and passages have been omitted, as they do not materially affect the point at issue. By looking at the under side of the first one it will be seen that there is little or no diagonal bracing in these cylinder saddles. By taking the cylinders in the hands and twisting them in a similar way to which cylinders are twisted on engines, by the causes previously mentioned, it will be seen that the front and back faces of the saddle walls will buckle at their weakest points, "*XX*," which are right below the verticle corners of the saddle. It is well known that the majority of broken cylinders give away right at this place. Your committee believe they are safe in saying that 90 per cent. of the cylinders in service on American railroads to-day are weak in this particular way.

The second model is identical with the first, except that a bottom flange or rib has been inserted. The insertion of this rib does not add materially to the difficulty in making the casting. By taking this model in the hands and attempting to wrench it, it will be found to be absolutely rigid. Your committee feel that they cannot too strongly recommend that additional stiffening to the walls of the cylinder saddles, as exemplified by this second model, be applied. Mr. Reuben Wells has suggested as a means of preventing the breaking of the cylinders, where this weakness of the saddle exists, that a ¾-in. steel plate, planed out ¼ in. deep to take the frames, securely bolted to the frames and saddle, and stiffened by angle irons riveted to the upper surface, be used front and back of the cylinder, as shown at *GG*, Fig. 37, which will no doubt be a good method of assisting weak saddles, but it would hardly be wise to design the saddles light in the first instance, and depend upon such braces for strength. They are too apt to come loose at the bolts and rivets, allowing the whole strain to come on the saddle, which not having been intended to withstand such strain will give way at once. Looked at from the above point of view it seems as if a better plan to follow would be, when designing new engines, to give a longer base to the cylinder saddles where they bear on the frames, and support them by heavy horizontal webs, as shown at Fig. 38, which would give the saddles great diagonal strength at the lower surfaces, and to help them to resist the wrenching or twisting strains, and also to use horizontal webs, as shown in Fig. 13, at *ZZ*. Great care should be exercised to see that the fastenings of the boiler to the frame at the saddle and back are such that absolutely no lateral movement of the back boiler head, relative to the frames, can take place. In addition to which there seems to be no reason why, if so desired, a system of diagonal or sway bracing cannot be introduced as indicated at HH, Fig. 37, which would greatly strengthen the frames and relieve the saddle of wrenching strains.

Having thus considered the strains transmitted from and through the frames and saddles, let us refer to Fig. 19, which shows a form of frame joint which has been very extensively used on lighter engines, but when applied to heavier locomotives in hard service has given much trouble. The lateral and vertical bending strains have a tendency to make the front bar work on the splice as a fulcrum, and thus break connection where the foot bolts up against the pedestal leg. The bolt securing the pedestal and frame foot together break off; the two ends of the frame foot break off at the fillets, and the pedestal itself breaks off where it is welded onto the main bar. A great deal of this working and breaking is due to the form of pedestal cap used, which, even when a taper is used where the cap fits to the pedestal leg, will not remain permanently tight. On Fig. 19 are indicated by arrows the strains in the frame bars. It is fair to assume that the pull of the engine between the cylinder and tail bar is equally divided above and below the axle in the main bar of the frame and along the line of the pedestal caps and bottom braces. The surfaces of these pedestal caps, which have thus to bear half the strain produced by the cylinders, are certainly insufficient when compared with the strength of the main bar of the frame.

The tee headed bolt used with the pedestal cap in Fig. 19 is also a very poor device as compared with the double bolts for holding the pedestal cap up, shown in Fig. 20. A very slight give or spring about the fastening of the pedestal cap to the frame leg, or about the foot where it fastens to the frame leg, will cause bending of the upper sloping bar of the main frame, and it is a fact that these frames do break just behind the splice in the upper bar of the frame. In Fig. 20 an effort was made to overcome some of the difficulties found in Fig. 19, and considerable success followed this improvement, the strains in the frames being more equally divided and better balanced. There is less metal strained by bending, and more by direct tension and compression. But the swaying and bending of the engine still causes the foot to work loose on the pedestal leg, the foot bolts to break, and the pedestal leg itself to break off from the main frame, as well as the top and bottom sloping bars of the frame to break close to the splice.

To get over this trouble with the bolts and the foot working loose on the pedestal leg, some frames originally designed, as per Fig. 20, have had the bolts removed and dovetail keys fitted, as shown on Fig. 20A. It is reported that this change was decidedly beneficial. The forging and finishing of the frame, shown in Fig. 20, make an expensive job, and require much skill. Fig. 21 shows another form of frame joint used by a prominent firm of builders on a large numbers of locomotives. When turned out of the shop, engines with this form of frame joint did not have the key which is shown in the curve where the foot fits up against the main frame. Before this key was applied the frame foot worked very badly on the pedestal. The bolts were broken off and the frames cracked. Since the keys have been applied frames have shown more endurance, although they require constant attention, refitting of bolts and tightening up. It will be observed that the single bar is not in the center of the line of thrust and pull in the main bar along the pedestal cap, which produces a tendency to bend at "Y."

Your committee would also like to enter a protest against the use of taper-headed bolts for holding the foot against the pedestal, as shown in Fig. 22 and others; the use of a recessed head, as shown in Fig. 21, being far preferable. In Fig. 22 is shown still another form of frame joint, where further efforts have been made to overcome the difficulty caused by the working of the frame foot against the pedestal leg by increasing the length of the splice, by adding more bolts and keys, and by using an improved pedestal cap. This form of pedestal cap, or rather brace, with a through bolt, is to be highly recommended. It can always be made tight and secure by the simple application of a wrench, without having to go to the blacksmith and machine shop for refitting. In Fig. 22 the single bar is fairly well in the middle between the lines of thrust and pull along the main bar and along the pedestal braces, but the sloping projection of the main bar of the frame where it comes down to the splice is weak, the main strength of the joint being below and attached to the pedestal leg, which can only be welded onto the main bar, so that a fair proportion of the strains have to be transmitted through the leg to the main bar just at the point where they are welded together. The form of the front projection of the main bar is such that it is bound to spring, and thus throw strains on the pedestal leg as mentioned.

In Fig. 23 is shown still another form of frame joint somewhat similar to Fig. 22, but the foot on the front section of the frame has been dispensed with entirely, and the bolts through the pedestal leg done away with as useless, the service which these bolts were meant to render being performed by an additional bolt and key through the end of the front bar and the lower jaw of the main frame. This joint would have been a stronger and better one if the full thickness of the front bar had been carried through the splice, thus removing the weak point at 7 "Z", and allowing the projection of the main bar to be straighter and stronger. The same weaknesses exist, however, in this plan as were referred to in Fig. 22, about the projection of the front bar and about the main strength of the splice, having to be transmitted through the welded pedestal leg up to the main bar of the frame. As far as the distribution of the strain goes, however, it will be seen that the line of thrust on single bar comes fairly in the middle between the upper and lower lines of the main frame. In Fig. 24 an effort has been made to remove the main difficulties which existed in Fig. 23. The main strength of the splice is here carried directly to the upper bar of the main frame, and the joint is a decidedly good one, except the lower jaw of the splice is weak and the connections to the pedestal cap poor. In addition to which, the line of thrust of the single bar is not as well placed with regard to the strains in the upper and lower portions of the main frame as in Fig. 23. Fig. 25 shows a form of frame splice adopted by one of the prominent Western roads, which comes pretty near being a good job, but has the disadvantage that the main strength of the joint is again transmitted through the lower joint of the splice, and through the weld in the pedestal leg. The line of thrust of the single bar is also considerably out of a central position between the upper and lower lines of strain in the main frame, which will cause bending of the single bar beyond the end of the splice, and this bending has been concentrated right at the end of the splice by a mistake made by the designer in making this the weak point of the single bar, by making it taper from this point to the cylinders. Fig. 26 shows a form of frame joint similar to that used by a prominent Eastern road on their latest design of engine, which your committee believes to be as good and cheap a form of frame splice as can be designed. All the weak points formerly enumerated in the other splices have been eliminated. The forging is cheap. There seems to be little or no difficulty in obtaining a good fit, according to the statement of the motive power officer who has used this form of frame extensively, and the lines of strain and the distribution of metal are good and well balanced. Figs. 27, 28 and 29 are simply drawn to show how money can be spent and frames weakened thoughtlessly. Fig. 29 shows a straight simple bar, the only forging about this being the welding on of two heavy lugs. Fig. 27, for obtaining the same object, shows a very expensive forging, and a very weak form, which could have been avoided by slightly modifying the design, which would not have affected the strength or good proportions of the engine. Fig. 28 shows a cheaper form than Fig. 27, but the expensive end was quite unnecessary. The bumper can be quite as well carried by castings bolted on to the front bar, and in case of collision, the frame shown by Fig. 29, will certainly stand the punishment far better than those shown in either Figs. 27 or 28.

The Design of Double Bar Frames from the Pedestal to the Front Bumper Beam.

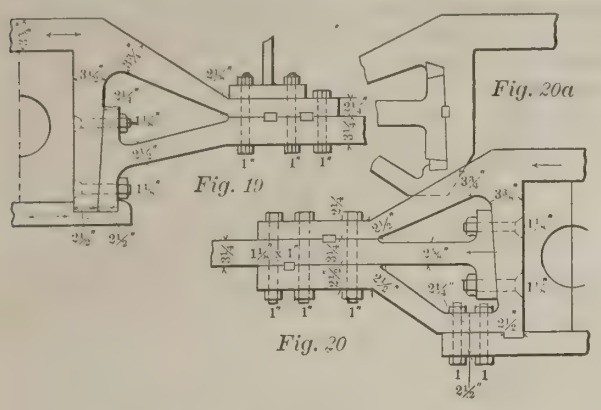
The same general remarks with regard to the strains and distribution of material hold good for the double bar frame as for the single bar frame. In Fig. 30 is shown a design of frame used on large numbers of consolidation engines. As first built, the foot of the lower frame only had one bolt in the upper lug; this was found to be insufficient—the majority of the brakes occurring in these upper bolts and upper lugs. The foot was lengthened out as shown, and also thickened from 2 inches to 2¼ inches; but even this is not sufficient, as both top and bottom lugs break off, the bolts are constantly breaking, and whenever there is any looseness about this portion, the main splices of the frame suffer. If the engine is allowed to run with slack in this foot joint or in the pedestal cap fit, the main bar of the frame is liable to break through one of the bolt holes or key ways at the splice. The counter-sunk headed bolts through the pedestal legs are also objectionable. They do not hold as well as a recessed headed bolt, as shown in Fig. 31, and the previously mentioned objection about using keys both at front and back of cylinder also holds good in case of Fig. 30. The standard distance between the center line of cylinder and the center of front axle cannot be so readily maintained, in addition to which there are two more keys to work loose. The forward portion of the lower bar of the frame is also of very weak design, and an expensive forging. It will also give way very readily in case of accident. Another objectionable point about Fig. 30, which also holds good in case of Figs. 31, 32 and 35, is that the top front bar is badly offset between the splice and the portion of the frame bolting to the cylinder. The arrows indicate the distance between the line of thrust at the main pedestal and the line of thrust over the cylinders, which will produce quite a tendency to bend at *W*, and will gradually cause the frame to open and shut on the key, resulting in loose keys, and after a while loose cylinders and loose bolts. In Fig. 31, the designer has endeavored to overcome some of the weak points of Fig. 30, but has increased the expense of the forgings materially in doing so. The attachment of the foot of the lower bar to the pedestal leg is objectionable for reasons previously mentioned, even although a key has been added and recessed headed bolts are used. The design of pedestal cap is better and more secure than that shown in Fig. 30, but still not as good as that shown in Figs. 33 and 34, for reasons previously mentioned. The greatest strength of the frame to resist collision is in the lower bar, the upper bar being badly bent downward in the front of the cylinder, and having an ugly offset just back of the cylinder. The only feature about Fig. 32 which is deserving of particular mention is the way the front ends of the two frames are joined together. This gives plentiful clearance for the front truck, and makes the front end of the frame light, and the fastening to the cylinders is very secure, but the single bar in front is not strong enough for use on heavy freight engines which have to do much pushing service, or which have to be used as double-headers, without throwing severe strains on the boilers through the smokebox braces, in addition to which it will be noticed that on account of the offset in the main bar of the frame at the splice there is a good deal of slotting work, which could have been avoided, and at the same time the design of the frame be improved.

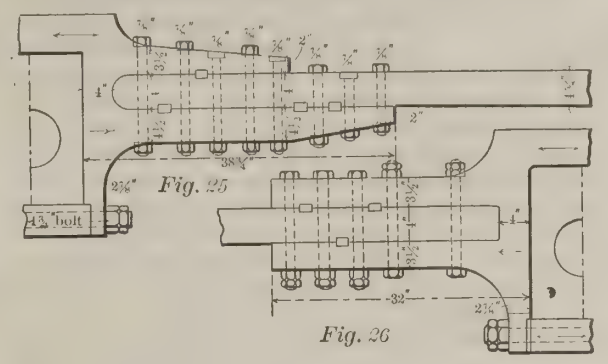
This slotting work is also introduced in Fig. 33, which shows a design of frame for heavy consolidation engines used in mountain service. This design is very heavy and strong. Especial attention is called to the introduction of a distance casting between the two frame bars just behind the cylinders, which is said to have given excellent results, and no doubt does add materially to the stiffness and durability of the frame. It will be noticed that the upper front bar has no offset to it, but that the thrust is transmitted as directly as possible to the upper bar of the main frame, which is a good feature. The front end of the lower bar is expensively forged and somewhat weak.

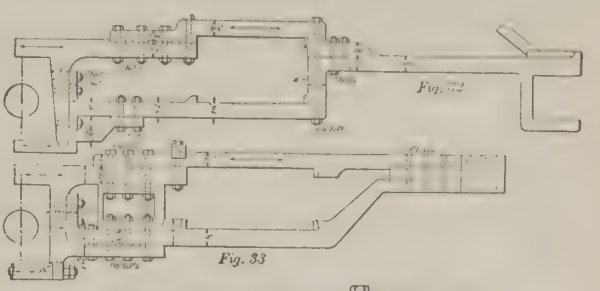
In Fig. 34 is shown a design recommended by a prominent railroad mechanical engineer, the object of which was to insure a good solid bearing for the keys over their entire width. It being supposed that if the key ways did not match absolutely in the ordinary design, the key would be in half shear instead of in direct compression. By use of proper drifts before fitting the keys, there ought to be no difficulty in obtaining a good fit for the keys, and it would be certainly cheaper to dress the key ways out so as to insure a good fit than to have to slot both the main and front frame bars, as would be necessary in case of Fig. 34, besides which it would be very difficult to maintain the proper relative position of the two portions of the frame. The keys will have a strong tendency to draw the upper portion of the frame forward or backward, according as to which key may be driven first and throw a heavy shearing strain on the bolts. Recently engines have been built with the frame slotted as per Fig. 34, and made to fit close without any keys at all—this is good, but very expensive, both in first cost and in renewal.

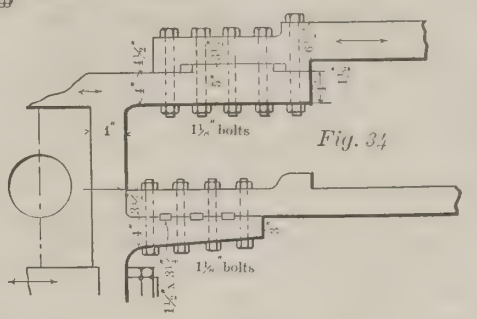
In Fig. 35 is shown a design for frame for heavy compound consolidation engines, the great space between the upper and lower bars being rendered necessary by the design of cylinders. No foot is used to bolt against the pedestal leg, but the end of the leg is turned forward in such a way that the grain of the iron can be made continuous along the pedestal leg and foot. The lower bar is bolted directly to this foot, and butts up against the front pedestal cap. The lines of strain between the cylinders and frames are very direct, but the front portions of this frame are quite weak, it being difficult to place them any other way and get sufficient clearance for the truck wheels with the wheel base which was permissible. It would have been possible in this case to use a design similar to Fig. 32, in the front of the cylinders to good advantage, and to have placed additional metal on the upper front bar, to give the required strength, if the engine was not intended for pushing or double-head service.

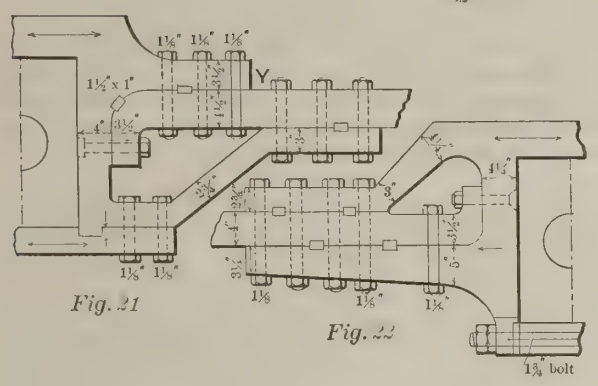
In Fig. 36 is shown what your committee believe to be about as good a design of heavy double bar frames for freight service as can be gotten up under the usual conditions. It will be noticed that the upper main bar is absolutely straight, the only forging about it being the addition of lugs at the forward ends of the cylinders, and drawing down of the forward end to 3¼ inches. There is offset back of the cylinders. Both the front ends of the main frames can be slotted off to a standard gage distance from the face of the front pedestals at one cut. The cylinders can be faced off at the lug where they bear against this frame at the time they are being bored out and faced off. By splitting the forgings under the steam hammer the grain of the iron can be made continuous along the pedestal legs and along the front projections, so that no additional welds will be necessary. The front bottom bar is turned down, and the pedestal bolt goes right through it, transmitting a large portion of the strain through the line of the pedestal caps direct to the cylinders. The pedestal leg itself is well backed by plenty of metal, and very stiff. If desired, the bolt back of the cylinders may be made a through bolt, so as to tie the frame bars together, and not depend on the strength of the casting for this. The lower front bar has been somewhat modified from the ordinary design, so as to obtain plenty of clearance for the truck wheel, while allowing ample strength to the frame, and at the same time stand the vertical pressure if the engine is being jacked up, as well as to give great strength in case of collisions. The thrust of the lower bar being taken up by the 3⅛ × 8 inch block and blocks, directly on to the upper main bar and cylinder, where they are strongest. These blocks can, if preferred, be forged in one piece, as at T, thus forming a cross-brace. The through bolt in the front of the cylinder will prevent the frames spreading in case of collision, and the forging of this frame as well as the machine work about it, is comparatively cheap.

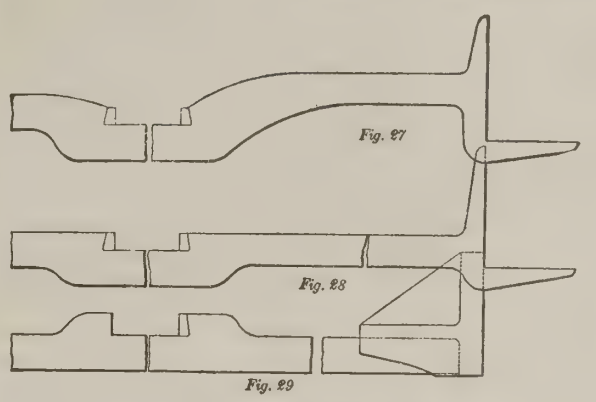


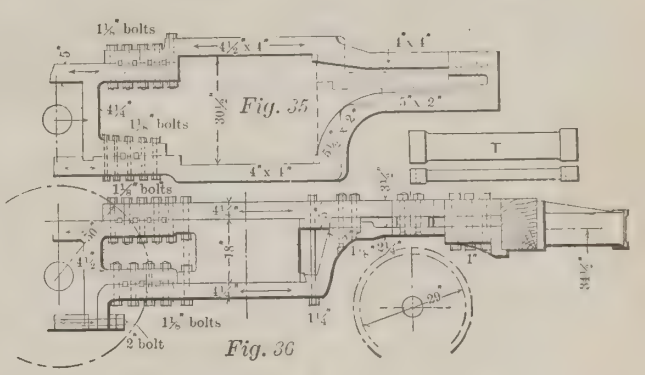


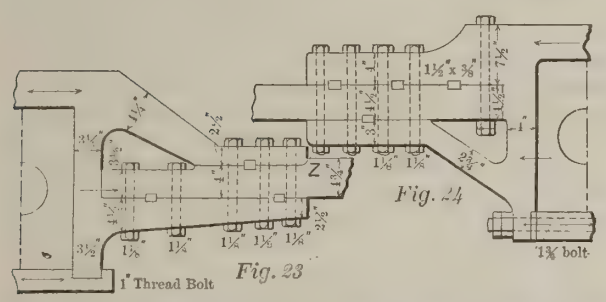


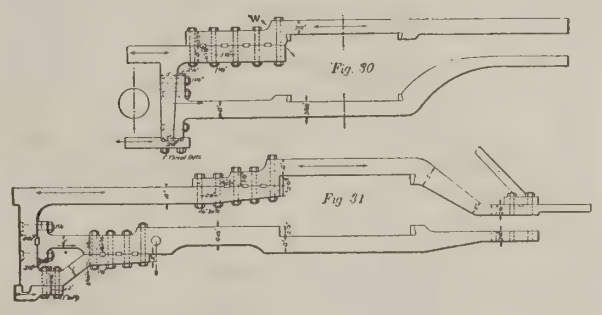


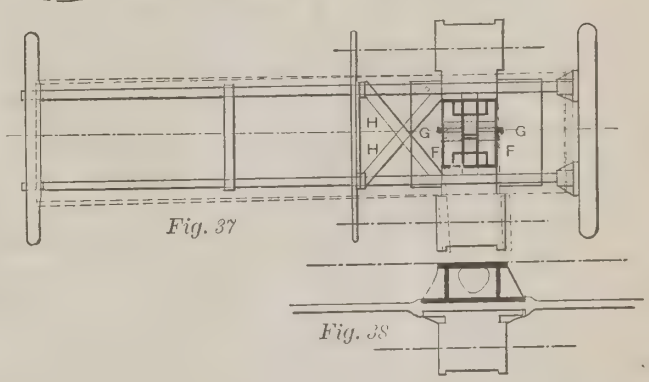












R. P. C. SANDERSON, P. LEEDS, T. W. GENTRY, Committee.

(*A synopsis of the discussion of this report appears on page 64.*)

Paint for Iron Work.

In the course of a paper read by W. Thomson at a recent meeting of the Manchester Association of Engineers, on the different paints and varnishes used for the preservation of structural iron and steel from rust, the author stated that from experiments made by him he had arrived at the conclusion that red-lead paint is the best preservative. This result had struck him as remarkable, because red lead is a highly oxidizing substance; but the reason was found to be that the red led had the effect of producing a skin of the unoxidizable and protective black or magnetic oxide on the iron itself under the paint. The author also found that other oxidizing agents, such as manganese dioxide, form a paint which preserves iron from rusting; and this discovery he regards as of great industrial importance. Mr. Thomson explained that, having been required some time ago to make a considerable number of experiments to ascertain the most suitable paint for protecting a large iron structure from the action of sea water, spray and rain, he arrived at the conclusion that red-lead paint was the best he could find for the purpose.

A combination of street railways, in San Francisco, which has been in progress some time, is at last completed, with a capital stock of a little over $18,000,000. Of this the Southern Pacific controls 76 per cent. and the remaining 24 per cent. is divided between the ferries and Cliff House road, the Omnibus Company and the North Beach and Mission roads. The combination includes 16 street car lines.

A northbound freight train, pulled by engine No. 36, on the Toledo, Ann Arbor & North Michigan Railroad, ran into a sinkhole three miles north of Hamburg Junction recently, killing the engineer and fireman and head brakeman. The hole had settled about 10 feet. The engine, two cars of coal and one tank car of oil were wrecked. The wreck caught fire. The brakeman's body was rescued from the wreck, but the remains of the engineer and fireman were deeply buried and were cremated. The fire was so hot nothing could be done to rescue them.

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

NO BACK NUMBERS.

All new subscriptions to the NATIONAL CAR AND LOCOMOTIVE BUILDER will necessarily begin with the current issue, or not earlier than the March issue, as our copies of the January and February issues are exhausted. Anticipating an unusual demand for the February issue, we published 1,000 extra copies of it, but the supply ran several hundred copies behind the demand.

LOCOMOTIVE SMOKE BOXES.

The communication in this issue from Mr. J. Snowden Bell discusses the advisability of dispensing with the ordinary extension to locomotive smokeboxes, and of returning to the use of short smokeboxes. Mr. Bell has never been able to see any good in the extension front end, and from former expressions of his we opine that he does not even like to see one, but that he would very much like to have a literary bout with some one who feels like championing the cause of the extension front end. We confess that we are not itching for such a set-to ourselves, but we will give our space to any one who wants to take the matter up. To our view Mr. Bell is standing with a chip on his shoulder, and we suspect that he is "loaded" with information respecting smoke boxes that he has not yet divulged.

There certainly appears to be a movement on foot toward the reduction of smoke-box length, and if, as Mr. Bell believes, the longer extensions can serve no useful purpose they should go, as the modern locomotive is expensive enough to build and maintain without having any superfluous parts or extensions.

PASSENGER CAR VENTILATION.

A correspondent in this issue expatiates on the evils of the present system, or rather lack of system, of ventilating passenger cars. This is a matter that has been repeatedly discussed in all the technical papers for a number of years. It is patent to even a superficial observer that the ventilation of passenger cars is wretchedly bad, and that it frequently causes much discomfort to passengers.

The Master Car Builders' Association has been trying for four years to get a report from a committee on this subject so as to enable it to take some action toward improving the ventilation of cars, but so far the effort has proved abortive. The trouble has been that, until the last convention, the subject of ventilating passenger cars was saddled on a committee having another subject in hand. For three years the committee on steam heating nursed the subject of ventilation and carefully returned it to each convention just as they got it, without any report.

The NATIONAL CAR AND LOCOMOTIVE BUILDER suggested to the last convention that the subject of ventilation be given to a separate committee. The suggestion was adopted, and a very able committee, of which Mr. R. P. C. Sanderson, Superintendent of Motive Power of the Norfolk & Western Railroad, is chairman, was appointed to make a report to the coming convention on the Ventilation of Passenger Equipment. Mr. Sanderson is not in the habit of letting grass grow under his feet, and the promise of an able and instructive report on this subject was given by the very inquisitive circular of his committee published in our issue of last December.

STEAM DISTRIBUTION FOR HIGH-SPEED LOCOMOTIVES.

A most excellent paper on this subject was read at the February meeting of the Western Railway Club by Mr. C. H. Quereau, Engineer of Tests of the Chicago, Burlington & Quincy Railroad. It is the best written and most complete exposition of the subject it treats that we have ever seen in print, but its length and amount of illustrative matter (diagrams) is such as to preclude its reproduction in these pages. All who are interested in the operation of locomotives should procure a copy of the paper and give its perusal their careful attention. Mr. Quereau has had a number of years' experience in testing locomotives on the C., B. & Q. in order to correct defects that injured the efficiency of the engines or contributed toward the expense of their maintenance or fuel consumption. This was a good school in which to study the subject he writes on, and dependence may be placed in the fact that his deductions are as good in practice as they are correct in theory.

The paper agrees with the general tendency in modern locomotive construction toward larger boilers and larger heating surfaces and higher pressures of steam, and insists upon the necessity of balancing the valves, quoting in substantiation of the latter from a report of a former Engineer of Tests of the C., B. & Q., Mr. Philip Wallis, to the effect that six horse-power of an engine is consumed in working unbalanced valves at 40 miles per hour, and but 2.2 horse-power is so required with balanced valves. The effect of speed on cylinder pressure is discussed, and it is shown that even though the cut-off and boiler pressure remain the same, the pressure in the cylinders decreases as speed increases, because the steam has less time to enter the cylinders and do its work. This finally limits the maximum speed of locomotives, and in the paper it is made the base of a recommendation of large driving wheels. The larger the drivers the slower is the piston and valve speed, giving more time for the steam to enter the cylinders and giving a higher cylinder pressure, upon which high speed depends. Tests to determine the economical influence of the diameter of drivers showed that of two engines carrying the same boiler pressure, but with drivers 62 inches and 68 inches respectively, the engine with smaller drivers made 8.8 per cent. more revolutions and used 7 per cent. more steam The opinion is expressed in the paper that larger drivers will lessen engine, track and bridge repairs. Holding in mind the necessity for high cylinder pressure, the paper states that this may ordinarily be increased by increasing the valve travel. Not only is the port opening for a given cut-off increased by this, but the port is opened more quickly, resulting at high speed in a higher pressure in the cylinders. The longer travel also gives a later exhaust opening and closure, and a larger exhaust opening; all conducive to high speed and economy.

The effect of lengthening the valve travel from 5 inches to 5½ inches was tried on one of a number of consolidation engines in which the average cylinder pressure was too low owing to lower boiler pressure (145 pounds), high piston speed and contracted steam passages. Testing the engine before the change showed 35 pounds average cylinder pressure while running 24 miles per hour, and a test after the change (with same boiler pressure and cut-off) showed 38.3 pounds average cylinder pressure at a speed of 27 miles per hour. The longer travel of the valve improved the steam distribution so that at a speed 13 per cent. greater there was 9.5 per cent. greater cylinder pressure. With the 5-inch valve travel the engine (No. 396) "was among the poorest of her class—loggy and a coal eater;" with the 5½-inch valve travel she became smarter, made better time and "lead her class in the number of miles made per ton of coal." This improved performance has been kept up for a year, showing the improvement to be permanent.

In an appendix to the paper more information is given respecting the supposed fuel economy resulting from increasing the valve travel of the engine just referred to. A table is given showing the fuel mileage of this and four other engines for the eight months from May to December, 1893. The valve travel of the other engines was five inches. The record for the engine with the 5½-inch valve travel shows an improvement of 9.5 per cent. better than the average record of the four engines with the five-inch travel. Another table gives the fuel record of the engines with five-inch valve travel for the months of August, September, October and November, and the fuel record of engine No. 396 for the months of April, May, June and July. This record is given in train miles per ton of coal, and shows an increase of 34 per cent. in these for engine 396. This is a little surprising, but we believe the comparison is not fair, as differences of temperature undoubtedly played an important part in causing the difference noted in coal consumption. Ordinarily there is a difference of about 7 degrees in the average temperature of the Fall months named compared with the Summer months named.* Mr. Quereau does not allow for this, but it certainly was a potent influence. The effects of the temperature of the air on locomotive fuel consumption is a matter that has been studied but very little, and is not generally understood.

The fact is that each degree of varied temperature noticeably affects the coal pile. This subject is treated in considerable detail in the NATIONAL CAR AND LOCOMOTIVE BUILDER for February 1892. (See Winter Resistance of Trains, page 26). The warmer the air the easier trains haul, and the further they run down grades and approaching stations without the use of steam; and the warmer is the feed water and the fuel, and the less is the radiation of heat from the boiler, steam chests and cylinders. All these causes act to reduce coal consumption as the air becomes warmer. Records of variation of temperature and of locomotive coal consumption for four years on a large railroad show an average variation of coal consumption of .03 lb. of coal per loader freight-car-mile. At this rate the difference in the average temperature (7 degrees) between the Fall and Summer months named would cause a difference in favor of engine No. 396 of .21 lb. of coal per car-mile. Assuming the train it hauled to consist of 30 loaded cars, this would affect its coal consumption (30 × 21 =) 6.3 pounds per mile, or 630 pounds in a 100-mile run; probably between 6 and 8 per cent. of its total coal consumption.

We have enlarged upon this point not because we doubt that economy of fuel is promoted by the improved steam distribution effected by the increased valve travel recommended by Mr. Quereau, but because the effects of temperature on locomotive fuel consumption do not receive the study and attention they should. When they do receive such study it will be found that their influence can be largely neutralized and many thousands of tons of coal saved annually on the large railroads.

We have not space to comment on all the subdivisions of this excellent paper, and must pass what is said of steam ports, lead, Alan valves and compression caused by lead, each of which is a chapter, to what is said on a subject which the NATIONAL CAR AND LOCOMOTIVE BUILDER has been more active than any other technical paper in discussing: The proper use of the throttle and reverse levers while running. We have preached in season and out of season against the extravagantly wasteful practice, so common on nearly every American railroad, of running locomotives with scant open throttles and unnecessarily late cut-offs. Mr. Quereau denounces this practice as "slovenly and wasteful," and gives the results of a test made on two "Empire State Express" engines as follows: Engine No. 870, running 58 miles an hour, with throttle one-eighth open and cutting off at 8½ inches, showed 445.6 horse-power at a cost of 24.5 pounds of water per horse-power. Engine No. 617, running at the same speed, developed 443 horse-power on 20.1 pounds of water per horse-power with a wide open throttle and six-inch cut-off, showing a saving of 18 per cent. for the latter method of using steam. Another test showed that these two engines, both running 61 miles an hour and both developing the same horse-power, used respectively 25.34 and 20.86 pounds of water per horse-power, a saving of 17.7 per cent. being effected in this case by the engine using a full throttle and 4½-inch cut-off compared with the engine using a scant open throttle and 8½-inch cut-off. Reference is made in the paper to a test made by Professor Goss at the Purdue University in which an economy of about 10 per cent. was effected by short cut-offs and full throttle compared with late cut-offs and throttled steam. This portion of the paper is concluded with the following statement:

"It is strange that motive power departments will design valve gears of the most approved patterns and then permit the steam to be distributed by the throttle. When this practice is allowed, higher boiler pressure, longer valve travel, or longer steam ports will result simply in a little closer trottling and a finer notched throttle quadrant."

RAILROAD CLUB REPORTS.

Those useful societies, the railroad clubs of the country, have decided that the members of each should be supplied with not only the printed reports of the proceedings of their own club, but also with printed copies of the reports of the meetings of each of the other railroad clubs.

Up to this time railroad men have had to depend upon the technical press for reports of the proceedings of the clubs which they were not members of. The NATIONAL CAR AND LOCOMOTIVE BUILDER has for a number of years enjoyed the distinction of making the publication of the reports of the various railroad club meetings a special feature, and of giving them more space than any other paper. We have always considered the work of the railroad clubs highly valuable in improving the methods of building, repairing and operating railroad rolling stock, and second only in importance in this field to the work of the Master Car Builders' and Master Mechanics' associations, and we have regarded the publication of their proceedings as among the most interesting news in each issue.

Sometimes, it is true, this matter becomes so old before being published as to be hardly deserving of the name of news. This was due, and occasionally in some cases is yet due, to the disinclination of the members of some clubs to have their remarks published; and it was, and is yet sometimes, due to the apathy of club secretaries in the matter of early publishing their reports, and in regard to supplying the technical press with copies as early as possible. Generally, when the secretaries have been con-

*Seven degrees is the average variation of temperature between these periods, according to a carefully kept record covering five years.

nected with newspapers themselves, their apathy in supplying the other newspapers interested with copies of reports has been most marked and regrettable. Self-interest explains this.

This disinclination of club members to see their remarks in print and the apathy of the secretaries just referred to we have always regarded as a narrow, selfish policy which deprived the railroad fraternity of interesting and valuable and otherwise available information. The contemplated interchange of reports of club proceedings will rectify this matter, and will, no doubt, accomplish a valuable educational work among men on whom the cost of operating railroads largely depends. There will be other advantages derived from the interchange of these reports. They will be more complete and more fully illustrated than the technical press can afford to make them ; they will be in better print for reading than if given in the papers, where they are generally presented in type that is injurious to normal eyesight ; and the reports may be systematically preserved for reference, indexed and bound so as to make a valuable collection of information of current representative railroad practice. These advantages are quite sufficient to warrant the interchange proposed, and it is to be hoped that each of the clubs will view the matter in this light and agree to a liberal interchange of reports.

We use the word "liberal" advisedly, as a disposition toward stinginess in the matter has appeared. The best objects of the interchange will be defeated unless liberality prevails, and each member of each club is supplied with reports of his own and the other club meeting. The full advantages of such interchange can only be attained by perfecting the system so that all the members of all the clubs will receive at their personal or business addresses all the reports they are entitled to. The postal and printing expenses of doing this should be met by increasing the membership or, if necessary, the membership dues.

Some of the railroad clubs are pursuing a different policy, and appear to be trying to make running expenses by selling advertising space in their monthly reports. This does not enhance the usefulness of the reports, but detracts very much from their good appearance and is incompatible with the dignity of tone which is desirable and should be maintained in publications whose objects are purely educational. This fault is carried to such an extreme in one report that its pages are made up alternately with advertisements and the proceedings of the meeting, and in a most aggravating way. The reader of this report on turning a page is confronted not by a continuation of the subject he is interested in, but by a glaring advertisement that shocks his sense of propriety, distracts his attention from the subject engaging it, and which by its dissimilar appearance to the page he must read is a source of continued annoyance. Such gross infringement on the rights of the reader would not be tolerated in a newspaper, and is deserving of special censure when appearing in the report of the proceedings of an educational society, as each of our railroad clubs undoubtedly is.

There is another phase of this advertisement matter that should not be passed in silence. It is exerting an undue and unfair influence on manufacturers for actual or prospective patrons to insist or solicit that advertisements be placed in a publication in which they are directly interested. While this is plain talk it is a presentation of the matter as it actually exists, and its treatment has been actuated by no selfish motives, but simply by a desire to see a very excellent means of education kept within its legitimate bounds, free from extraneous matter than can only lower its tone and usefulness.

General Manager Theodore Voorhees, of the Lehigh Valley road, has lost caste with labor unions since issuing an order some time ago to the effect that, owing to the general depression in the business of the road, the uselessly large force of extra men already employed in the train and engine departments should not be increased by the employment of more men. The order distinctly states that while this was necessary as a matter of justice to those in the company's employ, yet when vacancies did occur that permitted the hiring of others, these should be selected with "due regard to the qualifications of the applicant, giving preference—all things being equal—to those men who are familiar with our rules and our road by reason of former employment thereon." An order more just and considerate than this can hardly be imagined, but it was received with savage resentment by the fifty per cent. of engineers who had struck and had not got back, and the *Engineer's Journal* declares that in issuing this order Mr. Voorhees has closed every avenue to the esteem of labor unions. It is quite evident that the esteem of labor unions, as at present dominated, is a very precarious thing for railroad officers of common-sense to hold.

The gratifying fact is noted by Dun's agency that the amount of failures in the United States during February was only $15,000,000, as against $30,946,000 in January, a decrease of more than 50 per cent.

The lumber firms of Minneapolis have decided to consolie date, and, it is stated, have consummated a large deal of pine timber on the upper Mississippi, comprising some 1,500,000 feet.

Literature.

Objects of Interest to Engineers and Others in and About Philadelphia. Presented by the Engineers' Club of Philadelphia.

This book is a guide for strangers to the principal objects of interest in Philadelphia and vicinity. It is especially arranged to suit the needs of visiting members of the engineering professions, and the objects of interest to these are named in alphabetical order under respective headings as Amusements, Associations, Buildings, Bridges, manufactures, etc., etc., and their location described. Those of special importance are designated by single, double or triple stars, according to their degree of importance, so as to enable those whose stay is limited to utilize their time to the best advantage. The book is accompanied by maps of the city and of the principal railroads entering it.

This guide is very nicely gotten up, and contains 109 pages of nicely printed information. It is bound in cloth, with gold lettering, and its size is convenient for the pocket. It is a book that must be highly appreciated by any one needing the information it contains, and its publication is highly creditable to the Engineers' Club of Philadelphia.

Transactions of the American Society of Mechanical Engineers. Vol. XIV., 1893. Published by the society, 12 West Thirty-first street, New York.

This volume of the Transactions contains the reports of the proceedings of the meetings of the society held in New York City in December, 1892, and in Chicago in August, 1893. The last named meeting was also the sessions of Section B of mechanical engineering of the World's Columbian Congress of Engineering. This volume therefore contains the papers presented at the meetings of that section, and the discussion of them. The volume contains 1,442 pages, and the excellent index covers six pages. The volume is printed and its contents are arranged in the usual excellent manner that characterizes the publications of this society.

The Manual of Statistics. Sixteenth annual edition. 1894. Price, $3.00. 493 pages. Cloth. Good index. The Nicoll & Roy Co., 16 Dey street, New York.

This edition of this excellent work embodies an exceedingly valuable condensation of the facts and figures bearing upon the history, finances and condition of the railroad and other companies whose stocks and bonds are dealt in on the exchanges of the country. This information, as well as the statistical data relating to the agricultural and mineral production of the country, has been carefully revised and brought down to date, and is supplemented by a full but succinct compilation of the street railway systems of the country. It is the claim of the publishers of this volume that no other work combines to the same degree the condensation and convenience of reference with such an amount of information necessary to the banker, broker, investor or speculator. The present issue is carefully revised and corrected to December 31, 1893.

A bill has been introduced in the New York Legislature abolishing the customary three days of grace on the payment of notes. It is stated that this will greatly simplify banking matters. Mr. Henry Clews, speaking of the matter, said : "The bill is a wise measure. The origin of this grace dates back to the time when the only means of travel and communication was by stage-coaches and canal-boats, and in the event of the drawer of a note not arriving on time, through mishap or other delay, to provide for payment the three days were given as leeway ; but with our present facilities for communication by the telegraph, telephone and railroads, distances are shortened, and uncertainties as to time of reaching destination no longer exist ; therefore, to be in conformity with present conditions, the three days' grace should be done away with."

A California mountain cable railroad, running up the Sierra Madres, is described and profusely illustrated by Frank Van Vleck in the April number of "Cassier's Magazine." It is perhaps chiefly remarkable as having steeper grades than any other railroad in the world, not excepting the various much-talked-of Alpine roads, ranging up, as they do, to as much as 65 per cent. Interesting views are given of the cars, terminal stations and power equipment, the whole forming an admirable exposition of American enterprise in this branch of railroad engineering.

Several West Shore box cars started to cross the Atlantic from New York on their own hook March 15, but, like the little chickens in the old song, they soon "found that chicks are not ducks, cluck cluck, quack quack," and were finally rescued by a tugboat and towed back to their native element—dry land—after sustaining $5,000 damages to themselves and their cargo, which consisted of cooperage material. A barge upon which they were being conveyed across the East River sunk and furnished the opportunity for their nautical experience.

The railroad between Jaffa and Jerusalem has now been in operation about 15 months, and, it is said, is being run at a loss of about $120 a day. Two passenger and two freight trains are run each way daily.

Andrew Carnegie's offer to duplicate every dollar contributed for the relief of the poor in Pittsburgh, before March 1, cost him something over $125,000.

Car Building Statistics.

Hon. Carroll D. Wright, Commissioner of Labor, in charge of the completion of the Eleventh Census, has transmitted to the Secretary of the Interior a report which presents preliminary totals for all classes of mechanical and manufacturing industries in the United States, as prepared by the Division of Manufactures. The following are the statistics relating to the manufacture of cars used on steam railroads.

Number or establishments reporting	716
Aggregate capital represented	$76,192,477
Total value of plants	54,733,171
Value of land	10,860,668
Value of buildings	25,399,382
Value of machinery, tools and implements	18,473,121
Live assets	21,459,306
Miscellaneous expenses	95,054
Average number of employes	108,585
Total wages	61,797,675
Officers, firm members and clerks above 16 years, males.	1,914
Wages for same	1,568,759
Officers, firm members and clerks above 15 years, females	39
Wages for same	15,483
Operators, skilled and unskilled, above 16 years, males.	100,209
Wages for same	56,276,276
Operators, skilled and unskilled, above 15 years, females	125
Wages for same	38,250
Children operatives	56
Wages for same	12,852
Pieceworkers above 16 years, males	6,239
Wages for same	3,885,057
Pieceworkers above 15 years, females	3
Wages for same	998
Cost of materials used	66,561,526
Value of products, including receipts from custom work and repairing	129,461 698

The report also presents some statistics in reference to cars operated on steam railroads but owned by private companies. The number of such establishments reported was 71, representing aggregate capital of $43,641,210. The total value of their plants is $19,316,079 and the value of their land is $3,811,086, the value of the buildings being $7,878,189, and of machinery, tools and implements $7,626,-804. These companies employ 32,000 men and 174 women and 196 children; 7,982 of these employes work on the piece work system.

Electricity has been adopted for towing the canal boats on the summit level of the Canal de Bourgogne, which connects the Seine and the Saone, crossing in its course the divide between the Channel and the Mediterranean. In this portion of its length, the canal passes through heavy cuttings, and through numerous locks, but the summit level, nearly four miles long, is for more than one-half of its total length in tunnel. Since 1867 the traction in this section has been made by tow boats fitted with a steam engine, arranged to haul on a submerged chain.—*Engineering.*

While a gang of railway laborers were repairing the track at Charlottenburg, Germany, March 5, they were interrupted by the approach of a train. They stepped to the opposite bound track. As the train rushed by the men were enveloped in smoke and did not see a train which was coming on the track they stood on. Before they could realize their danger they were struck and hurled into the air. Six of them were instantly killed, and not one of the others, a dozen or more, escaped injury.

There is a movement on foot to remove the capital of Brazil from Rio de Janeiro to some point far in the interior. The place most favored is a territory in the Pyreneos Mountains, at an elevation of 3,000 ft. above the sea, and at a distance of over 600 miles from Rio Janeiro. It is expected that the removal of the capital to the interior would cause the construction of numerous railroads, and the development of the country.

Mr. Wm. F. Shunk, the Chief of the Corps of Engineers who surveyed the proposed route for the Intercontinental Railroad, has completed his report on the survey. The distance of the line from New York to Buenos Ayres will be 4,000 miles. The cost of the roadbed and bridges is estimated at $30,000 per mile, and for the road and equipment ready for operation $50,000 per mile.

Edison has perfected his latest invention, the kinetoscope, an instrument by which a series of pictures can be rapidly taken of a person or object in motion. Photographs can be taken at the rate of 64 per second with this instrument. He has taken some perfect plates with this apparatus, which promises to mark a new era in photography.

It is stated that the Grand Trunk Railway is considering the advisability of running electric engines in the St. Claire tunnel on account of the injury to the iron plates composing the interior of the tunnel occasioned by the gases from the steam locomotives.

A 50-year contract has been given by the State of New York to the Cataract General Electric Company, of Niagara Falls, to operate an electric plant along the lines of the State canals by which boats may be propelled by trolley or other system.

The shops of the Lehigh Valley, at South Easton, Pa., are to be enlarged, and will be made the main repair shops of the company. Much of the work now done at Sayre will be done at these shops.

The boilermaker with oratorical proclivities, says the Buffalo *Courier*, should have little trouble in riveting the attention of his hearers.

Personal.

Mr. S. M. Prevost, General Manager of the Pennsylvania Railroad, has been ill for some time, but is now improving.

Mr. E. E. Hudson, Master Mechanic of the C., C. C. & St. L., has had his office removed from Cleveland to Bellefontaine, Ohio.

Mr. E. B. Gilbert has been appointed Master Mechanic of the Pittsburgh, Shenango & Lake Erie, in place of Mr. E. Richardson, deceased.

Mr. Robert Walker, formerly Master Car Builder of the Missouri, Kansas & Texas, died at Sedalia, Mo., March 14, after a long illness. He was 52 years of age.

Mr. W. H. Rosing has been appointed Division Master Mechanic of the Denver & Rio Grande road, at Burnham, Colo., vice Mr. Quinby Lamplugh, resigned.

Mr. W. A. Robinson, Purchasing Agent and Assistant to the General Manager of the Brooklyn Elevated Railroad, has resigned and the office is abolished.

Mr. Chas. Dewitt, Division Master Mechanic of the Lehigh Valley at Weatherly, Pa. has been appointed foreman of the shops at that point and at Delano, Pa.

Mr. Rollin H. Wilbur, General Superintendent of the Eastern Division of the Lehigh Valley Railroad, has had his jurisdiction extended over the entire system.

Mr. J. D. Morehead has been appointed Master Mechanic of the Terre Haute & Indianapolis at Paris, Ill. He was formerly foreman of the roundhouse at Terre Haute, Ind.

Mr. H. M. Smith has been appointed General Master Mechanic of the St. Louis Merchants' Bridge Terminal. He will have charge of both the locomotive and car departments.

Mr. V. B. Lang, formerly General Foreman of the West Shore shops at Durham, N. J., has been appointed Master Mechanic of the Louisville Southern, with office at Louisville, Ky.

Mr. W. F. Bentley has been appointed General Foreman of the Baltimore & Ohio shops at Zanesville, Ohio. Mr. Bentley was formerly General Car Inspector of the Trans-Ohio divisions.

Mr. S. A. Sheppard, formerly Master Mechanic of the Tavares & Gulf Railroad, has been appointed Master Mechanic of the Carrabelle, Tallahassee & Georgia with office at Carrabelle, Fla.

Mr. Quimby Lamplugh has been appointed Master Mechanic of the Rio Grande Western. Mr. Lamplugh was formerly Division Master Mechanic of the Denver & Rio Grande at Burnham, Col.

Mr. George F. Gardner, of the Pittsburgh Locomotive Works, has been appointed Master Mechanic of the Columbus, Sandusky & Hocking, with office at Columbus, O., vice A. J. Ball, resigned.

Mr. A. J. Ball, Master Mechanic of the Columbus, Sandusky & Hocking Railroad, has resigned, and has been appointed Master Mechanic of the Ohio Southern, with headquarters at Springfield, Ohio.

Mr. J. B. Barnes, Superintendent of Motive Power and Machinery of the Wabash Railroad, has gone to Hot Springs, Ark., to remain awhile. Mr. Barnes has experienced a good deal of trouble during the last year from a broken leg.

Mr. Bernard Clark has been appointed Mechanical Engineer of the New York, Lake Erie & Western at Susquehanna, Pa., succeeding Mr. F. A. Hibbits, promoted to be Master Mechanic at Rochester. Mr. Clark was formerly Foreman of the car shops at Buffalo.

Mr. David Clark, Division Master Mechanic of the Lehigh Valley Railroad at Hazleton, Pa., has had his jurisdiction extended to include the shops at Delano, Pa. Mr. John McGraw, formerly Master Mechanic of these shops, has been made Road Foreman of Engines of the Wyoming Division.

Mr. W. T. Read, Superintendent Motive Power of the Chicago Great Western, has resigned. He was formerly Superintendent Motive Power of the St. Paul, Minneapolis & Manitoba, and was previously in charge of the mechanical departments of the Canadian Pacific and Grand Trunk railroads.

Mr. Charles L. Kimball, General Superintendent, Purchasing Agent and General Freight Agent of the Newburgh, Dutchess & Connecticut, died at Matteawan, N. Y., March 16, at the age of 65 years. He had been in railway service since Dec. 1, 1849, and had held the positions above named since Feb. 1, 1877.

The jurisdiction of Mr. Washington Lavery, recently appointed Assistant Superintendent Motive Power of the New York, Lake Erie & Western, is specially west of Salamanca, N. Y. Superintendent of Motive Power A. E. Mitchell informs us that Mr. Lavery will occasionally accompany him through the Erie shops, with a view of establishing uniform shop practice at all points on the system.

Mr. Samuel F. Moore, of Elizabeth, N. J., and who was the first Master Mechanic of the Central Railroad of N. J., died March 17th. Mr. Moore was in charge of the motive power department of the old Elizabethtown & Somerville Railroad in 1850, when that road operated but three engines. For the last 40 years Mr. Moore has been engaged in the foundry business at Elizabethport, N.J., being the head of the Crescent Iron Works.

Mr. Geo. G. Lobdell, President of the Lobdell Car Wheel Company, Wilmington, Del., died at his home in that city on March 1st. Mr. Lobdell was born in New York City, Oct. 1st, 1817, and was 77 years of age. He began his career as an apprentice in the foundry of Bonney & Bush, at Wilmington. He soon became foreman of the shop, and in 1838 succeeded to a partnership in the business. He paid particular attention to the manufacture of car wheels and made many improvements in the same. He invented several forms of wheels, and was the first to produce the double plate convex wheel so largely in use at present.

Mr. David H. Baker, General Foreman of the Pennsylvania car shops at Jersey City, died in the latter part of February. Mr. Baker was one of those who formed the Master Car Builders' Association, and was the oldest master car builder in the country. The last convention of the Master Car Builders' Association adopted a resolution making him an honorary member, and highly complimenting him for his long and valuable services to the car building interests of the country. He was born at Schenectady, N. Y., June 22, 1811, and entered railway service when 23 years of age. He began in the car department of the old Mohawk & Hudson Railway. In 1849 he was appointed Master Car Builder of the New Jersey R. R. and Transportation Company, which is now a part of the Pennsylvania system. His title was changed to General Foreman in 1871, and he held the position as long as he lived.

Mr. Thomas Middleton, formerly Locomotive Superintendent of the New South Wales Railways, died at Sydney, N. S. W., Jan. 31. Mr. Middleton was one of the most noted locomotive engineers in the world. He was born in England and began his railroad career in the shops of the Great Western Railway at New Swindon, England, where he served for five years. He then entered the service of the Great Eastern Railway, where he designed many locomotives, becoming also an inventor of improvements in their details, and was active in securing many patent-law reforms in Great Britain, and again later in New South Wales. In 1882 he was appointed Locomotive Overseer of the New South Wales Railways, and in 1888 he was promoted to be Locomotive Engineer, with entire charge of the locomotive and mechanical engineering branches of both the railways and tramways, at a salary of £1,000 a year. He held this position until 1889, when he was retired with a compensation of £1,500. Mr. Middleton died at the early age of 46 years, and leaves a widow and one son.

Lumber in Car Construction.*

BY C. M. HIGGINSON.

It is interesting from a railroad point of view to notice the changes that have been made toward cheapness and simplicity in the use of lumber and other timber products. In the better grades of hard lumber used for inside coach finish and decoration, we notice on every side a movement toward simplicity of pattern and the disuse of the more expensive species of woods. Less time is spent also in smoothing the surface and rubbing down the varnish coats, and the finish taken by the varnish naturally is left. With ordinary passenger traffic, this style of finish is all that is needed in a first-class coach.

Another item is the use of as low grades of material as are adapted for the desired work, which has the double result of cheapening the work done, and of using up more completely the lower grades of lumber, resulting in a more complete utilization of the entire log with incidentally a better revenue to the lumber manufacturer.

There has often in the past been a tendency among wood-working mechanics, partly from pride in the character of their work and partly from the greater ease of working, to use better grades, especially of pine lumber, than the needs of the service really required, and it is of pine mainly that we are now writing. The necessity of greater economies, however, forced a closer examination into ways and means, with the result that for many purposes of both construction and repair much cheaper grades of lumber were found fully good enough for the needs of the service.

It often happens that in repairing cars or buildings material can be used which, while not as high a grade as may have been put in the structures when built new, is fully good enough to use with the partly wornout structure in question, and makes a material reduction in cost. If, for instance, in repairing a double-board car roof after three or four years of use, the same grade of flooring is used that was put on in the first place, we shall have, by the time the balance of the car wears out, a certain amount of high-priced lumber yet good which has to be thrown away. The operation of this practice has relieved to a certain extent the demand for the higher grades, which, as the years go on and the pine timber supply diminishes, are becoming less in quantity. As it is now, we find that nearly all the products of a pine log are utilized in railway work. The solid and clearer portion makes bridge, car and building lumber of the better grades. For the middle grades there is an infinity of use, while for the poorer grades, "grub plank" and culls, there is a demand for rough platforms, foundation work, for lumber for car door coal gratings and other purposes which were not developed until comparatively recently. The slabs and edgings are used with good results, as regards economy, for firing engine and stationary boilers as compared with hardwood, and even the sawdust is used in large quantities for icehouses, protecting pipes and tanks against frost, and for deadening car floors.

It would seem as if this increasing variety of use would be to the advantage of the lumber dealers and manufacturers through making a market for the "by" products and low grades of lumber, while still being able to sell them at a comparatively low price for such uses as they are adapted to.

* From the *Northwestern Lumberman.*

Running a Freight Train Under Difficulties.

During the recent cold weather on one of our Western roads, when the snowfall was such as to nearly obliterate all signs of a railroad, especially the outlying branches, a conductor on a branch line freight train had an experience that has perhaps not been duplicated by any one. The branch in question was one running north from the main line at a division point, and the run was about 100 miles. The freight train was due to leave early in the morning, and when it pulled out the track was already covered deep with snow and more was coming down. Arriving at the second station, where they were to meet the down passenger train, the crew ascertained that this train was somewhere between two stations about fifty miles up the line. Asking for orders against it, they discovered that the telegraph line was broken between them and the dispatcher's office. Here was a dilemma. Should they sidetrack and wait for the passenger train to arrive or the line to be repaired, or should they flag their way along? The storm was so bad and the snow already so deep that they decided it would be useless to try flagging.

The conductor was an energetic man who did not believe in losing time if there was any possible way of avoiding it; and in this case he avoided it, though the means were certainly unusual and doubtless a transgression of the rules. He telegraphed to the agent at the first station ahead: "Will you act as my flagman and hold train No. 72 until I arrive with train No. 73?" This was repeated back and "O. K.'d," and the agent answered: "I will act as your flagman and hold train No. 72 until you arrive with train No. 73." When this was repeated back and "O. K.'d" the freight pulled out for station 3. Arriving, it found the passenger train not there; and the conductor ascertaining that it had not yet reached station 4, the same messages as before were sent and received to and from this station, and so station 4 was reached. In this way the freight made stations 5 and 6, at the last one of which it found the belated passenger train.

When the conductor got into headquarters he was invited into the superintendent's office and asked to explain how he made four stations against No. 72 without orders. After explaining his method the superintendent said it was certainly safe and under the circumstances a pretty good scheme for getting over the road, but on account of the liability of laying out superior trains he did not believe he could recommend it for general practice.

Teacher—Yes, children, when the war broke out, all the able-bodied men who could leave their families enlisted in the army. Now, can any of you tell me what motives took them to the front?

Bright Boy (triumphantly)—Locomotives.

Passengers over the Portland & Rumford Falls road always notice upon the platform at East Peru, Maine, a plump and pretty girl who wears the regalia of the station agent. She wears a cap with gold lace and a brass shield, and on the shield is "Station Agent." This is Miss Lillie Howard, and she has had charge of the station at East Peru for some time. She is attentive to her duties. East Peru has about the neatest and best kept station on the line of the Portland & Rumford Falls road.

The length of railway in operation in Belgium at the close of 1892 was 3,590⅝ miles, according to *Engineering*, upon which there were 2,866 locomotives, 4,314 passenger carriages and 59,348 trucks and vans. The number of passenger tickets issued during 1892 was 88,225,605, while the quantity of heavy goods carried was 41,158,459 tons. The revenue collected from passengers was £2,446,738; from baggage, £60,122; from goods, £4,432,554, and from miscellaneous sources, £456,117, making an aggregate of £7,395,532 for the year. The working expenses of the 12 months having been £4,301,144, the net profit realized was £3,094,388. The ratio of the working expenses to the traffic receipts stood in 1892 at 58 per cent. The staff employed comprised 53,605 persons, viz., 10,423 functionaries of various kinds, and 43,182 agents and workpeople. The number of persons killed during the year was 151, while 1,008 were injured.

A System of Tracing Train Delays.

The following statements show the number and causes of delays to passenger trains on a prominent Eastern railroad during the month of January, 1894. We are permitted to publish these statements through the courtesy of the general officers of the road, and they show not only the number and causes of delays, but also illustrate a system of tracing, recording and correcting them. To correct any evil it is very important to know the causes that lead to it, and to correct train delays on a large system of railroads it is very important that a system of tracing and recording such delays be adopted and zealously and unremittingly followed. On the road furnishing this information the Superintendent of Motive Power has several sources of information respecting train delays, the principal of these being the train dispatchers' sheets and the reports of engineers. Engineers are supplied with a form of report which briefly states the cause and time of delay, number of train and engine, and name of division. For easy identification these reports are of different colors for different divisions, and when folded show simply the address of the Superintendent of Motive Power, to whom they are sent direct. The rule requiring these reports to be sent direct to the Superintendent of Motive Power is regarded as specially important.

Statement A shows that during the month 10,554 trains were run on the four divisions of the road, and that there were 76 engine failures, causing delays aggregating 22 hours and 22 minutes. It shows that the most prolific cause of delays was hot boxes, there being three on engine trucks causing 55 minutes' delay; eleven on tender trucks causing 144 minutes' delay, and 19 hot driving boxes causing 346 minutes' delay; the total delays caused by hot boxes aggregating nine hours and five minutes, or 40 per cent. of the length of delays due to all engine failures.

STATEMENT A.

STATEMENT OF PASSENGER-TRAIN DELAYS CAUSED BY ENGINE FAILURES IN JANUARY, 1894.

Time: Hours are designated by ′, minutes by ″.

Divisions.	A.		B.		C.		D.		Totals.	
	No.	Time.	No.	Time.	No.	Time.	No.	Time.	No.	Time.
Air pump	2	0	1	10″	..	.....	1	10″	4	20″
Bricks	..	.....	1	6″	..	.....	..	.....	1	6″
Blower disconnected	..	.....	1	28″	..	.....	..	.....	1	28″
Cock on main drum	1	7″	..	.....	..	.....	..	.....	1	7″
Driver brake	..	.....	..	.....	1	18″	..	.....	1	18″
Equalizer broke	..	.....	..	.....	..	.....	1	0″	1	0″
Engine leaking	..	.....	..	.....	..	.....	1	5″	1	5″
Eccentric broke	..	.....	..	.....	..	.....	1	85″	1	85″
Grates	1	6″	..	.....	..	.....	1	7″	2	13″
Guide bolt	..	.....	1	6″	..	.....	..	.....	1	6″
Gov. on air pump	..	..	1	4″	..	.....	..	.....	1	4″
Hose on feed pipe	..	.....	..	.....	..	.....	1	20″	1	20″
Hose bet. eng. and tender	..	.....	..	.....	..	.....	1	5″	1	5″
Hot engine truck	1	0″	..	.....	1	40″	1	15″	3	55″
Hot driving box	..	.....	6	113″	6	124″	7	109″	19	346″
Hot tender truck	2	23″	3	21″	6	90″	..	.....	11	144″
Injectors	..	.....	1	0″	1	55″	..	.....	2	55″
Key in cross head	..	.....	1	45″	..	.....	..	.....	1	45″
Key in draw head	..	.....	..	.....	..	.....	1	57″	1	57″
Packing	1	0″	1	8″	..	.....	..	.....	2	8″
Pop valve	..	.....	..	.....	1	17″	..	.....	1	17″
Reach rod	..	.....	1	5″	..	.....	..	.....	1	5″
Stirrup in driving springs	..	.....	1	25″	..	.....	..	.....	1	25″
Spindle on main rod	..	.....	..	.....	..	.....	1	45″	1	45″
Strap on main rod and both cylinders	..	.....	..	.....	..	.....	1	108″	1	108″
Steam hose	..	.....	..	.....	1	25″	..	.....	1	25″
Slide in front end	..	.....	..	.....	..	.....	1	5″	1	5″
Steam chest burst	1	46″	1	35″	..	.....	..	.....	2	81″
Spring hanger	2	20″	2	0	..	.....	..	.....	4	20″
Train line pipe	..	.....	1	13″	..	..	..	.....	1	13″
Valves broke	..	.....	1	10″	..	.....	..	.....	1	10″
Valve stem and yoke	..	....	..	.....	1	0	1	47″	2	47″
Water bars	..	.....	..	.....	..	.....	1	5″	1	5″
Wedge	..	.....	1	2″	..	.....	..	.....	1	2″
Waste on fire	..	.....	1	7″	..	.....	..	.....	1	7″
	11	1′ 42″	26	5′ 48″	18	6′ 9″	21	3′ 43″	76	22′ 22″

	Number of trains run.	Number of engine failures.	Time lost.
Division A.	2,414	A. 11	A. 1h. 42m.
" B.	3,337	B. 26	B. 5h. 48m.
" C.	2,463	C. 18	C. 6h. 9m.
" D.	2,640	D. 21	D. 8h. 43m.
Total.....	10,554	Total.... 76	22h. 22m.

Percentage of failures to No. of trains.

A..... .0045
B..... .0078
C..... .0073
D..... .0080

Statement B shows there were 16 cases of hot boxes on cars, causing delays aggregating 3 hours and 31 minutes. But considering the number of trains run it becomes evident that passenger trains on this road are rarely delayed by hot boxes on cars, the average delay to each train run amounting to but .0242 of a minute. This statement also shows that the motive power more than holds its own, having made up, in addition to the time lost by engine failures, over 100 hours lost by other causes than engine failures.

Statement C is designed to correct the trouble from hot boxes on locomotives, by recording the dates, train and especially the engine they occur on, together with the length of the delays. This statement is posted on the engine house bulletin boards on each division, and the names of the engineers involved are given in the space provided for the purpose. This publicity has been found to exert a strong influence in causing the engineers to pay special attention to avoiding hot boxes; and the statement provides the means of enabling the Superintendent of Motive Power to detect carelessness on the part of these men. An engineer who has an unusual number of hot boxes on his engine is promptly called upon to explain the same. Engine 911, on Division "C," had three hot boxes on different occasions during January, causing delays aggregating 43 minutes. It is probable that the engineer was called upon for an explanation. Promptness in taking these matters up with those involved is considered very important, as it is found that after the lapse of a short time it is very difficult to get accurate information about the occurances that cause delays.

STATEMENT B.

TOTAL DELAYS ON DIFFERENT DIVISIONS, JANUARY, 1894.

	A.	B.	C.	D.
Detention by signals	2 h. 42 m.	50 h. 3 m.	35 h. 24 m.	23 h. 51 m.
Total time lost other than engine failures and signals	59 h. 51 m.	121 h. 38 m.	63 h. 49 m.	143 h. 36 m.
Total time lost due to all causes	64 h. 15 m.	177 h. 29 m.	105 h. 22 m.	176 h. 10 m.
Total time made up exceeding schedule time	14 h. 3 m.	107 h. 7 m.	90 h. 3 m.	124 h. 00 m.
No. of hot boxes on cars	.....	6	4	6
Time lost due to hot boxes on cars	.....	1 h. 48 m.	50 m.	53 m.
No. of passenger trains	2,414	3,337	2,463	2,640
Time lost per passenger train due to hot boxes	.....	.0323 min.	.0203 min.	.0200 min.

STATEMENT C.

LIST OF HOT BOXES ON ENGINES AND TENDERS, JANUARY, 1894.

Division "A."

11th....	Train	7	Engine	975	Engineer	Hot engine truck	0 min.
13th....	"	13	"	973	"	Hot tender truck	3 "
18th....	"	62	"	1018	"	Hot tender truck	20 "

Total of 3 hot boxes and 23 minutes lost.

Division "B."

1st.	Train	108	Engine	1011	Engineer	Hot tender truck	3 min.
5th	"	31	"	981	"	Hot driving box	3 "
13th....	"	207	"	1024	"	Hot driving box	5 "
22d	"	46	"	872	"	Hot tender truck	6 "
23d	"	78	"	921	"	Hot driving box	30 "
25th .	"	83	"	1016	"	Hot driving box	23 "
25th....	"	94	"	955	"	Hot tender truck	22 "
30th...	"	2-70	"	985	"	Hot driving box	36 "
31st	"	2-70	"	983	"	Hot driving box	16 "

Total of 9 hot boxes and 2 hours and 24 minutes lost.

Division "C."

1st. . .	Train	109	Engine	971	Engineer	Hot tender truck	3 min.
2d..	"	13	"	911	"	Hot tender truck	23 "
4th.....	"	112	"	877	"	Hot engine truck	40 "
6th.....	"	6	"	902	"	Hot tender truck	10 "
6th.....	"	21	"	892	"	Hot driving box	0 "
6th. ..	"	61	"	918	"	Hot driving box	5 "
7th.....	"	13	"	911	"	Hot driving box	6 "
12th...	"	17	"	889	"	Hot driving box	28 "
17th ..	"	51	"	893	"	Hot tender truck	18 "
22d.....	"	51	"	893	"	Hot tender truck	22 "
25th....	"	65	"	737	"	Hot driving box	65 "
27th....	"	13	"	911	"	Hot tender truck	14 "
29th ...	"	6	"	902	"	Hot driving box	20 "

Total of 13 hot boxes and 4 hours and 14 minutes lost.

Division "D."

1st....	Train	15	Engine	954	Engineer	Hot driving box	22 min.
6th....	"	10	"	883	"	Hot driving box	15 "
7th.....	"	11	"	900	"	Hot driving box	5 "
8th.....	"	111	"	516	"	Hot driving box	12 "
10th....	"	111	"	516	"	Hot driving box	15 "
16th....	"	3	"	899	"	Hot driving box	23 "
25th....	"	2	"	957	"	Hot engine truck	15 "
26th....	"	16	"	962	"	Hot driving box	17 "

Total of 8 hot boxes and 2 hours and 4 minutes lost.

American vs. English Cars.

The following letter addressed to the editor of *Engineering* appears in a recent issue of that paper. The writer describes his impressions of the comparative merits of American and English passenger cars from the standpoint of an English car builder.

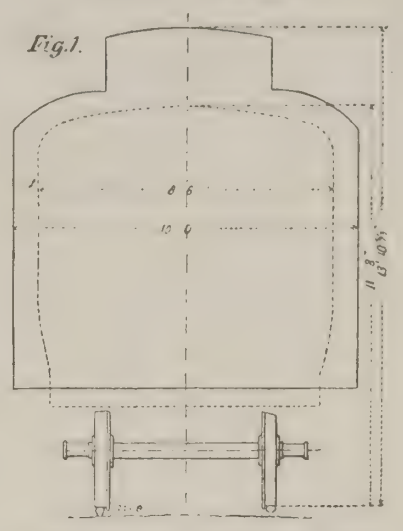
SIR.—So much is heard in England regarding the superiority of the American railway carriages, and at the same time one reads of so many serious accidents (so numerous that in October one American paper had a column headed "The Daily Smash"), that some remarks comparing the two types of carriages may not be without interest.

The main difference is that the English carriage is on the "compartment" system, one vehicle containing, say, six distinct compartments not communicating one with the other. In the States the vehicle is on the "corridor" system, and is practically one large open room with a passage down the center, each carriage communicating with its neighbor. The American vehicle, which is invariably longer than the English, is entered by a door at either end, instead of one door on each side for each compartment.

The American condemns the English compartment, because the passenger is at the mercy of any rogue or madman who may be his or her sole companion, and is therefore occasionally the victim of serious assault without being able to obtain assistance or move to another part of the train. Undoubtedly their system has the advantage over the English in that respect. They obtain the corridor by making their carriages some 20 inches wider than the English, and at the same time they gain head-room by raising the height of the vehicle in the center. The diagram, herewith, shows clearly the relative modern practice as taken from recently published drawings. The rail gage being the same in each case, it will be at once seen that in America the center of gravity is placed much higher; consequently the carriage is more liable to oscillation, and, in fact, it rolls heavily, especially when striking points or entering a curve, when the tendency of this large and somewhat top-heavy vehicle (in some modern cases 76 feet long, weighing nearly 50 tons) is to shoot forward at a tangent to the rails. It is, therefore, more than probable that many derailments are caused, and the serious consequences of accident intensified, by the disposition of this vehicle to leave the rails and fall over on its side. This wide vehicle is attached to the two bogies in the usual manner by resting on three blocks, and being held down by one bolt in each bogie; the strain upon these two bolts must at times be so enormous as to break them, when, of course the carriage is free from control.

FULL LINE. AMERICAN.
DOTTED LINE. ENGLISH.

Fig. 1.



ENGLISH AND AMERICAN CARS.

Another feature of American coaches open to adverse criticism is the form of the seat and the manner of attaching it to the vehicle. In England the seat is an integral part of the carriage, and, even in the third class, is padded high enough to form a rest for the head. Across the water the seat is little more than a chair attached by screws to the floor of the carriage, and the back of the seat, which is reversible, only reaches to the shoulder. In the event of a sudden stoppage or jerk, the American either falls forward with his face or chest against the back of the seat in front of him, or, having no support to his head, his neck is probably broken over the back of the seat he occupies. Take a very serious shock, say a collision or derailment; the seats in all probability give way, and, with the passengers (perhaps fifty in number), are thrown together into a confused heap at one end of the car, where in winter the lighted stove adds to the horror of the situation. In England the compartments localize the personal injuries.

As a matter of comfort in traveling, the third-class passenger here is even better off than the first-class passenger in America, in each case setting aside the more wealthy passenger who travels in parlor cars or saloons, whilst the English vehicle offers considerable advantages, as already shown, in the direction of safety of the passengers generally. A CARRIAGE BUILDER.

[A correspondent in the last issue of the same paper criticises the above communication, and says that few who have enjoyed the conveniencies of the American passenger car will agree with the writer's statements, except, perhaps, that English car seats are more comfortable than American car seats. The criticism is concluded with the following paragraph :]

"A Carriage-Builder" ends his letter by saying that, "as a matter of comfort in traveling, the third-class passenger here is even better off than the first-class passenger in America, setting aside travelers in parlor and saloon cars." His experience in third-class traveling must, I should think, have been confined to the dining car trains running north. I have no hesitation in saying that the ordinary American car is immeasurably superior to the ordinary third-class carriage in England. It is more roomy, has lavatory accommodation, rides more easily, and is warmed. I must admit that it is warmed too much, but that is due to the habits of the people, who like a temperature that is unbearable to an Englishman. Five a side in a third-class carriage is a condition of discomfort which cannot be attained in an American car, or, indeed, anywhere else.

Condensing Engines in Scotland.

In view of the completion of the Glasgow Central Railway presently under construction, and which is to be worked by the Caledonian Railway, a number of engines have been specially designed for overtaking that particular service. They are built on the condensing principle, and from the extremely creditable manner in which they handle the trains they are at present experimentally running in the vicinity of Glasgow, it is considered that the new line will have every advantage as far as motive power is concerned. These engines are the only condensers in Scotland.—*The Railway Engineer.*

An excursion to Rock Island, Ill., caused a train on a branch road leading to that city to be crowded recently. Every seat was occupied and the aisles were filled. The train was delayed two hours at Prophetstown Junction, and the passengers, leaning their heads on the seats in front of them, went to sleep. When the train reached Lynwood it ran into an empty box car on a side track. The jolt threw the passengers forward. No one was seriously injured, but about 30 had the skin peeled off the center of their foreheads, down the bridge of their noses and a little off the bottom of their chins. The next day any of them could be identified a block away by the sticking plaster down the center of their faces.

A Scandinavian Industrial Exhibition will be held at Malmö, Sweden, in 1896.

Communications.

Why Not Decrease the Length of Locomotive Smokeboxes?

Editor National Car and Locomotive Builder:

In line with the abandonment of the extended smokebox by the Union Pacific, and the resultant substantial advantages attained on that system in coalsaving and reduction of fire damages and delays of trains by engines failing for steam, it is noticeable that the most recent and approved practice, on other roads which still retain the extension, is to shorten it considerably. Instances of this

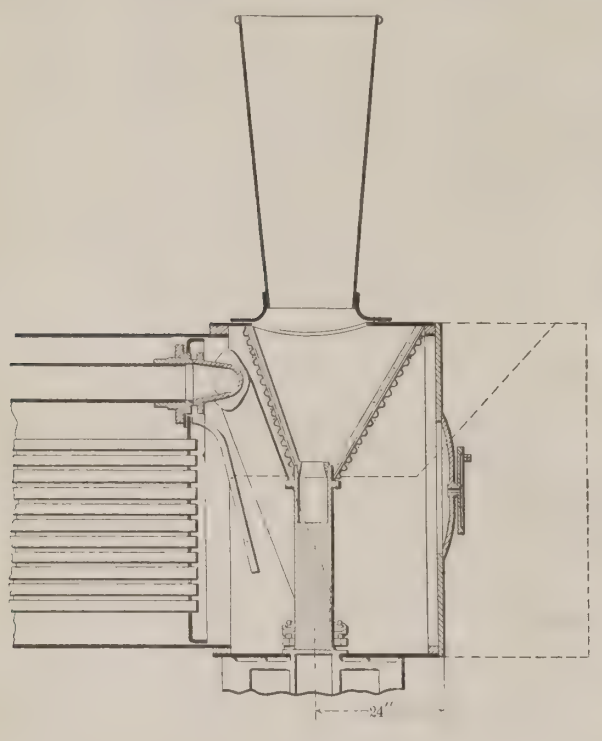


Fig. 1.

are shown in two representative engines of the World's Fair exhibit, No. 350 of the Chicago, Burlington & Quincy Railroad, their latest design for fast and heavy passenger service, and the famous 999 of the New York Central. In the former engine, the distance from center of exhaust pipe and stack to front of smokebox is only 37⅛ inches, and in the latter 38½ inches, these lengths being very much less than that which was the general practice in the last few years. In view of the unquestioned satisfactory performance of these and other engines of the same types, it is not unreasonable to suggest that a further reduction of smoke box length (all other structural features of the front and draft and spark arresting appliances remaining the same) might be made with advantage and would retain all the desirable features of the present construction.

A superintendent of motive power of one of the trunk lines, who is now deceased, stated to the writer that the only feature of advantage which he saw in the extended smokebox, and by reason of which he had been led to adopt it, was that it gave room for a sufficient area of netting, which, as he believed, could not be obtained with an

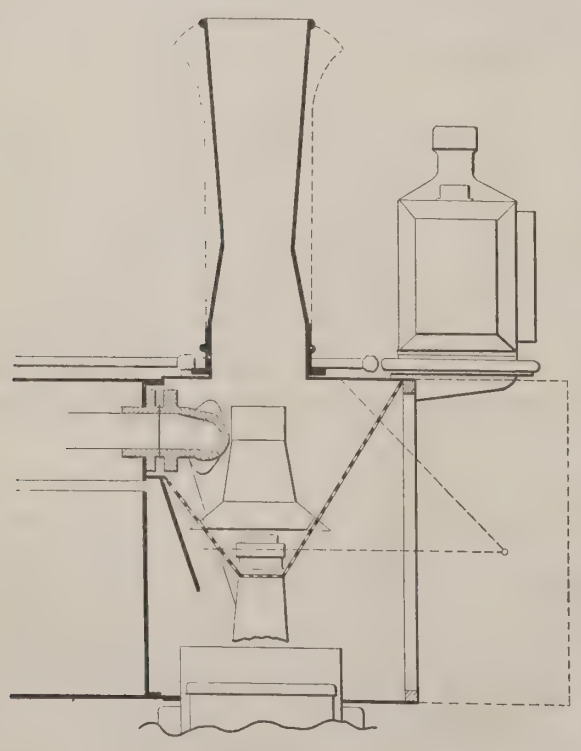


Fig. 2.

open stack in an ordinary smokebox, and similar statements as to the extension have been frequently made and printed. It is probable that the theory of the extension carrying the cinders to the terminal has, by this time, been pretty thoroughly acknowledged to be an erroneous one, and that the majority of those who continue to use the extension do so on the basis that they cannot get enough netting otherwise. Just why many of the recent compounds of a well known type are saddled with enormous extensions, notwithstanding their builders claim that with their light exhaust they keep their coal in the firebox, remains a paradox, which cannot be explained either on the theory of cinder transportation or necessary netting capacity.

The accompanying front end designs, each of which represents a modification of a construction in use to a considerable extent, are submitted in support of the writer's position that all the advantageous features (including ample netting capacity) of the extended smokebox construction are obtainable with a short front. Fig. 1 shows, with the addition of the dotted lines, and the omission of the two sheets of netting in similar lines, substantially the present standard extended smokebox construction. The modification, as shown in full lines, is practically that which, after experiments with extensions, has been adopted as standard on the Mexican Central Railroad, the smokebox being 24 inches from center of exhaust to front. That road having recently adopted wood as fuel, the engines have been fitted with diamond stacks, the length of smokebox remaining as shown. It will be obvious on inspection that the area of netting is ample, and the rear sheet also has the advantage of avoiding joints around the steam pipes.

Fig. 2 will be readily recognized as a modification of a well know type used to some extent on Western roads, the peculiarity of which is a comparatively low nozzle, with lift pipe, and an inclined plate, running backward from the front of a horizontal sheet of netting to the stack, the netting, inclined plate and extension being shown in dotted lines. Omitting these, and using two inclined sheets of netting, as in full lines, all the remaining features are retained (except a slight change in the lower end of the lift pipe, which can be avoided by bending the netting to clear it), and there is not only an abundant area of netting, but almost as much as in the original construction.

If either of the above designs should receive sufficiently favorable consideration by any of your readers to be deemed worthy of a trial, it may be added that they are public property, neither of them being either covered by a patent or intended to be, so far as the writer is concerned, and, from his knowledge of past practice in this line, not presenting any patentable features whatever.

J. Snowden Bell.

Pittsburg, March 14, 1894.

A Criticism of Merrick's Proposed Passenger Car.

Editor National Car and Locomotive Builder:

Your February issue contained an illustrated article by Mr. Merrick, which, owing to the radical changes proposed and to the prominence given it in your paper, calls for criticism.

Mr. Merrick asks your readers to receive his illustrations "more as the recordings of an investigator rather than as of consequence from definite and positive assertions" such as he claims some car builders are in the habit of making. It is not easy to understand what he means by this remark, but whatever it may refer to it certainly does not hinder him from making quite a number of positive as well as remarkable statements.

He says that the platforms of cars droop slightly when first constructed and that this causes them to jar loose. No respectable car builder will allow a new car to leave his shop in this condition; he will see that the platforms are at least level, the general practice being to raise them about three-eighths of an inch at the outer end: consequently this cannot be the cause of their jarring loose.

Mr. Merrick also states that "cars have been sent in for repairs with an entire platform hanging on with but a single bolt," and then wishes to know what this platform would be good for in a collision. Perhaps he looked at this particular platform after the collision.

The platform having plated timbers and secure fastenings, however, seems to be too strong to suit Mr. Merrick, as he makes it "*mount its neighbor and go plowing through the wreck*"; neither does he like one of medium strength. In fact, he wishes to do away with platforms altogether. We will perhaps all agree that the platform is a weak point, but there must be a weak point somewhere. Mr. Merrick seems to realize this when he says that he does not believe a car can be made to withstand the shock of a collision, but has an idea that in a collision a train of his cars would assume a zig-zag shape, thereby preventing telescoping. We know that he advocates shorter cars, and that short cars have a tendency to do this, but I am inclined to think that 50 feet is still too great a length to produce this effect, and the desirability of such an effect is questionable. But, granting this to be the case and leaving the platform argument out of the question, is Mr. Merrick's end framing sufficiently strong to cause this upward or sidewise deflection? Or is it as strong as the Pullman or Wagner framing, which are also composites of wood and iron? Mr. Merrick states that, in the cars of the "Keystone Express" and "Exposition Flyer," we have all the safety that can possibly be had in car designing, thus admitting that he considers them stronger than his own. But he objects to the cost. These cars perhaps cost $10,000 and upward, as he says, but he neglects to inform us that the great length of these cars, the elaborate interior and furnishings, six-wheeled tracks, etc., make up the greatest portion of this expenditure. I venture to say that the cost of Mr. Merrick's end framing will be as great as that of either the Pullman or Wagner.

Taking up the design in detail and following the headings in the same order as arranged by Mr. Merrick in his description, we find that he claims, when referring to the plan of his car, to facilitate ingress and egress. When we consider that passengers get on and off at but one side, the one next to the station platform, and as there is no place provided on his car where two persons can pass each other, we cannot help but find that the reverse is true. This also applies to the passage from one car to another.

Mr. Merrick also claims that there is an advantage to be derived by placing the body bolster as near the end of the car as possible. Conceding this (but for the sake of argument only) we find that he limits himself to 8 feet 6 inches, being hindered by the steps; but as these same steps govern the distance on the present car, we fail to see the improvement. In fact, it is quite possible to place the bolster on the ordinary car at a distance of 8 feet 6 inches or 8 feet 9 inches at the most, from the face of the platform end sill.

Under the heading of End Frames attention is called to the manner of framing the door posts, and that it tends to decrease the decay usually noticed at these points. This may be the case as far as the posts are concerned, but the advantage will be more than offset by the rotting of the exposed ends of the sills and stringers, which in the present car are thoroughly protected.

It is not surprising that Mr. Merrick was concerned about the design for a suitable step. The thing is rather trappy and about as convenient as the step on Pullman's new vestibule; aside from the fact that it would require a special attendant, I question the policy of blocking up the only exit in case of an accident.

Mr. Merrick makes his draft separate from his buffer rigging, and copies this feature from the English practice. This is going a long way for something which we have, and have had for more than 20 years, right here at home. This separation of the two functions is the principal feature of the original Miller coupler and buffer arrangement, and in a modified form of the Janney and Gould also.

The vestibule matter is disposed of in Mr. Merrick's proposed design by simply stretching a curtain across the face of the gate. But Mr. Merrick will find, when he comes to study out the details, that the designing of a vestibule, especially when he has to avoid existing patents, is not so quickly accomplished. Aside from the fact that provisions must be made for light, proper fastenings, etc., how are these combination step gates—with curtains spread over them like a sail, and when open sticking out like so many wings from the side of the train—to be operated in a strong wind?

Referring to the interior, it would seem that the arrangement of the toilet-rooms, heaters, etc., is not the best; it is certainly not as convenient as what we now have.

Supt. Car Department.

Some Advantages of Merrick's Proposed Car.

Editor National Car and Locomotive Builder:

I have read the articles in your recent issues by Mr. Merrick advocating the abolition of passenger car platforms, and while I could criticise some of the minor points of his proposed construction, I do not feel inclined to do so, for there are some very good ideas suggested. The articles and proposed car require careful study to appreciate this.

I think, however, that in service his buffer coupling cannot be handled with the same ease that we now hook up our safety chains, but I believe the device is practicable, and even if it does require a little more time, it is certainly worth it if it will prevent oscillation. The idea of holding the buffer plates together in this way is good, for it relieves the strain on the cars that we now have where the buffers are kept in contact by spring compression.

I was struck with the easy manner in which he dispatches the subject of vestibules. The platforms are taken off and the cars run up close together, so that all the side vestibuling that seems to be necessary is the application of four curtains of some serviceable material. It does really seem that we could get rid of the enormous cost of the Pullman vestibules by this construction, and still retain all the essential features. There is no doubt in regard to the present need of a better end construction on our passenger cars, but the advocacy of doing away with our platforms is a very radical one.

I agree with the writer, however, in what he says about the length of passenger cars. We have come to some definite conclusion as to the length of a freight car, but we are building our passenger cars all the way from 48 feet to 70 feet and more. These cars all have their proportionate over-hangs, and when a long car is coupled on to a short one, the side strain on the couplers of the latter is something enormous. The cost of repairs in service would be very much reduced if our passenger cars were of some uniform length. I see that this car is but 50 feet over all, and it seems remarkable that 50 passengers can be seated, and still the car have all the modern conveniences of two saloons, washstands and heater space. This should greatly increase the earning capacity of the car.

Car Builder.

In Favor of Abolishing End Platforms.

Editor National Car and Locomotive Builder:

It is very seldom that I consent to put in type any ideas that I may have on car construction, for the reason that we engineers in the contract shops are "generally supposed to have no opinions," but to simply build cars in exact conformity to the plans and specifications sent to us by the various railroad companies. But in this particular instance, however, as the car under consideration is such a complete innovation, a few statements on my part may not be out of place.

I consider Mr. Merrick's idea of doing away with pas senger car platforms a step in the right direction. It had not occurred to me to entirely abolish them, but I have often thought that great benefit would be derived from extending the center and intermediate sills right through to the buffer beams. But, to come to the design in question, I fail to find any well-founded objection to the omission of the platforms. I do not consider the design of swinging the steps out from under the car a serious objection. On the contrary, it will have many advantages in every-day traffic, as the designer points out. Furthermore, it occurred to me in reading over the article that should the addition of trainmen to operate these steps be considered an objection, the steps could, by a little study, be made to operate in unison by compressed air, possibly by some connection with the compressed air now used for the brakes.

The Challender truss is a good truss for passenger cars. In addition to the small angle iron riveted along the lower edge, there should also be one at the top. Again there should be an additional larger angle riveted along the center of the truss plate just over the heater pipes, to be used for a foot rest, and also to hold the wall end of the seats. All this to hold the thin steel truss plate very rigid and to keep it from buckling.

As a car without platforms admits of large projecting end sills, which also serve as buffer beams, a fine opportunity is thus afforded to put the body truss rods clear through to the end sills. I have never come to think that the idea of securing the truss rods, or rather anchoring them, to the bolster at the side sills is the most e fficient truss. I believe a car could be made sufficiently strong up to 60 feet in length.

The equalizing lever as shown in the platform plan is, in my judgment, entirely too light. As the stems are placed far apart the strain leverage on this lever will be something tremendous. It would not hurt things to also make the stems a little heavier, say 2½ inches by 3½ inches, instead of 2 inches by 3 inches. Two additional buffing stems, the same distance apart as the Janney, would be an improvement. I could also make some slight criticisms on the interior arrangement, such as doing away with the corner seats directly in front of the ladies' saloon, but these are all minor considerations, and, as I said in the beginning, I consider the general design of the car a step in the right direction.

A Mechanical Engineer.

Carrying Surplus Coal on Tenders.

Editor National Car and Locomotive Builder:

In regard to the matter of carrying surplus coal around on tenders, which was discussed editorially in your last issue, I agree with you fully. It seems to me that the matter of carrying more coal around than necessary (within reasonable limits) or wasting it along the right of way is something for which there is no reasonable excuse. Of course it is sometimes a matter of circumstance. In my own experience I have had to do with motive power in such condition from chronic defect that when a man pulled out on beginning his trip he wouldn't know when he was going to arrive at his terminal. Sometimes the old horse would lean up against the first depot platform for want of breath, and a constant struggle would be maintained to get somewhere. Such circumstances or bad weather on mountain divisions seems to warrant carrying extra fuel, but, strange as it may seem, I have never known an engineer at such a time, however he felt the security of having plenty of everything necessary, who carried his blankets or even an extra supply of "grub" with him to tide over a layout.

The matter of carrying around constantly an extra amou nt of coal is a needless expense and one that railroad managements should avoid. There is on modern, well-organized roads a method in general management that keeps out of stores and shops any more material than is absolutely necessary. If such method shows economy as stated, why should it not be extended to the coal pile and relieve the drain through that source? Our standard arrangement places a board across the top of tank about five feet ahead of the back end sheet to keep coal off top of tank. Any accumulation of moist coal or dirt on iron sheets will corrode them as would occur if placed in moist ground.

Engineer of Tests.

Unnecessary Weights on Tenders.

Editor National Car and Locomotive Builder:

I am glad to see you revive the subject of carrying surplus coal on tenders. When making coal tests on a Western railroad several years ago I made the engineers and firemen very unhappy by only taking on the tender about a tubful (1,000 lbs.) of coa lover what I expected we would use on the run. The engineer wanted at least three or four tubs extra for emergencies and the fireman wanted a good deal extra so he would not have to shovel it forward from the back of the pit. The writer wanted as little as possible left at the end of the run to weigh off. It would seem that the objection you name and the additional cost of carrying extra coal ought to pay for the extra work on a tender which would feed the coal to the fireman until it (the coal, not the fireman) was exhausted.

But should you not carry this economy of tender load to the inside of the tank? On the engines I was accustomed to ride on, it was usual to carry at least 1,000 gallons excess of water in the tank, and the water was scarcely ever run closer than 10 inches to the bottom, 800 or 900 gallons. Injectors "break" with four to six inches of water in the tank, so this last 400 or 500 gallons is just so much dead load, doing nobody any good. If this has not been remedied already by using a receptacle around the strainer, or some other method of keeping the entrance to the hose always covered with water, it seems to me it is high time it was

J. H. S.

Richmond, Va., March 21, 1894.

The Antwerp Exposition.

Editor National Car and Locomotive Builder:

At a meeting of the members of the United States Hon orary Commissioners to the Antwerp International Exposition, held at their offiees, 14 and 16 Church street, New York City, on Wednesday, April 14, it was resolved to again call the attention of American manufacturers and producers to the fact that the Antwerp Exposition will open promptly on the 5th of May next. This is assured, as all the main buildings of the Exposition are now completed. Intending exhibitors are urged to make their applications for spaces or concessions immediately.

For manufacturers and producers who are now seeking the markets not only of Continental Europe, but of Latin America and Australia, exceptional opportunities can be had at the Antwerp Exposition for placing the samples of their goods before the buyers from these markets, because this is a business exposition.

The representatives of the United States Commission will (where such services are required) have the general supervision of the reception and care of exhibits during the term of the Exposition. Exhibits should be ready for shipment not later than April 10th. Special low rates for shipments to the Exposition direct have been obtained.

For further particulars apply to the Headquarters Ant werp Exposition, 14 and 16 Church street, New York City.

T. A. Matthews, Commissioner.

Sanitary Appliances on Railroad Cars.

Editor National Car and Locomotive Builder:

There is something radically wrong in the methods of changing the air on the railroad passenger cars, especially on sleeping cars. This evil has existed for a long time and is now increased by the new systems of steam-heating. The cars at times get very much overheated, the ventilators are then opened in the upper part of the car, bringing in cold drafts, and the result is that passengers catch colds. Every traveler compelled to ride much in sleeping cars has experienced this, and there is no doubt but that there has been more sickness, disease and death caused by bad ventilation in cars than have ever been caused by the so-called deadly car stove.

If the press would criticise the railroad companies on this matter of ventilation as it has for the stove, there would be a change. The idea of ventilating a railroad car by opening windows right over the passengers' heads is about on a par with placing the bed in a sleeping room close to the window and then opening it. Could anything be conceived that would be more absurd? And yet that is just what is done on thousands of cars to-day. Is it not time to make a change? If the perfect ventilation of a car was a very difficult or expensive undertaking there might be some reason for delaying to do what must inevitably be done sooner or later at any cost.

It is not difficult to ventilate a car, however. The writer believes that a car loaded full of passengers can be ventilated with absolute perfection—that is, the air changed without violent drafts (the existence of which condemns any plan of ventilation)—by cheaper methods than are now used. Why not, then, give some attention to the subject? Why ignore it altogether? Certainly there is nothing that is more needed at the present time. I note that the Master Car Builders' Association appointed a committee last year to investigate and report on the subject. It is to be hoped that some good may come out of this; and good will come if some clear and well-digested plan is recommended. To this end the best way of admitting fresh air must be shown; that is, the best place on the car where the opening will be most free from cinders, smoke or coal gas, taking into account the varying conditions to which the train is exposed.

To illustrate: If the wind was always strong abeam, the smoke and gas from the locomotive would be blown away. In that condition of things the best place would be to admit the air on the roof. But that condition does not always exist. Cars go through tunnels and cuttings, and run along hillside embankments. At such times the smoke and gas follow the roof of the cars, and they are filled with smoke if the admission parts are open. Again, the atmosphere is often perfectly still. The cloud of smoke, gas and steam does not rise at all, but clings close to the roof. Openings that permit the entrance of this contaminated air are not evidences of good engineering.

In this connection it is proper to quote the remarks of Dr. R. Harvey Reed, of the National Association of Railway Surgeons:

"If we could only succeed in getting the car builders to attach a ventilating system to their steam heating apparatus which would free the air from dust, bring it in and warm it to a comfortable temperature, and release it at or near the level of the floor of the coach, and at the same time ventilate the coach at all the most distant parts of the car with ventilators placed at or near the floor, you would find a vast sanitary improvement as compared with the comforts of the coach of to-day."

This is without doubt the right idea as far as the inlet of fresh air is concerned, and the method above proposed, while bringing in the air, by its wide distribution would avoid drafts. The outlet of impure air is naturally at the top, and these openings should be provided with ventilators that would be self-acting, and so constructed that nothing in the shape of cinders, smoke or cold drafts could come in.

Observer.

On the Wyoming "Flyer."

A man was one day making a trip on the "flyer" of a Wyoming railroad. Passage on these trains is never taken except for journeys of considerable length; walking is as easy and much safer for short distances. On this occasion the movement was even more deliberate than usual, and the passenger called the conductor to his seat and said:

"Isn't this motion pretty slow?"

"Well, we ain't flying, I admit."

"May I ask what is the trouble, then?"

"Certainly. We found a fine two-year-old steer stuck in a trestle back here before you got on and stopped and helped it out. You know the rules of the road are in such cases the animal belongs to the company."

"But I don't see why that should make you run so slow."

"Why, we're taking that steer to headquarters, got it tied behind, and it ain't used to leadin', and don't walk up very well. I'm doin' all I can—got the brakeman prodding it up with an umbrel', and an ear of corn tied to the end of the bell-rope. If you think I'm going to start up and go howlin' along, and yank the horns off as good a steer as there is in the State, why, you're mistaken, that's all!"
—*Converse County (Wyo.) Press.*

Economizing on the Corpse.—The Marietta "Journal" says that while an excursion train to Alabama was waiting at the depot, a negro appeared at the ticket window in the depot and purchased a ticket for himself. Then he said to the ticket agent:

"Boss, I want 'nuder round trip 'scursion ticket for a corpse."

The agent opened his eyes in astonishment. An excursion ticket for a corpse was something new to him.

The negro explained: "You see, boss, my brudder died yesterday, and I want to take de corpse down to Montgomery and let the family view the 'mains, and den bring 'em back to Birmingham and bury him. Dis will be a heap cheaper den fur de family to come up here.."

Fourteen locomotives on the Orleans Railroad, in France, are equipped with a new form of valve gear, devised by Messrs. Durant & Lencauchez, and, from all accounts, have thus far performed very satisfactorily. Illustrations and particulars which are given in the *Revue Industrielle* of Dec. 16, 1893, show the locomotives to be practically modified Corliss engines, there being independent admission and exhaust valves at each end of the cylinders, and the valves themselves being of the rocking type. The advantages aimed at are, of course, those incident generally to the use of four-valve engines – independent cut-off and compression, and economy in steam consumption.

The use of electricity as a motive power for vehicles on streets and roads has seemed to be one of the obvious appliances of this agent, which has been delayed chiefly because of the difficulty in finding a suitable form of storage battery for the purpose. The use of such batteries for street cars and launches has proved successful, and it is now stated that carriages run by electric motors have been put in actual use in Berlin, Germany. These carriages, according to a brief desciption, have three wheels, the main axle having two, while a third one in front is used for steering. They carry power enough in storage batteries to run a considerable distance, and have so far worked well.

Aluminum is finding its field of usefulness broadening in many directions. The United States Navy is experimenting successfully with aluminum life boats. Aluminum yachts are coming into use abrord, and the metal has recently been suggested here as a suitable material for car construction. Aluminum horseshoes are being made in France that are four times lighter than iron shoes. They should be good for racers. The latest thing out is aluminum cabs, which are to be tried in Paris by the "*L'Urbaine*" Company, the largest cab company in Paris.

"The next train for Chestnut Hill leaves at 5:17—17 minutes after 5. Train now ready, on track No. 5. Track No. 5 for 5:17 train to Chestnut Hill!"

Those were the words of the guard, and they rang through the waiting-room in Boston, with penetrating distinctness. As soon as he had uttered them a fair young thing rushed up to him and said:

"Is the train for Chestnut Hill ready yet? And what time does it leave?"

Southern and Southwestern Railway Club.

Interchange of Proceedings with Other Clubs—Grinding Treads of Wheels—M. C. B. Rules—Cylinder and Frame Fastenings—Counterbalancing.

The regular quarterly meeting of this club was held at Atlanta, Ga., Jan 18. Considerable time was taken up at the beginning of the meeting discussing means of collecting dues from delinquent members, most of these being new members of the club who had never paid anything. A recommendation of the Auditing Committee was adopted to the effect that hereafter all applications for membership must be accompanied by the amount of one year's dues.

Interchange of Rules.

A movement has been going on in the different railroad clubs looking to the interchange of the reports of their proceedings, the intention being that the members of each club shall be supplied with reports of the meetings of all the other clubs. At this meeting of the Southern and Southwestern Club communications were received from the New England Club, the New York Club, the Central Club and the Western Club, requesting such interchange of reports. In discussing the matter it was suggested that the cost of postage would be considerable, as generally the postal charge on each copy of a report mailed was two cents. Some thought that only those members who attended the meetings of the club should be given the reports of the other clubs. Others differed with this view, and expressed the opinion that those who paid for enjoying the advantages of membership in the club should be permitted to have them all—even these books. It was finally decided to send each of the other clubs 100 copies of the reports of meetings and request reciprocation.

Grinding Wheel Treads.

A committee consisting of Messrs. W. H. Day, J. D. McPhail and W. H. H. Price made a report on the subject of grinding wheels cast in contracting chills. The report expressed the opinion that this particular style of wheel is yet so young in service that positive conclusions regarding it can hardly be formed, but that in order to obtain the best results from such wheels it is very necessary that a partial grinding should be given their treads, in order that the fins or ridges caused by the chills may be smoothed off. A member of the committee, Mr. Price, reported investigations that showed wheels having fins or the flanges frequently run from 500 miles to 800 miles before these are worn off sufficiently to cease humming while running, but that some wheels removed because of being track worn still retained marks of the contracting chill on their flanges. Brakeshoe wear and rolling on the rails cause the treads of such wheels to wear smooth, Mr. Price said, in 1,000 to 1,500 miles. He believed the flange should be ground as well as the tread.

Mr. Sanderson expressed the opinion that it is very necessary to grind the treads to avoid unnecessary wear on the rail heads, as without such grinding the fins on the treads of the wheels noticeably nick the railheads, and that such wear is a very important item of expense. His experience with contracting chilled wheels was that they are by no means round, and his practice is to bring them to a true circle before boring them.

Mr. Meehan expressed the belief that the wear of brakeshoes will remove the fins and leave the wheels perfectly smooth. In reference to this Mr. Sanderson said that this would be rather hard on the brakeshoes, as the chill of the tread was so hard that he had frequently tried to chip off the fins with a hard cold chisel, but the fins had chipped the chisel.

Mr. Meehan asked the cost of grinding the tread, but Mr. Sanderson had no figures in regard to it. Mr. Roberts stated that it costs 15 cents apiece to grind the Whitney wheel, and President Leeds stated that his company paid 20 cents extra for boring and grinding. President Leeds also said that in his opinion fins on the tread were very destructive to rails, and he believed that the humming noise produced by rough wheels proved this. He believed that wheels should be ground on an arbor, or by some appliance that would hold the wheel central and grind it perfectly circular. When ground on rollers with an emery wheel the tread is made smooth but the wheel may be left elliptical. Mr. Sanderson compared the action of a rough wheel running around curves to the effect produced by a good emery wheel applied to the side of the rail head.

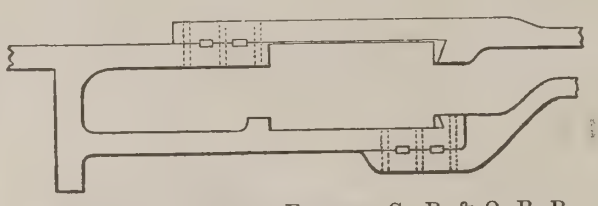
Mr. Hooker offered a resolution to the effect that all wheels should be first bored and then ground on an arbor, but after some discussion he modified the same to read that wheels should be ground in such a way as to insure removal of the fins, both on tread and flange, and at the same time insure their being circular.

Master Car Builders' Rules.

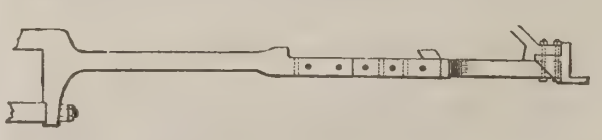
The committee on the subject of revising the M. C. B. rules is to report at the April meeting, and a short discussion of the matter was indulged in by the members present at this meeting. Mr. Sanderson said that the greatest troubles experienced in carrying out these rules were questions of veracity and stupidity, and said that the former would have to be left to the parsons but that railroad officers are responsible for the latter because they appoint men to positions for which they are not properly trained. He believed that the principal need of the Book of Rules is thorough revision, for as at present arranged the rules are very difficult to find speedily. In this connection President Leeds expressed the belief that a committee should be appointed to put the rules under subheadings, condense them, and have each subheading exhaust the subject that properly came under it. Mr. Roberts suggested that the rules should be made more specific, as inspectors are not familar with the views of the heads of departments, therefore the rules should cover what is intended. He also suggested that the Book of Rules should contain the Interstate Commerce Law. Mr. Sanderson suggested that the proper gage of track should be considered. President Leeds said that if this subject was taken up "we should go back to the five-foot track in order to get decent boilers for our engines." He suggested that specific weights should be adopted for bearings of M. C. B. dimensions; also, that a limit of thickness be established for the lining, as now in replacing brasses lead is often paid for as brass.

Cylinder and Frame Fastenings.

This subject was discussed at considerable length, the report of the committee on it having been presented to the previous meeting. The portion of this report referring to the fastening of cylinder saddles together and to the smokebox, and to the fastening of single and double bar frames to cylinders, was published in the National Car and Locomotive Builder for February; and the portion relating to the designing of frames appears elsewhere in this issue. In opening the discussion Mr. Sanderson referred to the models of cylinders shown in Figs. 1 and 2, and said that in the arrangement shown in Fig. 1 there was nothing to hold the saddle square but the stiffness of the vertical walls. He illustrated by pushing one cylinder ahead and the other back (as occurs in each revolution of the drivers), the weakness of the saddle. Handling the model shown in Fig. 2, in the same manner he illustrated the great strengthening advantage of the web *ZZ*. Mr. Davis, of the Richmond Locomotive and Machine Works, expressed in a letter the belief that shrinkage strains and bad metal were the most prolific cause of broken saddles, and stated that his firm made a practice of annealing the cylinders. Mr. Sanderson believed that a better practice was to leave the casting in the mold a couple of days, or at least over night, so as to cool slowly, and then annealing would be unnecessary.



Latest Improvement in Frames; C., B. & Q. R. R.



Proposed Design for Single Bar Frame.

Mr. Sanderson invited attention to a comparison of Figs. 13 and 14 (in the committee's report referred to), pointing out that in Fig. 14 the steam passages are crooked and contracted, and that in Fig. 13 the passages are free and large. He also spoke of the fact that the faces of the steam pipes were in line with those of the exhaust pipe seat, so that on large planers these faces can be trued off easily; and he spoke of the uselessness of placing these faces at different angles, as in Fig. 14, or of the fancy outlines shown in Figs. 10 and 11. Referring to a review of the report he had received from Mr. Rhodes, of the C., B. & Q., Mr. Sanderson said that exception was taken to the steadily increasing weight of frames and to the large number of bolts and keys used to keep them together, when a better plan would be to dispense with splices and get the joints in front of the cylinders. Mr. Rhodes sent a blueprint of the latest design of double bar frame used on his road, and which is forged solid to the front pedestal leg and carried forward past the cylinder. An engraving illustrating this frame is presented herewith. In reference to this design, Mr. Sanderson expressed the belief that it would be better to make the upper bar all in one piece, and splice the lower bar back of the cylinder, and suggested that a similar plan could be followed for a single bar frame, and he presented a drawing of such a proposed frame, which is shown herewith.

Counterbalancing.

Referring to the reports of the tests of locomotive counterbalancing at Purdue University, President Leeds said that the impression given by these reports that locomotives are usually counterbalanced in such a way as to be very destructive to the track should be corrected, as should also the impression that these experiments had revealed any facts or principles previously unknown. Speaking of his own practice Mr. Leeds said that recognizing the destructive action of the counterbalance of reciprocating parts, his instructions are to balance only two-thirds of such parts, which has been found sufficient to make a reasonably good riding engine, the deficit between this and perfect counterbalancing being yielded to spare the track from unnecessary punishment; and he quoted as follows from his specifications:

"That each pair of wheels shall carry its own counterbalance for the revolving and reciprocating parts, and no surplus will be allowed in any wheel to exceed the weight distributed on that wheel; that where main wheel cannot be properly counterbalanced with solid blocks cast in, the counterbalance blocks shall be cast hollow and filled with lead."

Mr. Leeds expressed the opinion that the experiments would have little effect on current practice in counterbalancing, although there might be more effort to reduce the weight of reciprocating parts, but he thought this was a study that had not been neglected.

As announced in our last issue, the next meeting of this club will be on April 19, at which the subjects discussed will be Construction of ends of box cars and the cause and remedy for bulging out of same; Is the collar or collarless axle best adapted to general rolling stock service? The relative strength of different patterns of metallic, composite and wooden brakebeams; and Methods of cleaning tubes while engines are housed.

Early Use of the Snow Plow.

(From the Philadelphia "Pennsylvanian," Feb. 4, 1836.)

Since last Saturdry, Jan. 30, the Camden and Amboy Railroad Company have not been able to drive a single car 10 miles! On Monday they attempted to perform their usual strip to New York, and after working eight hours, and making eight miles, they gave it up. In the mean time the passengers would have frozen to death, if it had not been for the farmers on the road, who took them in. Since then not a car has gone by—four if not five days they have been lying on their oars. This would have been fine work if they had had the mail. Five days without a mail to or from New York!

The failures here complained of ought not to impair the public confidence in Railroads, inasmuch as it is evident that they are referable to a deficiency in the management and not to any defect in the system. The Baltimore and Ohio Railroad, including the Branch to Washington, has been in operation from its first opening in all kinds of weather, notwithstanding the unfavorable nature of the Route, passing as it does through many deep cuts, narrow defiles and along almost perpendicular cliffs of great elevation, where snow-drifts and ice accumulate in much greater masses than in any open country. We have seen it stated that more than one thousand men are now employed on Camden and Amboy Railroad in removing the snow. Now the Baltimore and Ohio Railroad has been kept open by machinery invented expressly for the purpose, by which not only snow but solid ice is effectally removed, so that the engines and trains of passengers can advance at the rate of eight or ten miles an hour under the most unfavorable circumstances.

As pioneers in the construction of railroads in the United States, the Baltimore and Ohio Railroad Company deserve the thanks of the whole community for this great achievement, as it goes to establish the important fact that railroads can be kept open and in full operation in all kinds of weather by the timely application of proper machinery.

The machinery above referred to consists of a snowplow which effectually removes the snow, and a drag which rips the ice from the rails even when two or three inches thick, so that the engine and passenger trains can always pass; and as full evidence of the efficacy of the plan here in operation, we need only repeat that the trains of passenger cars to and from Washington and Baltimore have never since the opening of that road lost a single trip, though more unfavorable weather, so far as ice, snow and sleets are concerned, perhaps never occurred in this climate than has been experienced since that road has been in operation.

In spite of the hard times more anthracite coal was mined and sold in 1893 than any other year, while the average price obtained was higher than that of several years previous.

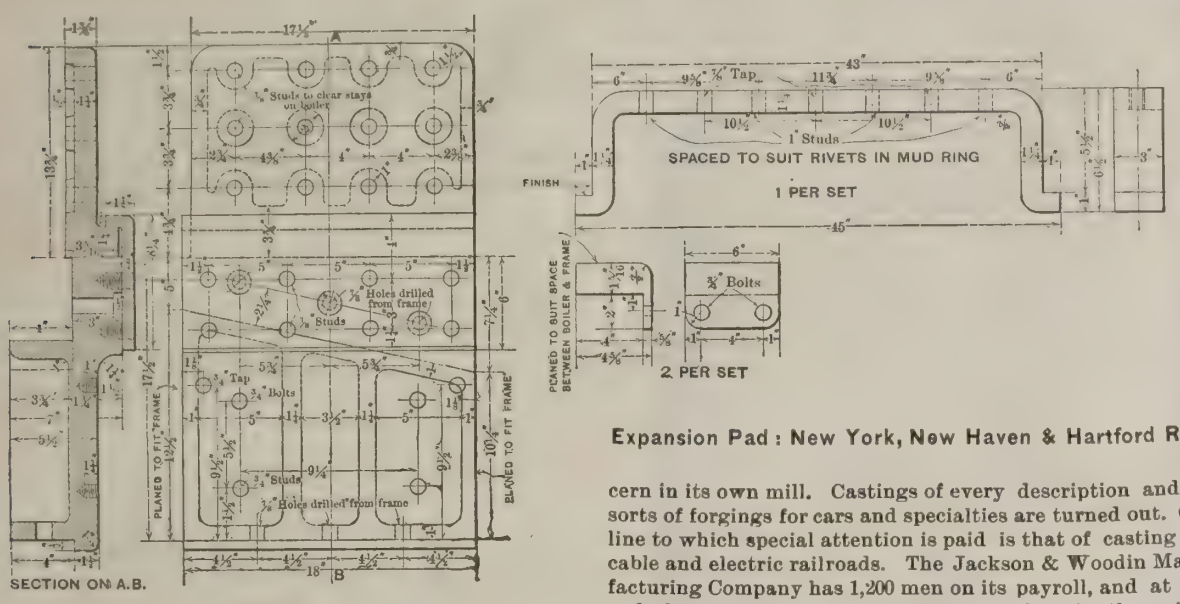
"I've been lying low for some time now," said the Fire; "and I believe this is a good chance to go out." "Oh, no, you don't!" said the Coal, as the porter dumped the hod; "I'm onto you!"

No one should ever read on a running car by daylight, and especially not by the imperfect artificial light supplied on them at night. The motion of the car subjects the muscles of the eye to a constant strain in the effort to adjust themselves to the printed page, and a perseverance in the habit will soon ruin the best pair of eyes in the world.

The Great Northern Railway of Ireland appears to be taking the lead across the channel in the improvement of passenger carriages. They have just turned out from their works at Dundalk two specimen composite carriages, embracing the newest improvements, and including lavatory accommodation. One of the carriages is for first-class passengers, and has four compartments, two of these having each a lavatory; the other is a composite, consisting of two first-class compartments with a separate lavatory for each, and two second-class compartments, also provided with lavatory accommodation. A device employed in each of the lavatories that will be much appreciated is the torpedo ventilator, which, acted on by the motion of the train, constantly purifies the air. The upholstery of the first-class carriage is luxurious, the interior of each being finished in rep and morroco leather, while the sides are ornamented with mirrors and photographs of Irish scenery.—The "Railway Engineer."

Expansion Pad for Compound Locomotive, N.Y., N. H & H. R. R.

In our issue for September, 1893, we illustrated and described at some length the compound locomotive built for the New York, New Haven & Hartford Railroad by the Rhode Island Locomotive Works, and we herewith present an engraving of a detail of this engine that will doubtless be of interest to many of our readers. It is a drawing of the expansion pad used, and which we understand is giving very good satisfaction, and is considered far superior to the ordinary link expansion arangement that is put on to engines having a firebox running over the top of the frames.



Expansion Pad: New York, New Haven & Hartford R. R.

Trains on the Congo Railroad.

The Congo Railroad has just opened for business so far as has been completed. It has arrived at the dignity of a time table, and schedules of passenger and freight traffic. What the road lacks in length it makes up in charges. It costs anybody who has a social position to maintain $10 to travel 25 miles. This is the first class rate, and the drop from first to second class is precipitous and abysmal. The only accommodations for second-class passengers are such as they can find in the freight cars, but they can afford to stand up if need be, for they are required to disburse only $1 for transportation that costs the unfortunate few ten times as much.

Modern improvements in train management are a feature of the new African railroad. The fact that only one train a day starts from each of the termini reduces to a minimum the danger of a rear-end collision; but as the Congo Railroad differs from our trunk lines in having only a single track, it is not expedient for trains to attempt to pass one another between stations. The four stopping places along the line have therefore been connected by telephone, and conductors are under orders not to leave one station until assured by telephone that they will have a full monopoly of the track to the station ahead.

When the line is completed to Stanley Pool there will be a fine opportunity for tourists of the adventuresome sort to catch a glimpse of the lower Congo Valley and return to the sea breezes in a few days. It is to be expected that the progress of civilization will have a tendency to reduce the price of first-class tickets. The company, however, has a monopoly of railroad building for many years to come, and will be likely to charge all the traffic will bear, without any fear that competitive routes or ticket scalpers will demoralize rates. Of course, the needs of commerce and the pressure that the Congo Free State may exert, will soon have a tendency to place all charges on a reasonable basis.

The road is completed to Nkenge, 25 miles from its starting point at Matadi. It is now fairly on the plateau behind the hills that overlook the foaming cataracts of the river. The road thus far has been hewn out of the toughest of rock, skirting first the Congo and then zigzagging up the Mposi River Valley, where a number of costly bridges were thrown over the troublesome stream. Nearly all the difficulties of the entire route have now been conquered, and rapid progress may be made to Stanley Pool, where steamers from far and near will bring freight to the cars.

Facts are stubborn things; and this railroad must astonish the small army of writers who affirmed a few years ago that white men could accomplish nothing in the trying climate of the Congo Valley.

According to Prof. D. S. Jacobus, for a given tank capacity and maximum pressure, from four to five times as much power can be stored by liquid carbonic acid gas as by compressed air. If the gases are heated to 383.5 deg. Fahr. before use, a carbonic acid compound engine would require 21.6 pounds of gas, and an air engine 14.3 pounds of air. If the exhaust of the carbonic acid gas engine is condensed, the theoretical efficiency will be the same as that of any other heat engine working through the same range of temperature. The working pressures will, however, be very high.

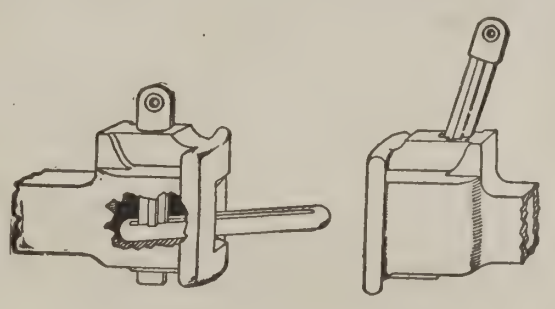
Plant of the Jackson & Woodin Manufacturing Company.

The Jackson & Woodin Manufacturing Company has its shops situated in one of the most picturesque localities on the Susquehanna River. These are at Berwick, Pa., a town of over 3,000 inhabitants and situated 1,500 feet above sea level. The great car works constitute the life of the town. These have grown from a very small beginning to one of the largest car works and manufacturing plants in the United States, covering at present nearly 75 acres of ground. The capacity of the car works is 12 cars per day of 10 hours, but at present only 10 cars per day are being built. Cars of every description are manufactured, and all the merchant iron used in their construction is manufactured by this concern in its own mill. Castings of every description and all sorts of forgings for cars and specialties are turned out. One line to which special attention is paid is that of casting for cable and electric railroads. The Jackson & Woodin Manufacturing Company has 1,200 men on its payroll, and at the end of every month these receive somewhere in the neighborhood of $40,000. The circulation of this money from hand to hand is the business life of the town. Without the corporation, Berwick would be but a hamlet. With this great industry it is one of the most prosperous towns in Pennsylvania.

The Sams Automatic Coupler.

The accompanying engraving does not show all the advantages of the Sams automatic car coupler, which really has many excellent advantages over any form of the link and pin type of coupler that has come to our notice. It is very simple in construction and effective in operation.

Referring to the cut it will be seen that the drawhead is of the usual design, excepting in the items of pin holder and link chamber. The latter differs from ordinary practice only in the fact that its bottom is inclined downward toward the rear, and that its opening is considerably flared. The pin hole is of cross shape, and at its top is beveled toward the rear. The pin is of the flat form, and carries ribs or wings which extend from the head to a point a little beyond the middle of the length of the pin. The pin is raised with the usual operating lever leading to the side of the car. In raising, its head is naturally slightly pulled backward, and the pin consequently, as soon as the



SAMS AUTOMATIC COUPLER.

ribbed portion emerges from the pin hole, falls back to the position in which pins are usually set for coupling, such as shown in the cut, the rearward beveling of the top of the hole permitting this. The pin thus set to lock is quite secure in its position, and will drop only when the concussion caused by two cars coming together occurs. The coupler upon the approaching car is in the condition shown, the link being upheld in position to enter the opposing coupler by the weight of the pin, the ribs of which bear upon it. These ribs thus have two essential functions, one to hold the pin up in position for coupling as shown, and the other to press the link down in the rearwardly inclined chamber of the drawhead and thus force the projecting end of the link up to proper alignment for entering the opposing drawhead, as also shown.

This coupler has proved itself to be thoroughly practical in service on the road. It is offered by the Sams Automatic Car Coupler Company, 516 Equitable Building, Denver, Colo. The Denver & Rio Grande has a number of cars equipped with it, as have also several other roads, and the reports are all very favorable as to its perfect and practicable operation.

The American Mineral Wool Company, of New York City, has been chartered in New York with a capital of $21,000. Frederick H. Prentiss, of Chicago, Ill.; Charles H. Rockwell, of Cleveland, O.; Wallace C. Andrews, W. F. Weiss, Bailey Whipple, Henry Franz and W. J. Townsend, New York City, are directors.

Morris Journal Box Lid Infringements.

The Morris Box Lid Company, of Pittsburgh, Pa., claims that infringements of its patents are being made by several concerns offering pressed steel journal box lids for sale. The company is taking steps to assert its legal rights, and has received the following letter from its attorneys:

LAW OFFICES OF RAYMOND & OMOHUNDRO,
MONADNOCK BLOCK, CHICAGO,
March 15, 1894.

Morris Box Lid Company, Pittsburgh, Pa.:

GENTLEMEN—Replying to yours of yesterday concerning the box lid suits brought by you, I am, for you, vigorously prosecuting suits under your last lid patent against the Drexel Railway Supply Company, of Chicago, and against Pennock Bros., of Ohio, the latter being a test case. I have as yet commenced no suit against the Davis concern, and have commenced no suit under your die patents for making the stamped steel lid, for I am confident of success in the test case referred to, and, that case being determined in your favor, the whole matter will be practically and commercially settled without a multiplicity of suits and without any appearance of persecution on your part.

In the test case above referred to, our testimony in chief was closed some time since, and the defendants are now in the midst of taking their testimony. In the litigation, the only allegation or particle of proof yet made, or even suggested, by the defendants militating against your claim as above named, is the allegation that Mr. Willard Pennock, and not your Mr. Morris, was the prior inventor. As to this, it is sufficient to say that he made the same claims in exhaustive interference proceedings in the Patent Office, but was there defeated, the decision being in your favor; and further, that I have completed the cross-examination of Mr. Pennock, which conclusively shows that the third story which he now tells about this matter is no more to be relied upon than was his prior story, as to which the decision of the Commissioner of Patents was adverse to him and in your favor.

Until receiving instructions from you to the contrary, I shall not commence any aditional suits, but shall push the pending test case, and follow the same, if the stubborness of the defendants shall so require, with additional suits under your other claims. Very truly yours,

JAS. H. RAYMOND.

As is well known, the Morris box lid is manufactured and sold by the A. French Spring Company, of Pittsburgh, Pa.

National Tube Works.

William S. Eaton has resigned as treasurer of the National Tube Works Company, of Boston. He has been succeeded by Mr. Arthur F. Luke, who has been assistant treasurer for four years. Mr. Eaton will remain as a director and as chairman of the Finance Committee. He has contemplated retiring for some time and now feels that with the company in good shape he is entitled to some respite at his age.

Mr. Eaton started with this company in 1869, when it was located in East Boston with only $100,000 capital, and with poor credit. Now it has the largest plant of its kind in the world, a share capital of $11,500,000 (half common and half preferred), $1,500,000 surplus of bills receivable over bills payable, $2,000,000 in material on hand, and manufacturing plant that cost $7,000,000. The sales of the company for the year ending July 1 last were $18,000,000, and the stockholders' profit about $900,000, which, after paying 7 per cent. on the preferred stock, left $500,000 surplus, which was invested in the company's new steel plant. It is understood the company during the present depression is doing about 60 per cent. of the business it was doing a year ago.—*Financial and Commercial News.*

Sales of the Magnolia Metal Company.

The business of the Magnolia Metal Co., in its sales of Magnolia metal, has increased 12 per cent. from January, 1893, to January, 1894, over the sales of the previous year, notwithstanding the great financial and industrial depression that has passed over the country during that time. The factory of this company has never closed down for one day on account of the panic, and a part of the time it had to run all night in order to keep up to the company's orders for Magnolia metal.

The outlook for the present year is very bright, and this company anticipates an increase of at least 50 per cent. over the sales of 1893.

The General Agency Company, manufacturers of the "Dragon" Fountain Car Washing Brush, and sole representatives of the D. A. Hopkins Company, manufacturers of journal bearings, etc., and other prominent manufacturers of railroad materials, have moved their offices from 115 Broadway to 32 Park Place, New York.

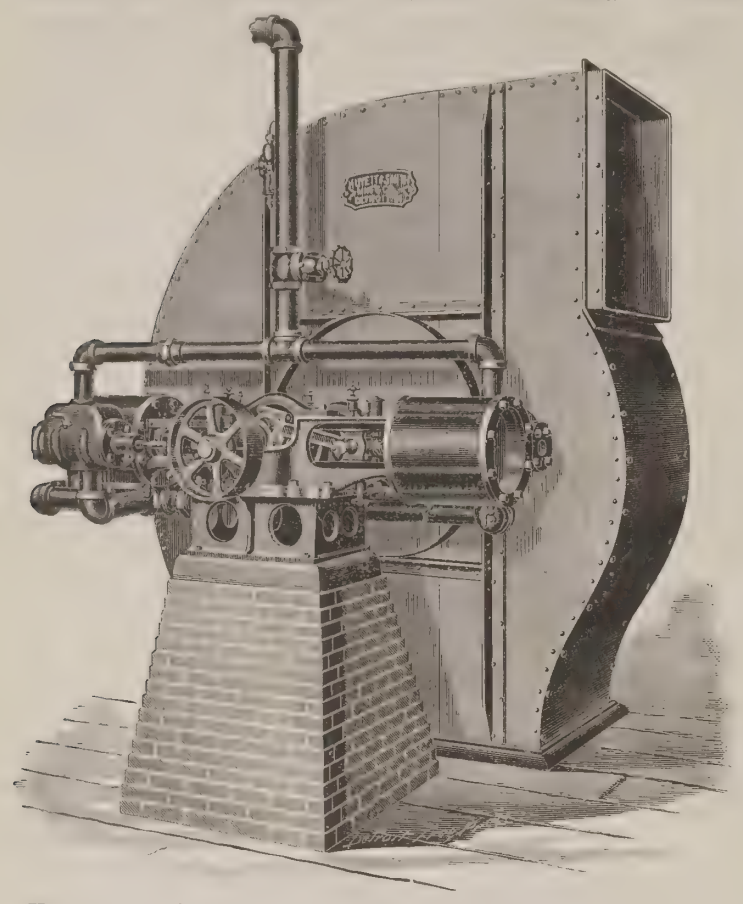
Mr. Charles T. Schoen, of Pittsburgh, President of the American Brake Beam Company, has resigned from that office. Mr. W. A. Pungs, of Detroit, who was formerly with the Michigan Railway Supply Company, and who has been general manager of the consolidated company since it was formed, has also retired. Mr. Henry D. Laughlin has been elected President and General Manager.

Riehle Bros. Testing Machine Company, of Philadelphia, Pa., has appointed Mr. Carroll B. Smith, 32 Builders' Exchange, Buffalo, N. Y., its selling agent for Buffalo and vicinity for the Riehle U. S. standard testing machines and special testing appliances, and for the Riehle-Marble molding and countersinking machines, marble sanders and hole cutters, Riehle-Robie patent ball bearing screw jacks, screw and hydraulic presses, and the Riehle-Anderson safety track jack.

The Beamless Brake Company, of Bloomsburg, Pa., has just received an order from the New York, Susquehanna & Western Railroad Company for 50 sets of the "Beamless Brake" to be applied to the new coal cars recently ordered by them. The New York, Susquehanna & Western has had the brake on trial for over a year and has lately put it on several cabooses. The above mentioned cars are a portion of the order for 200 cars recently placed with the Bloomsburg Car Company.

Ventilation with Low Steam Pressure.

It has always been supposed that if blowers are used to produce ventilation, a high steam pressure will have to be carried to run the engine. This objection has been overcome by the use of low pressure steam engines. The accompanying cut shows a steel plate fan with a double horizontal engine, each cylinder being twelve inches in diameter, with a stroke of six inches. The engine will drive a 108-inch steel plate fan 300 revolutions per minute, with a boiler pressure of ten pounds. At this speed the fan will deliver 50,000 cubic feet of air per minute, which is equivalent to making



Ventilating Blower with Low-Pressure Engine.

a complete change of air every 15 minutes in a building containing 750,000 cubic feet of space. The blower is made of heavy steel plate bolted and riveted to an angle iron frame supported by a cast iron base. It is very rigid and free from all vibration. The fan wheel has steel plate blades riveted to T shaped steel arms cast solid in the hub. The blades are all riveted to wide rims or bands on each side, which gives strength to the wheel and smoothness to its motion, and delivery of air. The shaft is extra large, offering ample bearing surfaces to the journal bearings, which are long and of an improved design.

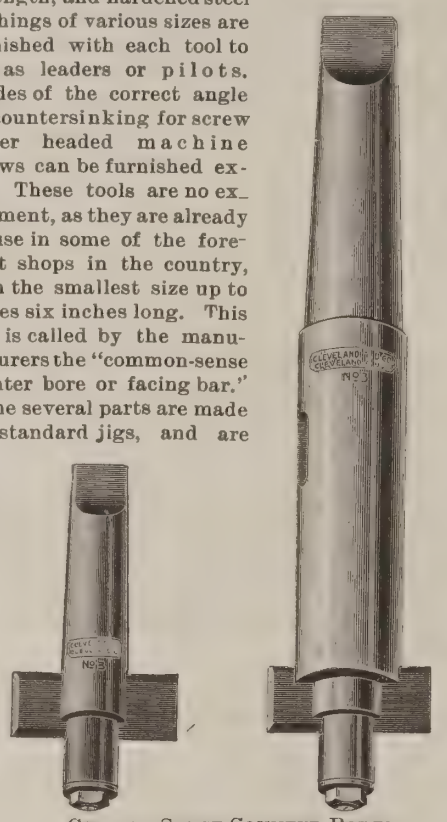
The engine has balanced valves, large wearing surfaces to all reciprocating parts and is the simplest in design of any engines on the market. It is built to run 24 hours a day and seven days a week, if necessary. The engine is supported by a cast-iron base, anchored to a solid brick pedestal capped with stone. The crank shaft in this case is extended through the blower and is supported on the opposite side by a bearing, thus becoming a shaft for the fan wheel as well as the engines. This is what is called a direct attached engine. The blower can be made for pulley and belt attachment when desired.

The cut shows what is called a right-hand top horizontal discharge blower, although they can be built to discharge in any direction and at any angle. Two blowers with engines like the one shown were erected in two school buildings in Salt Lake City, Utah, during the past season by the Huyett & Smith Manufacturing Co., of Detroit, Mich., who are the manufacturers. They have been given a thorough test this winter, and it is reported that they have more than filled every requirement.

"Common-Sense" Counter Bore or Facing Bar.

The counter bore or facing bar illustrated herewith is a new tool, designed by the Cleveland Twist Drill Company, of Cleveland, Ohio, and was first shown to the public at its booth at the World's Fair, where the tool was very favorably commented upon by some of the best known mechanics of the country. The company reports many sales already. The blade or cutter is held centrally in the taper plug by a conically pointed set screw shown in the illustration. This plug or holder, as it is called, is fitted into the ordinary twist drill socket of any convenient size, the end of the socket having a slot or notch milled across its open end to receive the top of blade or cutter. By this arrangement, the whole strain comes on the larger socket or driver, and there is no twisting or other strain whatever on the smaller part. The end of the holder is turned down as small as is consistent with the necessary strength, and hardened steel bushings of various sizes are furnished with each tool to act as leaders or pilots. Blades of the correct angle for countersinking for screw driver headed machine screws can be furnished extra. These tools are no experiment, as they are already in use in some of the foremost shops in the country, from the smallest size up to blades six inches long. This tool is called by the manufacturers the "common-sense counter bore or facing bar."

The several parts are made to standard jigs, and are carried in stock so that any piece can be duplicated with the certainty that it will fit into its place properly.



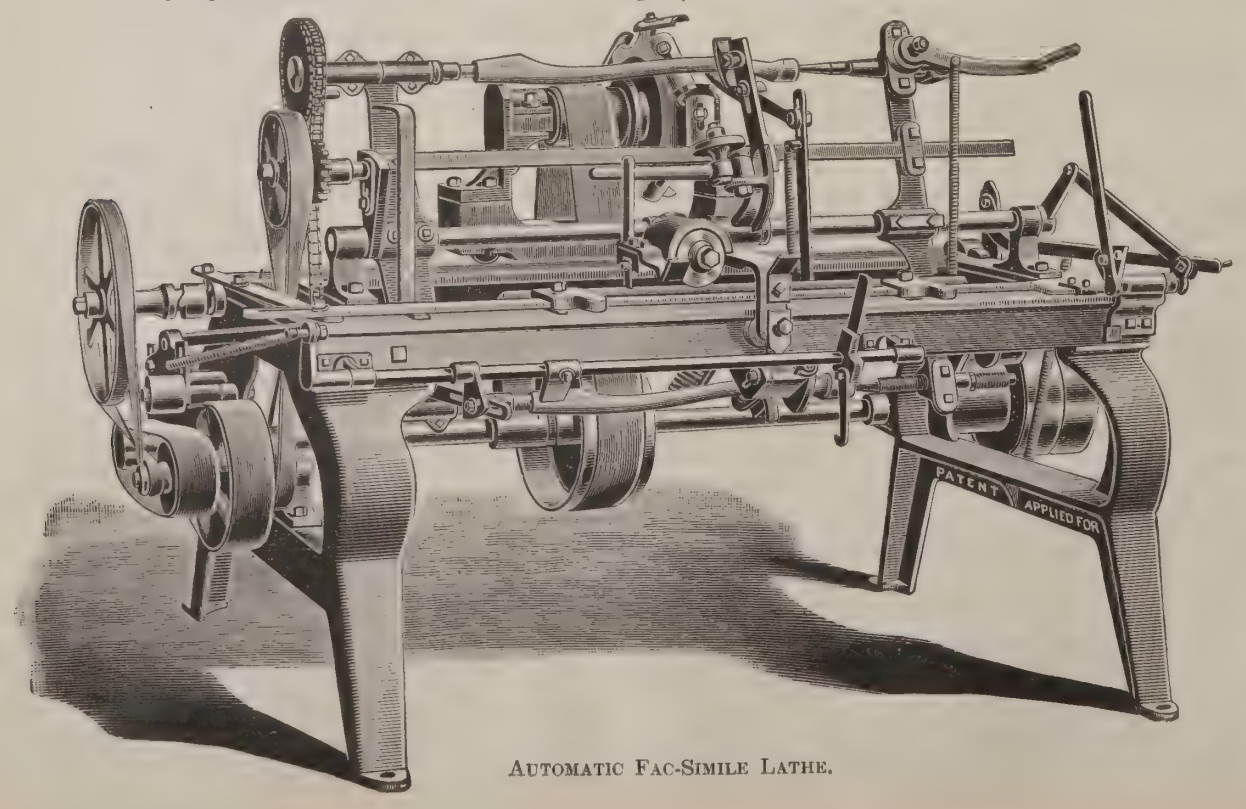
Common-Sense Counter Bores.

Automatic Fac-Simile Lathe.

The accompanying cut represents Gleason's Fac-Simile Lathe, which will turn an exact imitation of the original pattern in all its traits and peculiarities. If it is desired to turn a very small piece of work, a large woooden pattern can be used, and the work will be an exact imitation of the pattern in a reduced form. It will turn ax-handles, lasts and all kinds of odd shapes and contours.

The machine is designed to be simple, strong and well-proportioned, giving proper strength and lightness where required. Easy way of adjustments are provided, and all parts subject to wear can be easily and economically renewed. The operator on this lathe has no need to move from the position he takes in putting the stock in the lathe to be turned; he can operate all parts without going from one end of the machine to the other; this time saved means more work done. The screw and main shaft are large and made of steel, with a long bearing for the main driving-pulley, which drives the cutter-head, steel being used for the spindles and all studs.

This machine is manufactured by the Henry C. Ayer & Gleason Company, Second and Diamond streets, Philadelphia, Pa.



Automatic Fac-Simile Lathe.

The Detroit Graphite Manufacturing Company, of Detroit, Mich., is manufacturing a graphite paint which experiments show will prove valuable in many ways to railroads. A year ago several of the flues of a boiler at the company's works were given a coat of the paint. When they were examined recently they were found in as good condition as when painted. The other flues, which had not been coated with the graphite, were badly corroded. The tests showed that the paint prevented the scale from forming on the tubes, and it is believed that the same would be the case in locomotive boilers. The paint forms but a thin coat which would not materially obstruct the free transmission of heat to the boiler water. It is very adhesive and adheres to bright tin so tenaciously that the tin may be bent back and forth till broken without flaking the paint.

The A. French Spring Co. has issued a catalogue illustrating the various articles it manufactures. As is well known, among the principal of these are locomotive, passenger and freight car springs, and elliptic and spiral springs of all descriptions. This company makes the manufacture of spiral springs a specialty; and the excellence of the output of these and the other articles made by it is well known to be unsurpassed. The A. French Spring Co. also makes springs specially adapted to street railway service, for electric, cable and horse cars.

The Builders Iron Foundry, of Providence, R. I., has issued a new edition of its catalogue and price lists. The price lists have been revised and the catalogue is slightly larger than that of last year. It contains a list of offset pipes, and devotes a little more space to the Venturi meter. The specialties treated of in the catalogue are Globe castings, and other fittings for water works.

Anna Boristein is the only woman in Indiana who owns a locomotive. It is tied up in litigation with the Chicago & Southeastern Railroad, and is of no practical use to the owner. She sued for its possession in the Boone Circuit Court, which decided in her favor, as well as allowing her $150 damages. The railroad has appealed to the Supreme Court.

A woman who brought suit against a railroad company in Kentucky was awarded a few days ago $150 for the killing of her horse and 1 cent for her husband, who had received fatal injuries in the same accident. The connection of the awards gives them an invidious aspect.

Messrs. William G. Bell and Thomas M. Bell have formed a copartnership under the title of Bell & Co., with offices in the Betz Building, Philadelphia. They will handle railway and mine supplies, and represent manufacturers of iron and steel specialties.

Mr. Geo. E. Pratt, formerly with the Lamokin Car Works, Lamokin, Pa., has left that firm and is now representing the Street Railway Department of the Jackson & Sharp Co., of Wilmington, Del.

Mr. W. M. Wilson, who was formerly with the Otis Steel Co., of Cleveland, O., has resigned from that firm and connected himself with the Carbon Steel Co., of Pittsburgh, Pa.

The Cleveland Twist Drill Company has just furnished the United States cruiser *Columbia* with a full complement of its twist drills and tools.

Our Directory

OF OFFICIAL CHANGES IN MARCH.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Brooklyn Elevated Railroad.—W. A. Robinson, Purchasing Agent, has resigned, and the office is abolished.

Carrabelle, Tallahassee & Georgia.—S. A. Sheppard is appointed Master Mechanic, with office at Carrabelle, Fla.

Chicago, Ft. Madison & Des Moines.—J. C. MacKinnon, General Manager, has resigned, and is succeeded by E. F. Potter.

Chicago Great Western.—W. T. Read, Superintendent of Motive Power, has resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—E. E. Hudson, Division Master Mechanic at Cleveland, has moved his office to Bellefontaine, O.

Denver & Rio Grande.—W. H. Rosing is appointed Division Master Mechanic at Burnham, Colo., succeeding Q. Lamplugh, resigned.

Iowa Central.—J. P. O'Brien is made General Superintendent.

Lehigh Valley.—Rollin H. Wilbur, General Superintendent Eastern Division, has had his jurisdiction extended over the entire system. Chas. H. De Witt, Master Mechanic at Weatherly, Pa., is made Foreman of Shops at that point and at Delano, Pa. John McGraw, Master Mechanic at Delano, is made Road Foreman of Engines of the Wyoming Division. The jurisdiction of David Clark, Master Mechanic at Hazleton, is extended to include the shops at Delano and Weatherly.

Louisville Southern.—V. B. Lang is appointed Master Mechanic, with office at Louisville, Ky.

Newburgh, Dutchess & Connecticut.—Chas. L. Kimball, General Superintendent, Purchasing and Freight Agent, died March 16.

New York, Lake Erie & Western.—Bernard Clark is appointed Mechanical Engineer at Susquehanna, Pa.

Ohio Southern.—A. J. Ball is appointed Master Mechanic, with office at Springfield, O.

Pittsburgh, Shenango & Lake Erie.—E. B. Gilbert is appointed Master Mechanic in place of Mr. E. Richardson, deceased.

Rio Grande Western.—Q. Lamplugh is appointed Master Mechanic, with office at Salt Lake City, Utah.

St. Louis Merchants' Bridge Terminal.—H. M. Smith is appointed General Master Mechanic.

Terre Haute & Indianapolis.—J. D. Moorhead is appointed Master Mechanic at Paris, Ill.

NATIONAL CAR AND LOCOMOTIVE BUILDER

MAY, 1894.

CONTENTS.

The Savannah, Florida & Western is in the market for 10 passenger cars.

The Fitchburg Railroad is to build 100 cars at its shops in Fitchburg, Mass.

The Illinois Central shops located at Amboy, Ill., were closed on March 31.

The Pennsylvania is building 123 long gondola cars, class "Ge," at the Altoona shops.

The Florida Southern Railroad has ordered three 8-wheel passenger locomotives of the Brooks Locomotive Works.

The New England Railroad has contracted for 120,000 tons of soft coal at 25 cents a ton less than it paid a year ago.

It is reported that the Pennsylvania Railroad has arranged to enter Detroit over the Ann Arbor and Wabash railroads.

The Pullman Car Company, of Chicago, has received an order for 600 freight cars for the Baltimore & Ohio Southwestern.

The Billmyer & Small Company, of York, Pa., is building 25 freight cars for the Cartagena Railroad, in Colombia, South America.

Reliable estimates put the aggregate of Bessemer steel purchases at Pittsburgh and in the valleys since April 1 at 150,000 tons.

Plans have been prepared in Paris for an underground electric railway between the Bois de Boulogne and the Bois de Vincennes.

Old flues have been used successfully for the interior bracing of the tanks of locomotive tenders. They make light, stiff braces.

The Chicago Pneumatic Railway Gate Company, of Chicago, has been incorporated by George H. Clark, Paul Schwarzlose and Frank A. O'Donnell.

A reduction of wages of Wabash engineers, conductors, firemen and brakemen, averaging about 10 per cent., has been ordered and has been accepted by the men.

The mechanical engineering department of Cornell University, of Ithica, N. Y., is preparing to install a plant for making experimental tests of a compound and a simple locomotive.

The Lake Erie, Alliance & Southern Railroad, running south from Alliance, O., to Bergholz, will be sold on June 4 at a sheriff's sale to satisfy a claim of the Central Trust Company, of New York.

The oldest engine is claimed to be in operation in a Savannah, Ga., rice mill. It was built in 1815 by James Watt, of Lancashire, England, and was brought to this country in the same year.

The Greater New York, contemplated by a bill which has passed the Assembly of the State of New York, will cover 317¾ square miles, containing, by the latest estimates, 2,965,795 inhabitants.

The destruction of the Union Depot at Denver by fire was announced in our last issue. The insurance of $60,493 has been paid, and architects are engaged upon plans for a new depot to cost about $75,000.

The earnings of the Chicago, Milwaukee & St. Paul Railroad for the third week of April were $514,912.16, which compared with $625,757.23 for the corresponding week last year shows a decrease of $110,845.87.

Rapid progress is being made in rebuilding the engineering laboratory of Purdue University, which was destroyed by fire some time ago. It is expected that experimental work will be resumed about the middle of June.

In the annual report of the Southern Pacific Railroad Company it is stated that the company has acquired $2,160,000 of the capital stock of the Wells-Fargo Express Company, which approximates a controlling interest.

Several large roads of our acquaintance have recently adopted pickled cold rolled steel (No. 24) for locomotive jackets. It costs $3.43 per hundred pounds. It is easily worked into any desired shape, but is stiff and holds its shape.

At a meeting of the stockolders of the New York Central and the West Shore railroads at Albany, April 18, the old board of directors were re-elected without opposition. The lease of the Mohawk & Malone Railroad was ratified at the meeting.

The Legislature of Maryland has placed in the hands of the Board of Public Works the enforcement of the law forbidding stoves in passenger cars. This board will require the railroad companies to comply with the law as soon as possible.

A large order for machinery for wagon and car building, for works in Havana, Cuba, has been placed with the J. A. Fay & Egan Co., of Cincinnati, O. It is the largest foreign order this company has received, and it will require three months to execute it.

The Northwestern Elevated road of Chicago proposes to locate its downtown terminal station in the heart of the business district, and to run directly through the second story of all the business houses along the line, forming a sort of novel arcade.

Advices from Chicago of April 23 state that a strike of the 4,000 employees of the Pullman Car Company will be declared about May 1. The trouble is said to have been brewing a long time—in fact, ever since the reduction in the men's wages ordered last year.

Tests of the Westinghouse quick-action "reinforced" brake for high speed trains were made on the Pennsylvania Railroad at Philadelphia, April 10. The weather and condition of the track were very unfavorable, and the tests will be repeated in the near future.

Meetings of the representatives of the brotherhoods of engineers, firemen, trainmen and brakemen were held at Mattoon, Ill., April 23, to discuss the proposed reduction in wages on the "Big Four" and P., D. & E. roads, intended to be enforced next month.

The North Carolina Car Company, of Raleigh, N. C., will soon begin the erection of its new plant. The grading for the location of the buildings has already been started. The foundry will be 82 by 172 feet, with cupola; and the furnace and car-erecting shop will be 86 by 120 feet.

A serious accident occurred on the Grand Trunk Railroad April 21. A freight train ran into a washed out bridge over Nulhegan River, five miles above North Stratford. The engineer was killed and the fireman badly injured, while the engine was wrecked and several cars demolished.

A large railroad has adopted the use of basic chromate of lead in place of English vermilion for all outside painting, as for signals, semaphores, switch targets, way-car cupolas, etc. Tests showed that the chromate is much more durable and costs only about half as much as vermilion.

After the winter was supposed to be over, the Eastern States were visited by a heavy snowstorm that demoralized the train service on many railroads. The snowfall in Schuylkill County, Pa., was the heaviest in 40 years. The average fall was about two feet deep, and this drifted several feet deep over railroad tracks.

The Master Car Builders' Committee on Coupler Tests is conducting a series of tests on the apparatus of the Pennsylvania Railroad at Altoona. Mr. J. M. Wallis, chairman of the committee and Superintendent of Motive Power of the P. R. R. at Altoona, has charge of the tests, which will continue until about the middle of May.

The Chicago Great Western road has accepted an offer from the citizens of Oelwein, Ia., to erect shops at that point costing $200,000. The company's shops will be removed from South Park, Minn., to Oelwein. It is said that the new location is an excellent one, and will save a great deal of hauling of crippled engines and cars.

By a decision of the Court of Appeals at Albany, N. Y., April 24, the New York, New Haven & Hartford Railroad was compelled to pay $7,000 for using stoves in its cars. The case in point was the memorable tunnel accident on this road Feb. 20, 1891, in which six passengers were burned to death.

The Missouri, Kansas & Texas Railroad will begin on May 15 to build an extension from Green Ridge, 12 miles south of Sedalia, on the main line, to Holden, where it will make connection with the Parsons & Pacific line. This will furnish the Missouri, Kansas & Texas a through line to Kansas City, via the Missouri, Kansas & Eastern. The new extension will be nearly 50 miles long.

The Long Island Railroad Company has closed a contract with the Johnson Railroad Signal Company for the equipment of its line from Long Island City to Jamaica with an interlocking block signal system. The Johnson company is the associate company of the Hall Signal Company, whose system of automatic block signals has been adopted by many important railways.

The annual report of the Union Pacific Railroad for 1893, which was presented at a meeting of the company held in Boston, April 25, shows that the company now operates 8,167 miles of road, an increase of 18 miles over 1892. The gross earnings were $37,445,417, a decrease of $7,579,759. The operating expenses were reduced $2,858,656, leaving a net decrease in earnings of $4,721,103.

The Chicago, Burlington & Quincy will be connected with the Northern Pacific at Billings. The present terminus is Sheridan, Wyo. The new line will extend from there northward along one of the branches of the Yellowstone. The grade is easy, and it is expected that the 120 miles will be completed early in the fall. The filling of this gap will make practically a new line to Montana and the Pacific Northwest.

The annual meeting of the Pittsburgh, Cincinnati, Chicago & St. Louis (Pan Handle) Company was held in Pittsburgh, April 10. The annual report was submitted, embracing about 1,375 miles of railroad. The gross earnings on the main line were $15,750,809; expenses, $12,034,631. The total net revenue for 1893 was 3,730,224 a decrease as compared with 1892 of $182,380. The net profit for 1893 was $1,087,612.

The Columbus, Hocking Valley & Athens Railroad Company, with a capital stock of $100,000, was incorporated in Ohio, April 13. The promoters of the enterprise propose to parallel the Columbus, Hocking Valley & Toledo from Columbus to the coalfields, and expect to use a part of the roadbed of the Hocking Valley Canal, a bill having been introduced in the Legislature for its abandonment and lease to the new company.

The Daughters of the American Revolution planted a Liberty tree in Golden Gate Park, San Francisco, April 19. The soil placed around the roots of the tree was collected from more than one hundred and fifty historic spots, among them being Lexington battlefield, the tomb of Washington, the graves of Lafayette, Thomas Jefferson and Francis Scott Key, the trenches of Valley Forge and the base of Bunker Hill monument.

Arrangements have been completed for erecting a line of power shafting in the yard of Congress Hall Hotel at Saratoga during the coming conventions. Applications for space and power should be made at once to the chairman of the committee having the matter in hand, Mr. F. W. Coolbaugh, 29 Broadway, New York, or to Mr. R. C. Blackall, Superintendent of Motive Power Delaware & Hudson Canal Company, Albany, N. Y.

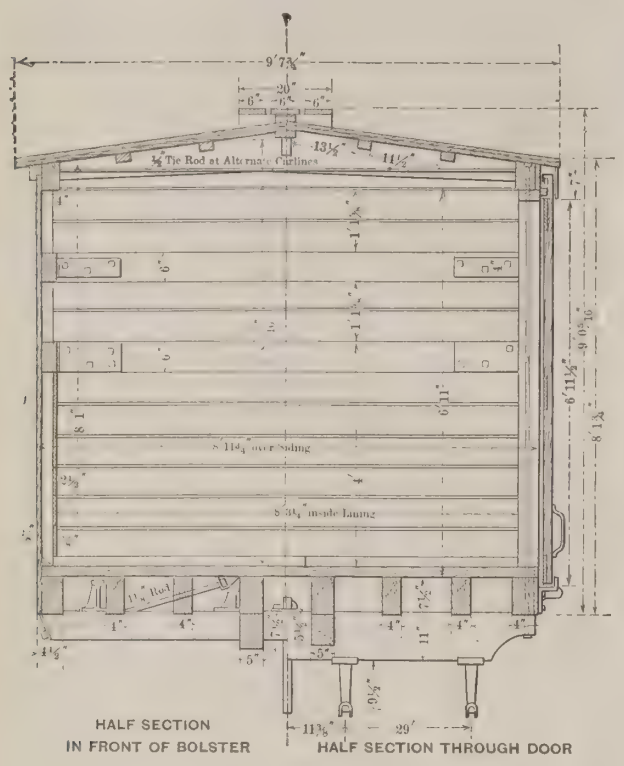
The General Passenger Agent of the Mobile & Ohio Railroad has issued a time-table folder which is a departure from the usual style of railroad folders. While it contains complete time-tables and other detailed information regarding the road, its officers and agents, and gives the population and altitude of all of the stations, it contains in addition a great fund of information regarding the South in general, condensed into a small compass. The pamphlet will be mailed free to all applicants.

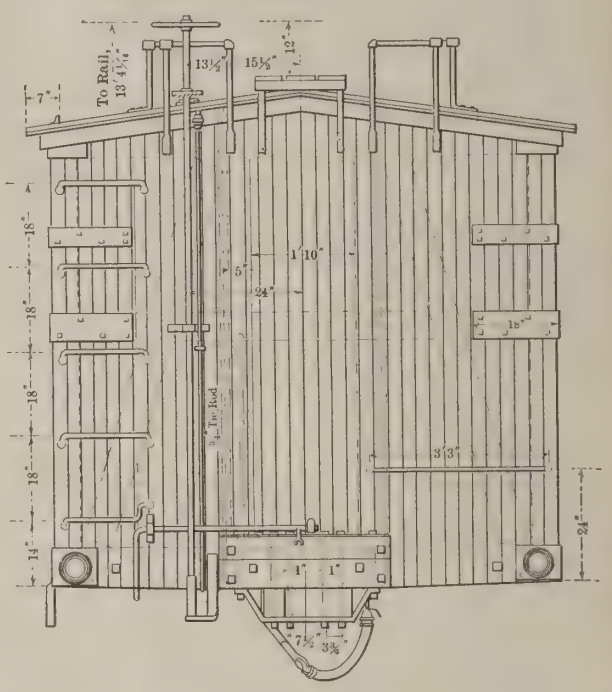
The destructive force of steel shots fired from the big guns intended for coast defense seems almost incredible, says the Philadelphia *Ledger*. At a recent test 12-inch armor piercing shots were fired at a 13-inch steel target, backed by 36 inches of oak resting against a sand bank. The shots passed entirely through the steel target, and Holtzer shots, made by the Midvale Steel Company, of Philadelphia, were not even cracked, but apparently came out in fit condition to be fired over again.

New York Central engine No. 870 has been doing some good work during the past year. It has been doubling the road between New York and Albany, 143 miles, nearly every day with heavy fast passenger trains. It came out of the shop March 26, 1893, and continued in service until April 2, 1894—370 days. During this time it worked 360 days, and run 106,866 miles. There were but two slight failures during the year, causing delays aggregating forty minutes; thirty minutes of this time was caused by a broken whistle.

New York Central Standard Box Car.

The engravings on this and the opposire page reproduce the general arrangement and some detail drawings of the standard box car of the New York Central & Hudson River Railroad. A careful inspection of the drawings will show that the design and construction of this car is of a very strong, convenient and generally advanced character, and it is not too much to say that it is a fair representation of the highest type of American freight car construction. The drawings show so plainly the construction of the car, and the arrangement of details, that an extended decription is superfluous. The floor, side and end framings are especially strong, and the roof construction is very efficient, the arrangement of running-board and gas-pipe railings at the end of the car being conducive to the safety of trainmen, as is also the automatic couplers with which each car is equipped. A rather bold departure is made in the adoption of the Fox pressed steel truck as standard for these cars, but it is one which the New York Central road will doubtless find no occasion to regret.





End View.

The length of the car over the end sills is 35 feet, and over the running board 36 feet 8¾ inches. The approximate weight of the car body is 19,376 pounds, and of the trucks 10,624 pounds, a total of 30,000 pounds. The capacity of the car is 60,000 pounds. The car is 8 feet 10 inches wide over the side sills, and 9 feet 7⅞ inches wide over the roof; the width inside the lining being 8 feet ⅛ inch. The door opens 5 feet. The car is 13 feet 4 inches high, measuring from the top of the rail to the top of the brake wheel, and 12 feet 4 inches high measuring to the top of running board.

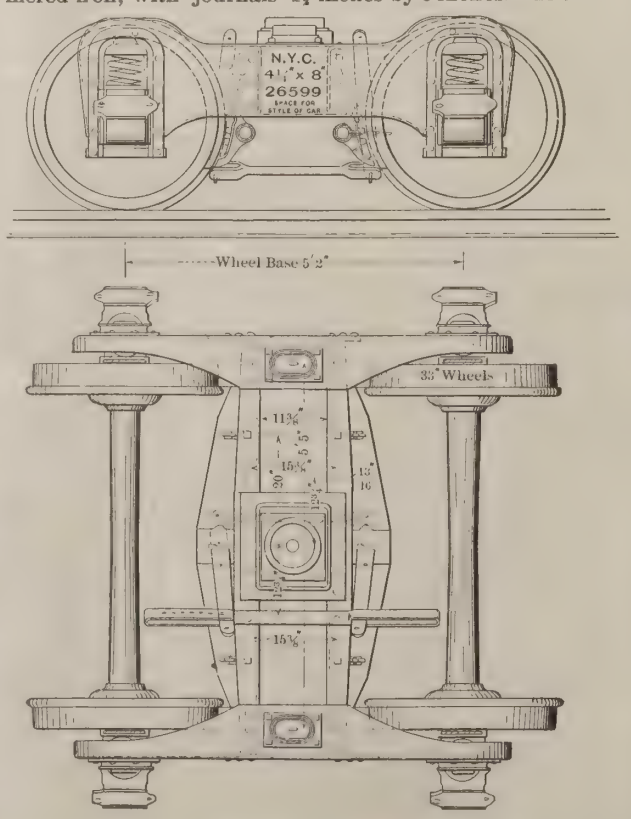
When the car is empty the center of the coupler stands 2 feet 11½ inches above the rail. The truck centers are 25 feet 4 inches apart, and the centers of the bolsters are 12 feet 8 inches from the center of the car. The figures on the half plan of the floor framing show the distance between the longitudinal sills, and the drawings of the wood details show the dimensions of these, as well as of the end sills and bolsters. Either Georgia or Norway pine is used for the side, center and intermediate sills, and white oak is used for the end sills, draw timbers, buffer blocks and body bolsters. These bolsters are made in three pieces with two plates of iron ½ inch by 6 inches sandwiched between them, and each yoke is secured in position by 2-inch bolts passing through the center sill and center plate. The end sills are secured to the side sills by inner and outer corner irons firmly bolted by four ½-inch bolts at each corner, and to the longitudinal sills by means of body truss rods, buffer block tie-rods and by two 1-inch bolts through the buffer blocks. The car has four body truss rods of 1⅛ inch round iron, free from welds, and with ends upset to 1½ inches, 5 inches from each end, to receive nuts and turnbuckles. The outside continuous truss rods pass through the end sills and are secured to the outside face of same by nuts and suitable washers. The inside rods pass through the face plates, buffer blocks and end sills; and all pass over cast iron saddles secured to the top of each bolster by one ⅝-inch bolt. The couplers used on these cars are the Gould vertical plane M. C. B. standard. The uncoupling device and the draw gear are the New York Central's standards. The corners of the car body are reinforced by inside and outside wrought iron corner-plates ⅝ inch by 18 inches, as shown in the drawings.

The roof boards are of select white pine ⅞ inch by 5¼ inches by 5 feet. The roof extends over the side plates 4⅞ inches, and over the end plates 3⅝ inches. The first layer is nailed to the plate and purlin by two 2¼-inch barbed wire nails in each board, two 3-inch barbed wire nails being used in each board of the second layer. The layers break joints, and no nails are put in the ridge pole. The running boards are of Norway pine 1 inch by 6 inches by 36 feet 8¾ inches. They extend beyond the roof 7 inches, and are supported beneath by blocks of white oak 2½ inches by 7 inches by 1 foot 8 inches, secured by three 2½ inch No. 18 screws in each board, the whole being supported by wrought iron brackets as shown in the drawings. These brackets are secured to the running boards and end plates by ¼ inch bolts.

The flooring is of Norway pine boards 1¼ inches thick, 7 inches wide, tongued and grooved and nailed with two 30d nails to the center, side and intermediate sills. Select white pine is used for the lining, the boards being tongued and grooved, 6 inches wide, full length, and nailed to each post and brace with two 2-inch barbed wire nails. The lining reaches to within 2 inches of the floor, a bevel strip 2 inches by 2 inches being backed up against the outside sheathing and nailed to the floor. The sheathing is of select white pine ⅞ inch thick and 3¼ inches wide, tongued and grooved and beaded. The boards are put on vertically and nailed with two 2¼-inch barbed wire nails in the plate, girths and braces, and with three 2½-inch barbed wire nails in the sills. The side girths are of white oak 3¼ inches by 6 inches, and the end girths are of white oak 4 inches by 6 inches. These cars are equipped with the Maguire grain doors.

As before mentioned the trucks are of the well-known Fox pressed steel pattern. Their construction is shown very plainly in the engravings, and is doubtless already more or less familiar to our readers. The axles are of hammered iron, with journals 4¼ inches by 8 inches. The dimensions are very plainly given in the drawing of the axle. The wheels are 33 inches in diameter, and are pressed on the axles under 60,000 pounds pressure. The King side bearings are used, and are secured with four 1½-inch bolts with double nuts on the top side. A space of ⅛ inch exists between the body and truck-bearings.

Westinghouse quick-action brakes are used, together with Central steel brakebeams. The brakeshoes are of the Christie pattern. The center plate is of pressed steel. All springs used on these cars are made by the Vose Spring Company. All threads are of U. S. standard. The steps and handles are secured to the corner post by ½-inch lag screws and through the sheathing and roof with three ½ inch × ½ inch lag screws. The gas-pipe railings on the end of the car are secured by 3½ inch × ½ inch lag screws and 1¾ inch screws, and to the end plate by ½ inch bolts. The trucks are painted black, and all ironwork exposed to view is given one coat of gloss black. The tops of all sills and all mortises and tenons are given one coat of tar.



Standard Pressed Steel Truck, New York Central & Hudson River Railroad.

Consolidation of Steel-Casting Manufacturers.

Six of the leading steel-casting companies of the country have formed a combination known as the American Steel-Casting Company, and have organized under the laws of New Jersey, with a capital stock of $4,200,000. The identity of the following companies has ceased, and they have become part of the new concern: The Pittsburgh Steel-Casting Company, of Pittsburgh; the Sharon Steel-Casting Company, of Sharon, Pa.; the Syracuse Steel-Casting Company, of Syracuse, N. Y.; the Norristown Steel-Casting Company, of Norristown, Pa.; the Standard Steel-Casting Company, of Chester, Pa., and the Solid Steel Company, of Alliance, O,

Fast Run by a 10-Wheel Engine.

A special train bearing an inspection party on the Lake Shore & Michigan Southern, April 16, made some fast time between Cleveland & Buffalo. The party included Cornelius Vanderbilt, Chauncey M. Depew and President John Newell; and the run from Cleveland to Erie, a distance of 95¼ miles, was made in 95 minutes, including a four-minute stop at Ashtabula for water, making the total running time for the 95 miles, 91 minutes. From Collinwood yards an 88-mile run was made in 82 minutes, including another four-minute stop. From Collinwood to Saybrook, a distance of 42 miles, was made in 36 minutes, or at a rate of 70 miles an hour. The run from Kingsville to Dock Junction, 33 miles, was made in 28 minutes, or a rate of 70.7 miles an hour, the fastest time ever made on this division of the road. The train weighed 170 tons.

The locomotive hauling the train (No. 188) is a Brooks 10-wheel engine, similar to the one illustrated on page 199 of the NATIONAL CAR AND LOCOMOTIVE BUILDER for December, 1893. It has cylinders 17 by 24 inches, and 68-inch drivers. The boiler is 52 inches in diameter, and the weight of the engine in working order is 88,500 pounds.

The Louisville, Evansville & St. Louis Consolidated road is to build a new passenger station in East St. Louis, which, it is expected, will cost about $40,000.

A Hundred-Mile Four-Track Trolley Railroad.

The Pennsylvania Traction Company, of Lancaster, which was chartered about a year ago, has announced its intention to construct a four-track trolley road between Philadelphia and Harrisburg, a distance of 100 miles. According to the plans of the company the road will leave Harrisburg and pass through Steelton, Middletown, Mount Joy, Lancaster, Coatesville, West Chester and many other towns. Branches will be run to Downington and to other places off the main line, especially suburban towns near Philadelphia. Two tracks will be used for through or high-speed traffic, two stops being made probably between Harrisburg and Philadelphia, and the other two tracks will accommodate the local traffic. The roadbed is to be of the best construction, stone ballasted, and the track will be of standard gauge. A 70-pound rail will be used. There will be no grades exceeding four per cent. The block-signal system will be used over the entire line. The cars will be of Pullman palace pattern, with vestibules. The through cars are to make forty to fifty miles an hour. The company is in consultation with the Westinghouse Electric Company in reference to the adoption of one of two systems, that of long-distance transmission or of several power-houses. The surveys have all been made, the right of way has been purchased and the work of construction has begun.

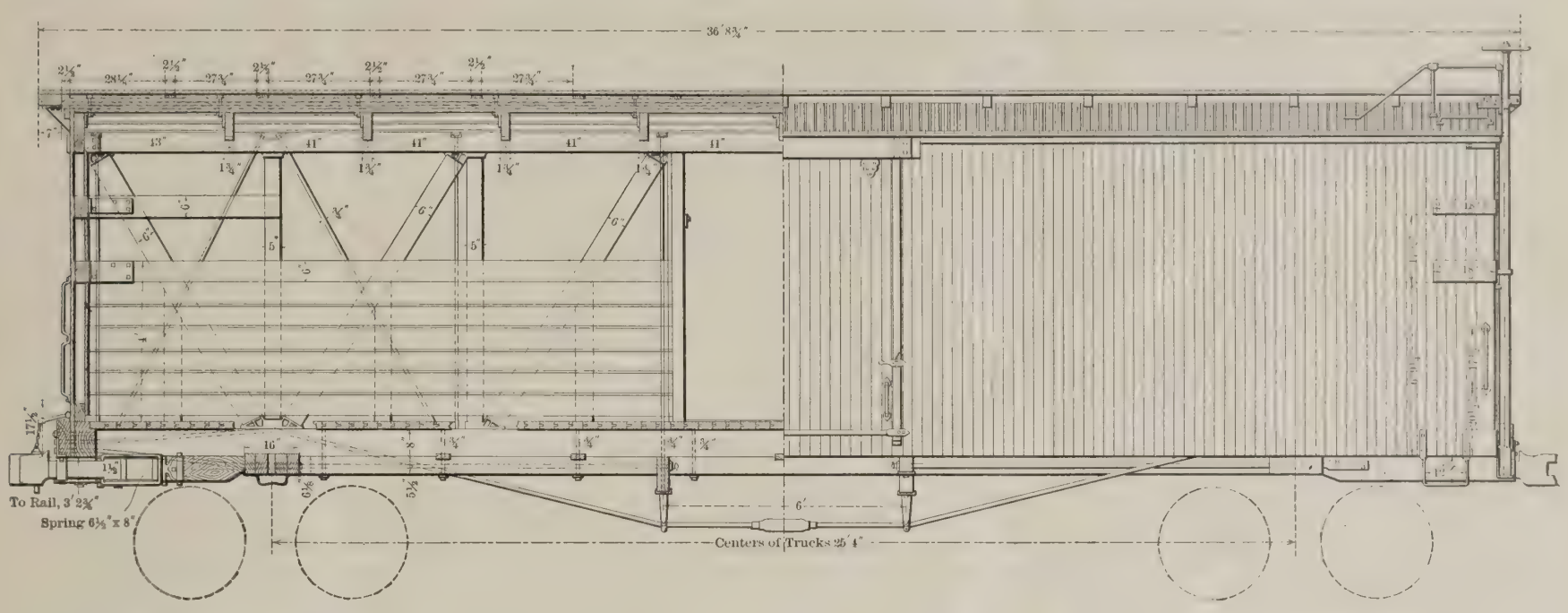
The Great Western Railroad Company.

(From the Oswego Advertiser, April, 1837.)

This is the style of the new company formed in Upper Canada under the sanction of the Provincial Parliament, from the London and Gore Railroad Company. The Parliament has also passed an act granting by way of loan to the company the sum of $800,000. The work is to be commenced with the opening of the spring. The line of road is from Hamilton (on Burlington Bay) at the head of Lake Ontario to Point Edward, at the foot of Lake Huron, and opposite to Fort Gratiot. The distance is 132 miles. From London we understand a southern branch, along the Thames, is to be extended to Chatham, the head of steamboat navigation on that river. Thence is every facility for steamboat communication with Detroit.

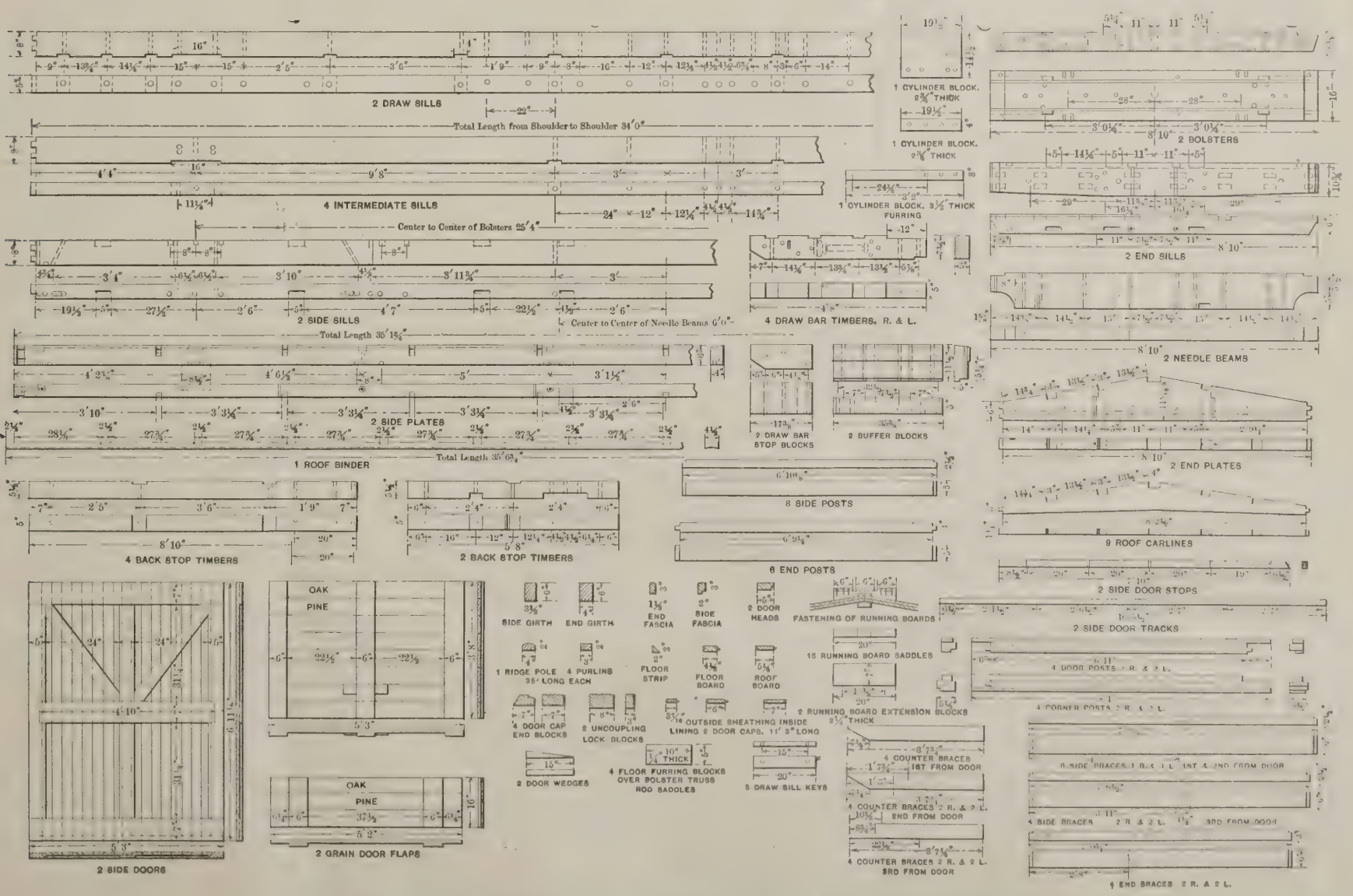
There is no railroad on the continent of more value or likely to be productive of greater results than this. It will effect a communication between New York and the remote West, with which no other route can contend. A reference to the map will satisfy any one that by this route a passage can be accomplished from New York to Fort Gratiot, in Michigan, in 40 hours! and in 42 hours to Detroit!! When the Michigan railroad across the Peninsula is completed the distance between New York and Chicago will be only from 55 to 60 hours! This may be easily shown:

From New York to Albany by steamboat	10	hours
" Albany to Oswego by railroads	10	"
" Oswego to Hamilton by steamboat	12	"
" Hamilton to Detroit by railroad	10	"
	42	"
" Detroit to Chicago by railroad and steamboat about	15	"
	57	"



Half Section through Center. Half Side Elevation.

STANDARD 60,000-POUNDS CAPACITY BOX CAR, NEW YORK CENTRAL & HUDSON RIVER RAILROAD.



Wood Details, Standard 35-Foot Box Car, New York Central & Hudson River Railroad.

A Visit to Western Shops.

The general business depression and resulting hard times on the railroads have caused many contemplated improvements in the shops and rolling equipment of Western roads to be postponed until the sun of prosperity, now rising boldly above the horizon, shall have attained an altitude that shall dismiss fear of its retreat. The Chicago, Rock Island & Pacific has adopted one improvement in its Chicago roundhouse that has given much satisfaction and effected considerable saving. It is a plant for firing up engines with crude petroleum from which the naphtha and gasoline are extracted. The oil is conducted to every stall in the roundhouse by an overhead system of pipes, and to and into the firebox by a hose with a sprayer in place of a nozzle. The oil is fed under an air pressure of 20 lbs. per square inch, and the air and oil are intermingled at the sprayer. A quantity of coal sufficient to cover the grates thoroughly is placed in the firebox, and the flame of burning oil (which, because of the air pressure, has considerable force) is directed on to the coal until it is ignited over the entire grate surface. This requires but two or three minutes and the consumption of about 1½ gallons of oil. The odor is hardly noticeable, and a good bed of burning coal is obtained without smoking up the cab even a little bit. The plant for doing this work was put in by the Leslie Brothers' Manufacturing Company, of Paterson, N. J. The oil costs 1.71 cents per gallon, and 2,097 engines have been fired up in this roundhouse at an average cost of 2.39 cents each, effecting an economy of about 30 cents per engine ($629), as formerly one-eighth cord of wood, costing 32.39 cents, was used to fire up each engine. The departure has proved so satisfactory that all the principal roundhouses on the Rock Island road are to be equipped with a similar arrangement. At the Chicago roundhouse the saving effected by the first carload of oil used paid the expense of putting in the plant.

Otis steel is used for driving wheel and engine truck axles on this road, and is considered very reliable. The use of brass oil cups for rods is discontinued, and wrought iron cups with stems about ¾ inch thick are being substituted. The method of their application is novel. As applied to the rod-end the cup is a solid cylinder of iron with a drilled and threaded stem, and the bottom faced off. After it is screwed home solid, a tool of special design bores out the interior, planes the exterior, shapes the needle feed and threads the top of the cup for the cover, all at one operation. As the motion of the tool is from right to left the cup is tightened on the rod by the process of boring and finishing. When finished the cup is on to stay, and has no flat surfaces to permit the application of a wrench. Indeed, it appears to be forged on the rod.

All Rock Island locomotives are being equipped with the close notched quadrant described and illustrated on pages 52 and 53 of the NATIONAL CAR AND LOCOMOTIVE BUILDER for April, 1893. The results have been highly satisfactory, and the engineers have now become so much impressed with the advantages of the close notches for saving coal that when any whose engines have the old style quadrant are lectured for extravagant fuel consumption they immediately say that they are working at a disadvantage, and that they need a close notched quadrant.

The Chicago & Alton road is, like other roads, afflicted with an extremely light business at present, and the roundhouse at Bloomington is too full of engines to look well. The light business, however, is giving Mr. Johann a good opportunity to get his motive power into shape to stand the long siege of brisk business that is in store for it in the near future. From what the writer saw at Bloomington it is safe to say that the locomotives of hardly any large American road stand so much in need of thorough rehabilitation as did the engines of this road when Mr. Johann assumed charge of them. The condition of the boilers was specially bad, but Mr. Johann has made good use of the short time he has been on the road to place these in first-class condition. It is reported that a famous engineer once advised a young associate to the effect that whenever he had to make anything strong, to "make it *damn* strong." Perhaps Mr. Johann is not familiar with the advice and might not approve of its grammar, but he has always carried out its principle in practice, and doubtless a large share of his high success as a mechanical officer is due to his doing so. Within the rigidly imposed limits of size and weight it is hardly possible to build locomotives too strong, certainly not to make boilers too strong or large.

Iron is used for axles on the Chicago & Alton; and it may interest some to learn that the once much talked of Wilson valve gear (the invention of the late William Wilson, formerly Superintendent of Machinery of the road) has been removed from the last C. & A. engine. The extension front smokebox and straight stack are standard on this road, although some diamond stacks are in use. Mr. Johann says the diamond stacks really give the least trouble, although not so fashionable as the straight stacks. Coal costs the C. & A. about $1.25 per ton on the tank. Mr. Johann has not yet seriously considered the adoption of the regular close notched or "fine tooth" quadrant, although in a general way he places the quadrant notches closer together on new work than they were in the old quadrants. Mr. Johann has always admired the familiar throttle locking device of the old Mason engines, and has adopted it as standard. The advantages of the device are that it is simple and inexpensive in construction, and that it always automatically holds the throttle lever just where it is placed. Single exhaust pipes are used on C. & A. engines, and the Schenectady arrangement of smokebox netting (which by the way is very neat and handy) is adopted as standard. Automatic bell ringers of Mr. Johann's design, and that may be operated by either steam or compressed air, are being applied to engines as they go through the shop.

The C. & A. has a number of old "McQueen" ten-wheel engines with cylinders 18 inches by 24 inches. The engines were built nearly 20 years ago, and, of course, have very small boilers, though these are yet in good condition. These engines have always been poor steamers and extravagant coal burners. The writer will never forget his experience in firing them 15 years ago, when they were considered "crack" engines. Their appetite for coal was simply ravenous, and he more than once fired one of them when it seemed that each "fire" would be the last that he could summon strength to put in, and when to climb upon the seat-box for rest between "fires" was a physical impossibility. Mr. Johann is doctoring these engines up now by bushing their cylinders to 17 inches. This will largely mitigate the disparity between their cylinder and boiler capacity, and will doubtless improve them for the balance of their career.

Mr. Johann is now engaged upon designs for a new class of 10-wheel engines, some of which will soon be built. The boilers of these engines will be of very strong construction and liberal size, and will contain some improved features. The Bloomington shops are so well equipped with traveling cranes that the need of air hoists has not been felt. The yards of these shops present a very clean and neat appearance. Very little scrap is in sight, and all new or useful material is well housed and carefully assorted so as to be easily found when wanted. Mr. Johann hates rubbish and has devised numerous means to prevent its accumulation about the shops, some of which are amusing as well as instructive, and amusing principally as showing how prone workmen are to let rubbish accumulate in available places. As is well known, the tops of cupboards and closets are generally the recepticles for all sorts of rubbish, from old shoes and overalls to smokestacks. Mr. Johann prevents this by making the tops of all cupbourds slanting at an angle of about 45 degrees. Nothing will stay on them.

The Wabash shops at Springfield, Ill., have changed but little in recent years, and but few new tools have been added to their equipment. A new quartering machine has been placed in the locomotive shop and has proved itself a valuable addition. A powerful and excellent steam hammer of home design and build has been erected in the blacksmith shop, and is used for forging the iron axles used exclusively under Wabash rolling stock. Mr. J. B. Barnes, the Superintendent of Motive Power and Machinery of this road, went through an experience with steel axles some years ago that left no doubt in his mind that iron is the best obtainable material for axles, and for many other uses in car and locomotive construction. Air hoists of home make are distributed where needed in the shops and have proved a great help in saving time and labor.

While few new improvements in these shops and their equipment are noticeable, the conclusion must not be jumped at that the mechanical department of the Wabash is standing still. Those familiar with current mechanical literature know better. Indeed, there are but few American roads that have mechanical departments as progressive as has the Wabash, but the improvements have been made mainly in methods of doing work and in the rolling equipment, where they were most needed and where they have yielded the largest possible return on the investment.

To those who have not carefully studied the various avenues of waste that are open in the mechanical department of a large railroad, the economies effected in this department on the Wabash during the last several years would appear surprising if the figures were given. The writer believes he is able to judge correctly in this matter, as he has been intimately acquainted with the workings of this department of this road for the past 12 years. By the use of improved material and the adoption of improved methods in making repairs and renewals, the cost of locomotive repairs has been largely reduced, although the engine mileage and speed and weight of trains have largely increased. By improved firebox and smokebox arrangements, improved tender facilities, closer notched quadrants, proper instructions to engineers and firemen, and carefully kept and freely displayed records of the individual performances of locomotives, the cost of locomotive fuel has been surprisingly reduced, with the increased service before mentioned and but little decrease in the price of coal. Agitation and instructions respecting the proper use of lubricating oils have reduced the expenditure for such oils very noticeably; and in the generally supposed insignificant matter of piston and valve stem stuffing box packing the cost of such has been reduced thousands of dollars per year by the use of metallic packing (of home design and make) instead of the hemp packing used previously. Economics aggregating the sum that the writer knows these do, make an eloquent testimonial to the ability and shrewd progressiveness of the department's management.

About a year ago a standard single bar close notched quadrant was adopted for Wabash engines, and it is about the neatest design of such a quadrant that the writer has seen. The results have been sufficiently satisfactory to cause enthusiasm among the engineers and road foremen who are trying to make good fuel records, and the demand for them exceeds the means of supply. These quadrants are all made at Springfield, and instead of being notched in a slotter, as is done on the Rock Island, they are notched very quickly and cheaply on the milling machine. Five dollars covers the cost of the material, workmanship and application of one of these quadrants and a suitable latch; and as Mr. S. W. Jeffery, the Master Mechanic at Springfield, says, they save enough coal if used properly to pay for themselves the first month. The writer is sure that if he was running an engine he could save enough coal in the first two weeks with one of these quadrants to pay for it, as compared with what coal he would have to use with a wide notched quadrant on the same engine. Coal costs $1.10 per ton on Wabash tanks. With higher-priced coal the cost would be regained proportionately sooner.

The hopper style of tank adopted as standard on this road about two years ago has proved highly satisfactory from every point of view. It is a great convenience to firemen, as the coal flows to the coal gate by its own weight. It avoids the spilling of coal at chutes and while running, as the hopper holds securely six tons of coal, and no incentive exists for enginemen to take heaping tanks of coal. It saves fuel, as all the coal taken on is used up the same or the next day, and none is allowed to deteriorate through exposure; and it is found that there is less corrosion of the iron sheets of the tank with this form than with the common style of tank, as fresh coal and fresh air are constantly in contact with the sheets instead of decomposing coal and its destructive acids, as in the common style, especially when a surplus of coal is carried undisturbed.

This hopper tank was illustrated and described in the NATIONAL CAR AND LOCOMOTIVE BUILDER for September, 1892, and has since been frequently mentioned. Some improvements have since been made in its details which will be illustrated in the next issue of this paper. This improved tender was designed by Mr. Barnes, but was not patented and will not be; so all are at liberty to profit by its advantages who choose to do so.

The writer enjoyed the privilege of attending the semi-annual meeting of the Master Mechanics' Association of the Chicago, Burlington & Quincy Railroad, and proprietary lines, at Lincoln, Neb., April 11. Aside from the pleasure of meeting old acquaintances, the sessions of the meeting were highly interesting and enjoyable, and through the discussion of the different topics presented a good deal of interesting information was acquired.

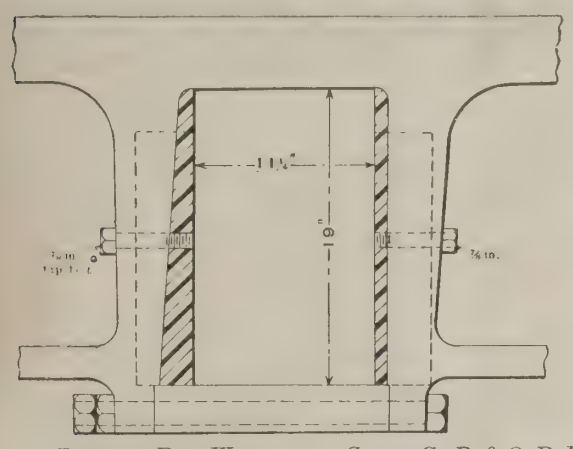
Among those present were Messrs. G. W. Rhodes, William Forsyth, A. Forsyth, E. Yates, S. Charles and R. N. Foster, of Aurora; R. D. Smith, of Chicago; R. W. Colville, of Galesburg; C. W. Eckerson, of Beardstown; Joel West, of Burlington; J. F. Deems, of Ottumwa; E. Jones, of Creston; D. Hawksworth, of Plattsmouth; George H. Baker, of New York; M. J. Paradise, of Hannibal; F. A. Chase, of St. Joseph; J. P. Reardon, of Alliance, Box Butte County, Neb.; and Messrs. E. S. Greusel, R. T. Smith, H. J. Helps, R. B. Archibald and A. B. Pirie, of the Burlington & Missouri River road.

This association is composed of the superintendents of motive power and the master mechanics of the Burlington system of roads. Mr. Godfrey W. Rhodes, Superintendent of Motive Power, of the C., B. & Q., is the chairman of the association, and presides at its meetings. These are held semi-annually at different points on the system. The association handles all questions pertaining to the cars and locomotives of the system, its conclusions being submitted to the management for approval. The members suggest possible improvements in methods of work, in materials for different purposes, in shop equipments, in details of cars and locomotives, and possible improvements in design. These are debated at the sessions by the members present, and the utmost freedom of expression and criticism characterizes the debates. No one is tongue-tied, and it is not at all unusual to hear a master mechanic forcibly arguing against the expressed opinion of his superintendent of motive power. This is a happy condition of affairs, and to its existence is largely due the efficiency of the association and the high standard of the rolling stock on the system.

The sessions of the association on this occasion covered two days, and a number of subjects of considerable local importance were treated, perhaps the most important being what boiler repairs should be made on engines with 17-inch cylinders and less. The system has about 400 such engines, which is over 200 more than are needed to operate the light local and branch trains that are run. In the normal freight and passenger service on the main lines more powerful engines are demanded, and the train department does a good deal of protesting against the small engines when they are offered. It was decided that expensive boiler repairs to such engines would be unwise, and that no new fireboxes or boilers should be built for them during the next two years. Probably by that time

it will be quite evident that a large portion of the number of these engines on hand should be dispensed with, and if so there will be very little good material to scrap.

Five years ago the writer suggested to a meeting of this association the advisability of some arrangement that would relieve the runners of locomotives from the care of wedges. He was "sat down upon" rather unceremoniously at the time, but the following cut shows the arrangement of this detail that after a protracted trial has been adopted as standard on the system. The cut shows the arrangement as applied to a Class H engine (19 in. by 24 in. mogul). The wedge and shoe are held rigidly in place by the tap bolts



FIXED DRIVING BOX WEDGE AND SHOE; C., B. & Q. R. R.

shown. Adjustment is made when necessary by inserting liners behind either the wedge or shoe as is required. The arrangement is eminently sensible, and cheaper to make and maintain than the adjustable wedge with its bolts and nuts. Neglect of and maladjustment of wedges constitute a prolific source of driving-box troubles, among which hot and broken boxes figure prominently. The "Burlington" will certainly experience a reduction of these troubles when the adjustable wedge shall have disappeared from its engines.

The freedom with which the chief officers of this system welcome criticism and suggestions results in there frequently being a number of small possible economies discovered and practiced which aggregate large savings annually. A considerable leak was noticed in the frequent loss and destruction of seat box cushions and arm rests. It was decided to plane the cab window sills off smooth and to dispense with arm rests, and to attach the seat box cushions securely to the boxes or seats. The advisability of dispensing with engine cushions altogether is now seriously considered. The writer doubts the wisdom of this. Years ago when the Wabash was very poor he had to ride every day on what was then facetiously termed "a Johann cushion," which was the soft side of a hard board. The experience will always be remembered as a hardship. Hardship should not be added to the arduous and hazardous duties of firing and running locomotives. The aim should be to make the work easy and the engines comfortable, even if at some expense, and then insist on economical work. This will pay with the right kind of men, and only these should be kept.

Another economy that is being practiced on this road is the abandonment of the practice of finishing the brass-work used on the engines. Check chambers, cocks of all kinds and even the bells are now placed on the engines just as these articles come from the brass foundry. It was found that the time used to finish up these details added considerably to the cost of an engine. Rogers black paint is used in the interior and exterior of cabs. Close notched quadrants have now been applied to all C., B. & Q. engines; the last one being applied to the compound engine a month ago. They are considered the means of much fuel economy. The C., B. & Q. recently patiently investigated the question of steel versus iron axles, and after some disappointing experiences with the best Cambria steel in this service has settled down to iron axles. This road expends about $15,000 per year for charcoal and is considering the advisability of utilizing the oak timber received from wrecks and old coal and freight cars for convertion into charcoal. Mr. L. B. Paxson, of the Philadelphia & Reading, used to make his own charcoal, utilizing for the purpose the waste hard wood from wrecks and repairs on his road. But large reductions made in the uses of copper rendered the use of large quantities of charcoal for brazing unnecessary, and gas was substituted for soldering.

Any one would have to travel a long way to find shops more progressive or full of interest to the visitor than the Union Pacific shops at Omaha. These are the principal shops on this system of roads, and they are presided over by Division Master Mechanic T. H. Manning, under the controlling eye of Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific system. The writer spent two very enjoyable and instructive hours in company with these gentlemen looking around the shops and making mental notes of many new devices and improved methods for saving labor and expediting the work in hand. Compressed air is in more extensive use in these shops than in any other railroad shop in America, and Mr. McConnell and Mr. Manning are both highly pleased over the results they have obtained in the various ways they have used it, and feel that they could not now get along without the valuable help their compressed-air devices give them. Certainly the work carried on at these shops could neither be performed so quickly, well nor economically without these devices as it is now. Among these may be mentioned a punch of home design and build that punches all rivet holes in boiler sheets quickly and accurately, and which by a few slight changes easily made is converted into a press to flange sheets for the fire doorway and others for the dome opening.

Hollow staybolts, threaded their entire length, are screwed rapidly into place by another compressed-air tool, and the square ends of these are pinched so nearly off by another air tool that a tap from a hammer does the rest. Air hoists do all the lifting that is required. These are of home design and make, and are simply and cheaply constructed, and are liberally distributed through the shops. Standing in one shop the writer counted twelve of these lifts in his vicinity. These compressed-air tools save a great deal of labor, and the writer was impressed with the conviction of their high utility, cleanliness and (a valuable quality in summer) coolness.

One of the most interesting performances witnessed was the operation of rolling flues in the smokebox end of a boiler with a compressed-air tool that seemed to make a thousand revolutions per minute, only the writer did not see it run a minute continuously, for each flue was rolled in from 25 to 30 seconds. As neat and smooth a job could not be done by hand, and as proof of the excellence of the work, U. P. engines are troubled less than ever before with leaky flues, although, as is well known, the feedwater on the road is notoriously bad.

A visit to the car shops, which are under the management of Mr. A. M. Collette, revealed some further uses of compressed air. Seat cushions are cleaned with it quickly and thoroughly by means of a hose having a flattened nozzle. No beating is necessary, and the application of the air for about three-quarters of a minute to the top surface of the cushion, and about the same length of time to the bottom, frees the cushion of dust.

Perhaps sandpapering a coach preparatory for painting would be one of the last uses any one would expect compressed air to be put to. Yet Mr. McConnell has devised an arrangement for doing this. A hose leading from the air pipe has attached to it a turbine, to the disc of which is clasped a sheet of sandpaper cut to fit. A cock regulates the flow of air to the turbine, which, of course, revolves rapidly when the pressure is turned on and imparts its motion to the attached sandpaper. All the workman needs to do is to place the revolving sandpapered disc against the "work," when the "fur flies." The apparatus was operated for the delectation of the writer, and a chance was given to examine some of the work that had been done on a coach side. It was almost uniformily perfect. This tool is "the latest," and while it has done good work, both Mr. McConnell and Mr. Collette are sure that with a little practice in its use still better work will be done. One unexpected development in the use of this tool is that it saves sandpaper, only a fraction of the quantity ordinarily used being required.

If more evidence was required to show that the working capabilities of compressed air are appreciated at these shops, it may be found in the fact that an apparatus has been made and used for whitewashing the interior of the roundhouse and shops by air pressure. A cylindrical tank for holding the whitewash is mounted on a truck, and suitable arrangements are made for connection with the system of air pipes that traverses all the buildings where air pressure is needed. A long pipe that will reach to the ceiling, and having a suitable nozzle at the top and a hose connection at the bottom with the tank, and a man to hold and direct it, completes the arrangement. The whitewash is injected through the pipe and sprayed upon the ceiling or walls. No ladders or scaffolds are used, and the job is done with the operator standing on the floor.

In reference to the question of short versus long smokeboxes, Mr. McConnell does not believe he made any mistake in going back to the short box and the diamond stack a year and a half ago. All Union Pacific locomotives are now so fixed, and Mr. McConnell regards the fact that the expenditure for fuel was $86,000 less last year (with engines in present condition) than the year before (with long fronts and straight stacks) as evidence that the present arrangement is much more economical than the former.

Crown bars are adhered to on this road for the support of crown sheets. All Union Pacific engines are equipped with close-notched quadrants, which are considered as largely and favorably affecting full economy. Iron is exclusively used for axles. A carefully worked out plan of air-brake-equipment repairs is followed on this road. All air-brake details needing repairs are sent to Omaha from all parts of the system. A special shop, with a special tool equipment, repairs everything of this nature, and a special storeroom takes care of all new and repaired equipment; the repaired parts being painted white to distinguish them from those not yet used.

The scrap pile is kept phenomenally small in the freight-car repair yard. This is because Mr. McConnell believes that such scrap piles are generally largely made up of car details that are fit for long-continued use. So he insists that in car repairs if the detail needed can be found in the scrap pile, it must be used if in good condition. The tracks in this repair yard are arranged like those in a roundhouse, and radiate from a turntable in the center. This is found to have many advantages in practice. Little trouble is experienced in moving or removing cars, and the foreman when near the turntable can see what is going on all over the yard.

In repairing old boilers Mr. McConnell follows a plan that saves much time and labor. The firebox end of the boiler is simply removed from the barrel. Most, if not all, of the repairs needed are in this end. These can then be made most conveniently, especially crown-sheet and crown-bar work, with plenty of light, room, fresh air, etc. This also allows the work of cleaning and thoroughly inspecting the interior of both the barrel and butt end to be done most conveniently and effectually. In building new boilers this plan is carried out, and the butt end is not riveted to the barrel until all the work that can be done on both portions while separate is finished. This seems an eminently intelligent plan.

COMPARATIVE STATEMENT OF ENGINE FAILURES ON UNION PACIFIC RAILROAD.—PASSENGER AND FREIGHT SERVICE.

	Number of engines in service.	Engine Failures.	Per cent. not steaming.	Per cent. machinery failures.	Per cent. running hot.
Last quarter, 1890.....	58,683	1,683	29	50	21
Last quarter, 1891.....	.....	695	.....	.....	Pass. 34. Frt. 8
Last quarter, 1892.....	.....	563	.....	.....	.....
Last quarter, 1893.....	.....	395	.....	.....	.....
YEAR, 1893.....	225,570	1,492	17½	66½	16
					Pass. 25. Frt. 7

NOTE.—Percentage of failures to number of engines in service in last quarter 1890, 3.02; percentage of failures to number of engines in service in year 1893, .75.

Space does not allow a recital here of all the lessons learned in the brief visit to these interesting shops. The Union Pacific operates 1,057 locomotives and 27,038 cars. Improvements made in the last three years in the methods of maintaining and operating these (some of which have been described above) have effected economies aggregating a sum in dollars well up in the hundreds of thousands. The table appearing above shows the remarkable reduction of engine failures effected, the value of which will be understood by practical men. A reduction of 11.5 per cent. in failures for want of steam speaks well for the change to short smokeboxes and diamond stacks on this road.

Master Mechanics' Association Circulars.

The following circulars have been issued by the Secretary of the American Railway Master Mechanics' Association:

Next Convention.

The twenty-seventh annual convention will meet at Saratoga, at 9 A. M., June 18. The headquarters of the Association will be in Congress Hall.

Members and their friends who expect to attend should apply for rooms to Mr. H. S. Clements, Congress Hall, Saratoga, N. Y., without delay.

The charge, where no extras are furnished, is $3 a day for each person.

Master Mechanics' Association Scholarships.

There will be vacancies for two scholars at Stevens Institute of Technology in September next. Sons of members and of deceased members only are eligible. Those desiring particulars of the entering examination will receive the same by applying to the secretary of the Association.

Fire in a Historic Building.

The roof of the old Speedwell Iron Works, at Morristown, N. J., caught fire April 19, and the firemen had much difficulty in saving the building. The structure has a history. It was erected just at the close of the Revolution by Judge Steven Vail. On the second floor of the building Prof. Samuel F. B. Morse and young Alfred Vail worked for years to perfect the electro-magnetic telegraph instrument. On the same floor, in 1836, the first successful tests were made, and the nails used to support the wires are still sticking in the beams and joists. In the same building the machinery for the steamship "Savannah," the first to cross the Atlantic, was built, and the wheels of the first American-built locomotive were made there. The bell in the belfry was cast before the Revolution. It was cracked in the fire and will be recast.

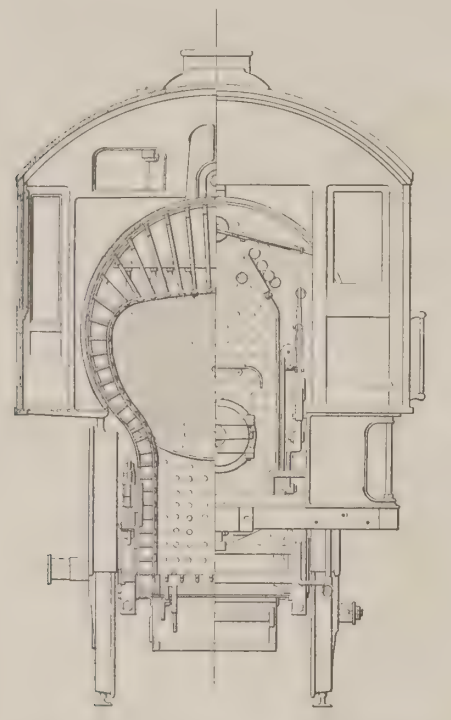
Removal of the Ferris Wheel.

The Ferris wheel is to be removed from Jackson Park, Chicago, to New York City. The work of removal has begun, and the site selected for it in New York is a large lot, now used for various purposes, but containing no building, at Broadway and 37th street. The location is well chosen, being in the heart of the theater district of the city, where all visitors and lovers of amusement frequently congregate. The job of tearing down, transporting and re-erecting the wheel will consume four months, and cost $150,000. The material will be loaded on five Illinois Central trains of 30 cars each. The car which carried the great Krupp gun will transport the 70-ton axle. There is 2,000 tons of metal in the wheel, and 500,000 feet of timber is needed for the falsework.

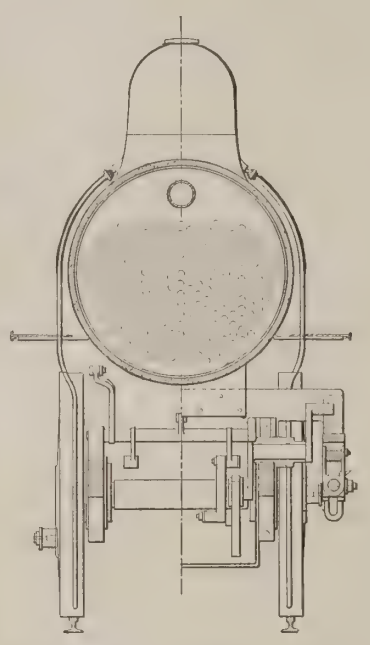
Ten-Wheel Passenger Engine, Chicago & Northwestern Railway.

One of the most interesting locomotives exhibited at the Columbian Exposition last summer was the 10-wheel passenger engine *Columbus* built for the Chicago & Northwestern Railway by the Schenectady Locomotive Works. In our last June issue we mentioned this engine and gave space to a photo-engraving of it. Since then the builders have sent us the general arrangement and sectional drawings reproduced below.

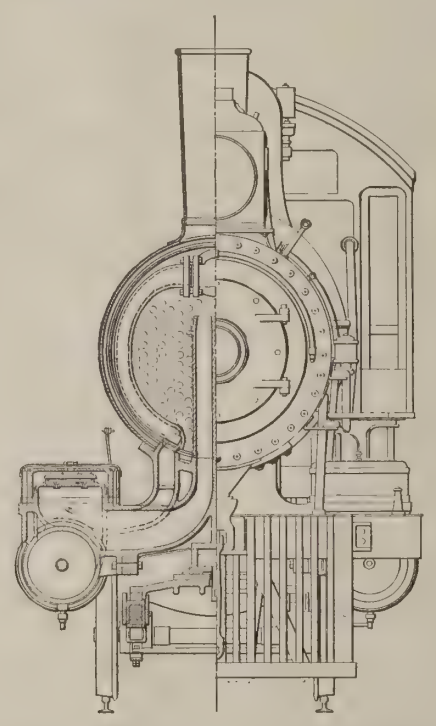
The engine is interesting as being an example of the best modern practice in the construction of such engines, and of the largely increased power required to haul the heavy passenger trains that are run on some of our large roads.



Back Elevation and Half Section through Firebox.



Section through Barrel of Boiler and Half Section through Guides, Etc.



Front Elevation and Half Section through Smokebox, Cylinders and Engine Truck.

SCHENECTADY TEN-WHEEL PASSENGER ENGINE, C. & N. W. RY.

The engine is a simple, bituminous-coal burning engine and weighs 129,000 pounds, 96,000 pounds of which rest upon the drivers and 33,000 pounds rest upon the engine truck. The total wheel base of the engine and tender is 47 feet 9½ inches, and the total length of same is 58 feet 4⅜ inches. The wheel base of the engine is 25 feet 3 inches, the driving wheel base being 14 feet 11 inches, and the rigid wheel base being 9 feet. The cylinders are 19 inches by 24 inches. The piston is 5¼ inches thick, and the piston rod is 3½ inches in diameter. Metallic packing is used in the piston and valve stem stuffing boxes. The driving wheels measure 67 inches outside of tire, and the driving axle journals are 7½ inches by 8½ inches.

The boiler is 60 inches in diameter, and is made of $\frac{9}{16}$-inch Wellman steel. It carries a working pressure of 170 pounds. The circumferential seams are double riveted, and the horizontal seams are butt-jointed and sextuple riveted. As the drawings show, the boiler is of the extended wagon-top type, with radial stays 1 inch in diameter supporting the crown sheet.

The firebox is made of Shoenberger steel, and is 77$\frac{11}{16}$ inches long, 33 inches wide and 84 inches deep. The sheets are of the following thicknesses: Crown and side sheets, $\frac{3}{8}$ inch; tube, $\frac{1}{2}$ inch, and back, $\frac{5}{16}$ inch. The water space in the legs of the firebox is 4 inches in front and 3½ inches at the sides and back.

The tubes are of charcoal iron, 2 inches outside diameter by No. 11 wire-gage. There are 268 tubes 12 feet 6 inches long, affording 1,742.3 square feet of heating surface. The firebox has 164 square feet of heating surface; the total heating surface being 1,906.3 square feet. The grates are rocking, and have 17.8 square feet of surface. The exhaust nozzles are double and 3¼ inches in diameter.

A feature of special interest is the liberal dimensions of the crank pins, which are made of Cambria steel, Coffin process, and each have a hole drilled through the center, as shown in the engravings. This feature caused considerable comment by those who noticed it at the Fair. The pins were so made in compliance with the wish of Mr. William Smith, Superintendent of Motive Power of the Chicago & Northwestern, for whom 10 eight-wheel engines were built about the same time with similar holes drilled through the crank pins, the object being to afford opportunity for examination of the condition of the pins. This is a common feature in marine practice, and it has not been found to detract materially from the strength of pins so treated. Some writers believe that a pin so treated is actually stronger. No tests of this have been made that we are aware of; but in the instance of this engine, and the others mentioned, the porportion of metal remaining after the holes are drilled is such as to assure the rigidity of the pins.

The staybolts are of Taylor iron, and the boiler is lagged with asbestos cement. The main rod and driving box bearings are of Ajax metal. The piston rods are made of Low Moor iron. The valve stems and rods are rigidly connected, no knuckle joints. The rod oil cups are forged with the rods and straps, and are worked out of the solid metal. The rods are of Midvale steel, and the driving-wheel tires are of Krupp crucible steel three and one-half inches thick. The width of the frames is four inches. Nathan triple sight-feed lubricators are used for the cylinders and air pump. The guides are of hammered iron, case hardened, and the crossheads (Laird type) are made of Syracuse cast steel, with brass gibs of C. & N. W. type. The engine truck center-pin casting is made a half inch short, and two half-inch plate washers are laid in the center casting. The smokestack is made taper, and is of sheet steel with a flanged steel base. The tender trucks are fitted with inside brakeshoes and the journal boxes are fitted with Fletcher lids.

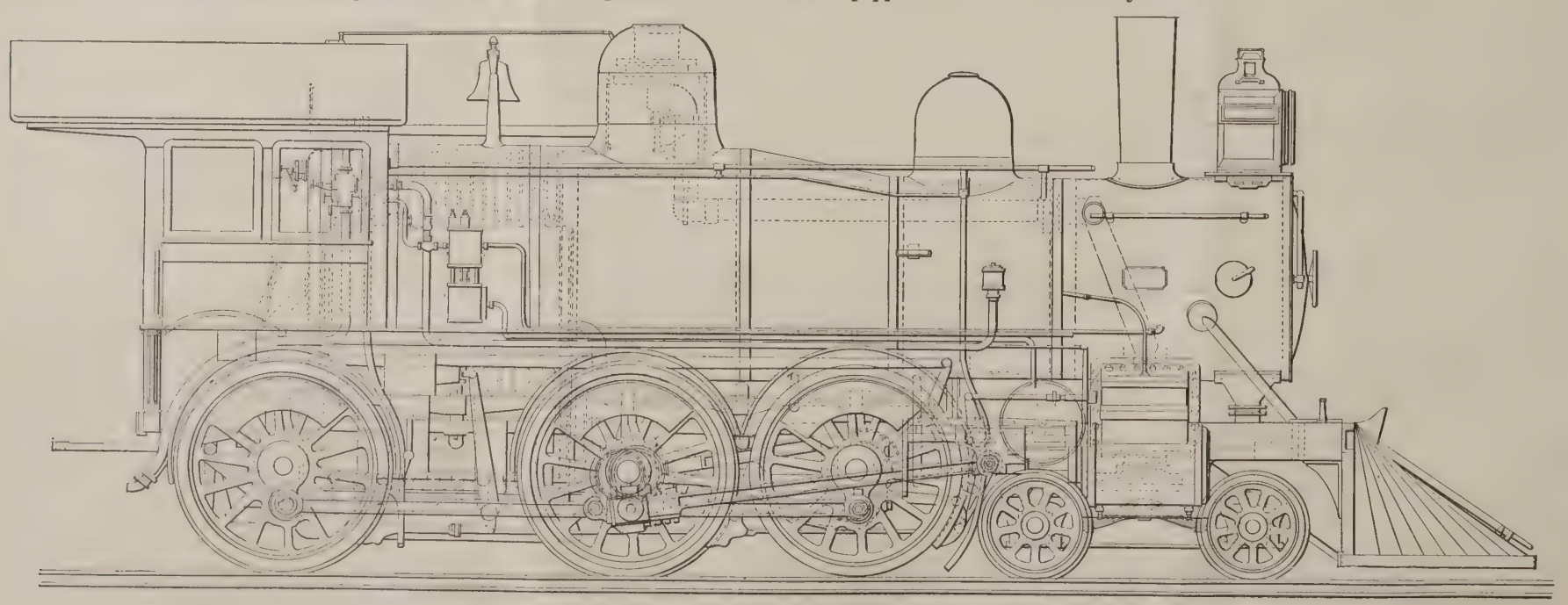
The engine has a balanced double poppet throttle valve and a close notched quadrant, an excellent combination to effect economical management. These standard features of Schenectady locomotives were illustrated and described in detail on page 155 of the National Car and Locomotive Builder for October, 1892. The throttle is an excellent arrangement, as, having two valves, its range of capacity is multiplied. The opening of one valve at first permits of nice manipulation of trains in starting, and the extra large opening of both valves enables the engine to be run with very short cut-offs. The close notched quadrant affords the means of doing this, and as we have just said, the combination is an excellent one to save fuel. The combined area of the throttle valves when both are full open is 60 per cent. greater than the capacity of the dry pipe. This largely overcomes wire drawing caused by turns of pipes and passages and openings of valves.

The engine truck is of the rigid center type with four Washburn steel-tired, spoke-center wheels 33 inches in diameter, and having journals 5 by 9 inches.

The following table gives some further information concerning the means of steam distribution in this engine, and some other details of interest.

Steam ports, size	18 × 1¼ in.
Exhaust ports, size	18 × 2¾ in.
Bridges, width	1⅛ in.
Slide valves, kind	American balanced
Slide valves, greatest travel	5½ in.
Slide valves, lap of	Outside, ⅞ in.; inside, $\frac{1}{32}$ in.
Slide valves, lead in full stroke	$\frac{1}{16}$ in.
Crank pin journals, main pin, main rod	6 × 5½ in.
Crank pin journals, main pin, side rod	6¼ × 5 in.
Crank pin journals, front pin, side rod	5 × 3⅞ in.
Crank pin journals, back pin, side rod	5 × 3⅞ in.
Smokestack, inside diameter	16 in. near bottom.
Smokestack, top above rail	14 ft. 10 in. eng. central
Boiler supplied by	1 No. 10 Monitor inj. R. S. 1 No. 9 injector L. S.
Tender, weight empty, in pounds	32,900
Tender wheels, number of and diam.	8, 33 in.
Tender wheels, kind	Barnum-Richardson cast-iron chilled plate
Tender journals	4½ in. dia., 8 in. long
Tender, total wheel base of	15 ft. 11½ in.
Tender frame, style	6½ × 4 × ¾ in. angle iron S. L. W. standard
Tender tank, water capacity	4,000 gallons
Tender tank, coal capacity	7 tons

The Birmingham Iron Works were sold at Birmingham, Ala., April 16. The plant consists of mammoth machine and foundry works and will now go ahead on orders already booked.



TEN-WHEEL PASSENGER ENGINE, CHICAGO & NORTHWESTERN RAILWAY.

Care of Passenger Trains at Terminals.*

The inspection and care of passenger trains at terminals may be considered under four heads, namely:

Inspection, repairs, cleaning and cost.

Inspection—that defects, if any exist, may be located, thereby assuring the safety of trains while enroute, as far as possible. Repairs—that defects or breakages discovered by inspection may be put in proper condition. Cleaning—that both the exterior and interior of passenger vehicles may please the eye and contribute to the comfort of the traveling public. Cost—that the labor and material expended may be charged to the proper accounts, so that the head of the department, as also the foreman in charge of the work, may at all times know if the cost be excessive, when compared with work done.

The inspection of both the exterior and interior of all passenger vehicles should be made by competent inspectors, under the careful supervision of a foreman who should have entire charge of the train, and who should be held responsible for its proper condition when it leaves the coach yard for the trip. The trucks and running gear should receive a strictly first-class inspection; for, upon their proper eondition depends, to a great extent, the safety of the entire train. The wheels, if steel-tired should have the tires, retaining rings and bolts carefully examined. The axles should also be closely inspected, as far as practicable. These are too often neglected, as a hurried glance at the wheels, from the outside, passes for a so-called inspection. Tires with sharp flanges are in many cases allowed to run until the cost, which arises from the waste of metal in again turning the worn flanges to gauge, is found to be excessive. Among the many "sins of omission" for which inspectors are responsible, the running of steel tires with sharp flanges is the most costly and flagrant that I have in mind. There is, in my opinion, no circumstance that would justify this practice.

The air brakes on passenger vehicles should be inspected and tested, and the pistons adjusted to the proper travel. The brake-cylinders and triple-valves should be cleaned and oiled once every three months, and the date of last cleaning and oiling should be marked in chalk upon the cylinder of each car. In every well equipped coach yard, air pipes should be laid so as to be accessible for connecting to and testing of the air brakes before the train leaves the yard. In those localities where the coach yards are adjacent to the main shops, pipes may be laid from the shops to the yards for the purpose of furnishing a supply of compressed air. In yards located too great a distance from the main shops to convey air (as is often the case), an independent air plant consisting of a small boiler, air pump and connections, could be established at a small cost. A passenger train should not be allowed to depart on a trip from a terminal station unless the air brakes have been tested and adjusted. In case no other facilities exist for this purpose, an air brake yard engine should be attached to the train and the air brakes be tested and adjusted. If a yard engine be not available, the regular passenger engine should be attached to the train in time to make the test and the adjustment before the time scheduled to leave.

The cleaning or wiping of the trucks under the coaches and the sleepers is a subject in connection with which some difference of opinion seems to exist. There is no question that trucks properly wiped add to the appearance of trains leaving terminal stations. The cost of such work is small, about 11¼ cents per car of four-wheel trucks, and about 15⅓ cents per car of six-wheel trucks. While this expense is small, yet it is an expenditure that should be avoided—if unnecessary—as it adds no element of safety to a train.

The examination of oil boxes, journals, wedges, bearings and packings should be made with great care and attention on the part of the inspectors. This is one of the most important matters in connection with the inspection and care of passenger trains. So much has already been said and written on the subject of "Bearings," "Packing," etc., that any further comment upon my part at this time seems uncalled for.

I believe that the best way to clean the exterior of passenger coaches is simply water and a suitable wash-brush. Soaps, oils, cleaners and compounds should be avoided as these will invariably attack the varnish. In cases where cars have been out of the shop for ten or twelve months, a small quantity of soap dissolved in water for washing will brighten the appearence of the paint.

As regards the interior of coaches, the wood-work and head-lining should be thoroughly washed at least once every month. The floors of coaches and the windows should be well washed. The window shades, or blinds, and the seats should be thoroughly cleaned at the end of each trip. Toilet rooms should be vigorously scrubbed and otherwise well cleaned with scrupulous care, and they should be disinfected so that no unpleasant odor shall be perceptible to the keenest sense of smell. No rubbish, dirt, or waste should be allowed to accumulate behind heater pipes, or in the heater room. Everything in or about the cars should be free from dirt and dust. They should be absolutely clean, fresh-looking and therefore inviting.

Probably we all have noticed, on many occasions, the close, musty and foul atmosphere so oppressive, unhealthy and uncalled for, as we have entered coaches at stations immediately after the train had arrived from the coach yard. This was the result of improper ventilation after cleaning. It is no doubt a difficult matter to thoroughly renovate coaches—I may say disinfect them—in from 12 to 15 hours, and, in some instances in less time, after they have completed an overland trip. For:

> "You may scrub, you may clean, the coach if you will,
> But the scent of the emigrant clings to it still."

The ceilings of the roof and the clear story of mail and baggage cars are, as a rule, painted either a white or other, very light color. Therefore they become quickly discolored by smoke from lamps, and the accumulation of dust should be washed away at least once every three months.

On sleeping cars, the exterior and interior should receive particular attention. All of the bedding and the carpets should be removed from the cars and thoroughly beaten, dusted and ventilated each trip. The windows, berth fixtures, lamps, etc., should be all in such condition as to prevent rattling, creaking, or making any noise that would disturb the rest of the passengers. The hand railings of the sleepers, as well as coaches, should be well cleaned, as regards brass fixtures; and those which are painted should be brightened with a thin coat of quick-drying varnish when necessary.

In caring for steam-heated trains at terminals where the distance is too great to convey steam from the main shop, a suitable heating-boiler should be located in the coach yard from which steam could be supplied to the train, thus insuring a proper temperature during the lay-over and the process of cleaning. At outlying terminals where steam is not available, the only alternative is to build fires in the stoves, or in the Baker heater, in order to keep the coaches warm during the lay-over. A suitable boiler in the coach yard could be utilized for both heating trains and running an air-pump. I understand a number of roads utilize compressed air very successfully for the purpose of cleaning dust and dirt from seats, cushions, windows and woodwork, on the inside of coaches. We are about to test this method and we believe that its introduction will effect a material decrease in the cost of cleaning passenger equipment.

Our experience demonstrates the average cost of cleaning passenger vehicles in coach yards to be as follows:

ORDINARY CLEANING OF A FIRST CLASS SLEEPER:

Inside.		*Outside.*		*Inside and Outside.*	
Labor	$2.41 5	Labor	$ .57 5	Labor	$2.99
Material	.37 1	Material	.19 3	Material	.56 4
Total	$2.78 6	Total	$ .76 8	Total	$3.55 4

ORDINARY CLEANING OF A FIRST CLASS COACH.

Inside.		*Outside.*		*Inside and Outside.*	
Labor	$1.15	Labor	$ .34 5	Labor	$1.49 5
Material	.16 8	Material	.15 7	Material	.32 5
Total	$1.31 8	Total	$ .50 2	Total	$1.82

I understand that the Canadian Pacific Railway, and the Wagner Palace Car Company, at Montreal, have a fixed charge of $2.50 per car for cleaning sleepers, and $1.50 per car for cleaning coaches.

WASHING THE ENTIRE WOODWORK, INSIDE, OF A FIRST CLASS SLEEPER.		WASHING THE ENTIRE WOODWORK, INSIDE, OF A FIRST CLASS COACH.	
Labor	$6.90	Labor	$4.60
Material	2.07	Material	1.20
Total	$8.97	Total	$5.80

COST OF CLEANING TWO 4-WHEEL TRUCKS.		COST OF CLEANING TWO 6-WHEEL TRUCKS.	
Labor	$ .09 37	Labor	$ .12 5
Material	.02 05	Material	.03 09
Total	$ .11 42	Total	$ .15 59

TEN-WHEEL PASSENGER ENGINE, CHICAGO & NORTHWESTERN RAILWAY.

* Read before the Northwest Railway Club, at St. Paul, April 10, by Mr. E. A. Williams, Mechanical Superintendent, Minneapolis, St. Paul & Sault Sainte M. Railway.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

THE CONVENTIONS.

The time for the annual conventions of the Master Car Builders' and Master Mechanics' associations is rapidly drawing near, and the general feeling among those whose duties will require their attendance is doubtless one of pleasant anticipation, and satisfaction with the place selected. Saratoga is so pleasantly situated and has such excellent hotel accommodations that it has proved a most convenient and desirable place for the congregation of the large number of people who in recent years have attended these conventions. Lakewood, on Chautauqua Lake, where the conventions met last year, will long be remembered pleasantly, and doubtless the conventions will meet there again. The lake will be missed at Saratoga, but there will be the compensating advantages of a better and more convenient hall for the meetings, and better hotels. As previously announced, the Master Car Builders' Association will meet at Congress Hall Hotel, Tuesday morning, June 12. The Master Mechanics' Association will meet on the following Monday morning, June 18. Those who make their hotel arrangements early will have no trouble about getting comfortably located.

INDEPENDENCE OF MECHANICAL OFFICERS.

The communication on "Passenger-Car Ventilation" published in this issue assails the independence of master car builders in the matter of adopting any improved means of ventilation that will differ radically from the practice of the sleeping-car companies, and charges that these companies "rule the roost" in matters of car improvements; or, practically, that master car builders may follow an example set by these companies, but that the latter would not follow an example set by the master car builders. The charge has also been made that master mechanics have adopted straight stacks and extension smokeboxes for locomotives, because the Pennsylvania Railroad set the example, and that the tenacity with which this arrangement is adhered to is due to this railroad's adherence to it.

If these charges were true the conclusion could not be escaped that railroad mechanical officers are little if any better than the Broadway dudes, who walk and dress and talk in the fashion that is set by their English prototypes on Piccadilly. But neither charge is true in any degree. Frequent communication and association with master mechanics and master car builders in all sections of the country has not impressed us with the idea that they are specially solicitous about what the Pennsylvania Railroad or the sleeping-car companies are doing, any more than about what any of the progressive roads or car works are doing.

Improvements in cars and locomotives, and especially locomotives, are more apt to be made on large than on small roads, because the large roads can afford to make tests and investigations that the small roads cannot afford. When such improvements have proved their worth on roads that adopt them, it is but right and proper that they should be adopted on other roads. There is nothing in this to justify the charges of servile imitation implied above. Indeed we know that the dread of such criticism stands in the way of the wider adoption of many improvements in car and locomotive design.

As a class, American railway mechanical officers are as originally and independently progressive as any other, as the superiority of our cars and locomotives, internationally considered, attests; and as some railroads have found to their cost, because of the irresistible desire of their mechanical officers to improve on established standards. No one needs to borrow any trouble about the committee's report on ventilation, the action of the convention in reference to it or about how any plan of improved ventilation indorsed by the Association will be received by the railroads and sleeping-car companies. The subject is in good hands; the time is ripe for action, as the traveling public and railroad officers are impressed with the need of improvement, and dependence may be placed in the ability and good judgment of those who will have to deal with the matter to do so intelligently.

THE INFLUENCE OF CLEANLINESS AND ORNAMENT.

Everybody has heard that cleanliness is next to godliness. It is certainly true that cleanliness has a potent influence on those who come within the circle of its spell. Practiced in daily life it breeds self-respect and commands the respect of others; practiced in the shop and on the engine it prompts care and economy in the performance of work; and practiced in the office it expedites business and adds a tone of respectability to the plainest furnishings. It is everywhere and under all circumstances a silent declaration of care, ability and economy, and always compels the admiration of the observer. The slovenly workman is never the efficient workman. The slovenly engineer is never the one to use the best judgment in running his engine and handling his train, but he is sure to use between every station more oil and coal and steam than are necessary. The slovenly firemen will slight his work at every turn—always to the loss of the company. A master mechanic should have no use for such a workman, engineer or fireman unless he can be speedily reformed. The nickname of "Greasy" Brown or "Dirty" Jones should suggest dismissal. A tidy workman in the shop, in the cab or at the desk may be depended on to do efficient work, because his condition of neatness and cleanlines announces the fact that he is master of his duties and methodical in their performance.

In an excellent paper on the "Care of Passenger Cars at Terminals," published in this issue, the author expatiates on the necessity of thorough cleanliness in the preparation of the cars for their next run. In regard to wiping the trucks of the cars he holds that cleanliness in this detail may profitably be sacrificed to economy. We doubt the expediency of doing so, especially as the saving effected is small, about 1½ cents per car. Simply as a matter of appearance the saving might be justified (although this is questionable), but cleaning the trucks facilitates inspection, and is in itself an additional form of inspection that may sometimes lead to the discovery of defects that threaten the safety of the car. The trucks require the most careful inspection, and if cleanliness can facilitate this at reasonable cost it seems that the precaution should not be neglected.

In the maintenance of locomotives the temptation to economize by neglecting to wipe them is frequently yielded to, and they are allowed to run in a condition of disgraceful dirtiness that must exert a strong tendency to demoralize the habits of careful inspection and maintenance of tidy, self-respecting engineers. From the apparent saving effected by this neglect a good deal should be subtracted to arrive at the net result. This would include occasional necessary repairs that under less dirty conditions would not have become necessary, or would have been less expensive; and it would include some failures of engines on the road, causing expensive and annoying delays to trains, the cause for which could be traced to the neglect of wiping engines. Another element of loss should be subtracted that would be more difficult to estimate the extent of, and that is the influence that dirty engines may exert on engineers and firemen tending to discourage cleanly, neat and methodical habits of work, upon which the economy of operating the engines largely depends. Dirtiness is a vice which is nowhere excusable, and is nowhere more demoralizing and expensive than about a locomotive. Whether the driving and truck wheels, frames, springs, etc., are regularly wiped or not, the valve gear, guides and rods should certainly be as a matter of common decency and needed precaution in inspection.

The transition from cleanliness to ornament is an evolutionary step that under proper conditions and within reasonable limits gives tone to the good influences of cleanliness. In this and some other ways ornament may prove useful and valuable. The popular love of ornament is shown in nearly every home where means permit, and its refining influence is attested to by the fact that in the homes of the most cultured special consideration is given to it. All are familiar with the importance given to ornament in passenger-car construction, especially private, parlor and sleeping cars. Much has been said about the over-ornamentation of cars, and doubtless extremes have been reached, but the attention given the matter has not been without reason. Those who have to deal with passengers know that this feature is so pleasing to them that once enjoyed it is required. Ornaments are of value in the clean cab of a clean locomotive. They add interest and pleasure to the work of running and firing the engine, and this favorably affects the economy of its operation. When a crew thinks enough of an engine to not only keep it clean and in good order, but to also ornament the interior of the cab in some tasteful way, it may be depended on that the engine will do good, economical work. Cabooses are sometimes tastefully ornamented by the crews belonging to them. The influence is good, and probably causes more zealous flagging by the rear brakeman while on the road, and less hours spent by the crew about saloons while at terminals.

The interiors of shops do not offer inviting opportunities for ornamentation, but very frequently the yards about the shops do. A few strips of greensward and a few beds of flowers tastefully arranged make a vast improvement in the appearance of an otherwise clean but barren-looking space. The effect of such a change is not lost on workmen, for love of the beautiful is human, and nothing can be lost by making one's place of work attractive. Such decoration of railroad shop and station grounds is becoming more popular every year, and doubtless the time will come when its advantages will be much more appreciated. Many large roads have the matter now well in hand, each having several stations beautified in the manner described. The Pennsylvania Railroad ranks foremost among these, Mr. Frank Thomson, First Vice-President of the road, having long been an ardent advocate of the practice, and being chiefly instrumental in its adoption and success on that system. No more beautiful spots are to be found upon any railroad line, even in England, where such features are constantly cultivated by the railroads, than the stations at Ardmore, Bryn Mawr, Rosemont, Wayne, Villanova, Overbrook and Merion on this road. In the Alleghanies the station grounds are made attractive, and over all the rocky cuts and stone bridges the Virginia creeper, ivy and honeysuckle vines are trained to grow over the massive stone and add picturesqueness to the scenery. This is a refinement of railroad management that has been found to pay well.

It is seen that the influence of cleanliness on shop and engine men encourages careful habits, which result in efficient and economical work; that it encourages and facilitates inspection of cars, and especially locomotives, which leads to economy in repairs and fewer failures on the road; and that the influence of ornament, where judiciously applied, is pleasing and elevating and encourages and confirms careful habits.

WESTERN ENERGY.

One of the compensations of the journalist who works in a technical field is the occasional opportunity he enjoys of meeting those engaged in carrying on the practical lines of work he is most interested in. The writer has just passed through a course of such pleasant and profitable experience, and returned to the sanctum much impressed by the spirit of active progression that is actuating many of those who are in charge of the rolling stock of railroads.

As the march of empire tends westward, so should the steps of one seeking the latest advances in the art of building, maintaining and operating cars and locomotives in the most efficient and economical manner. Difficulties develop resources to overcome them in well-balanced natures, and the difficulties that Western railroad men have had to contend with in the shape of bad feedwater and fuel, trying extremes of temperature and grades, and labor difficulties and adverse legislation have quickened their latent ability to improve, economize and rise superior to their environments. Among the observable results are improved tools in shops and methods of doing shopwork, improvements in the boilers and the general design and many details of locomotives, improvements in the construction of cars and their details, and a general evolution toward better work, better service and better records. Difficulties that develop our latent powers and urge us on to better things have their well-recognized use in the great plan of human improvement; and when, as in the case referred to, difficulties have fathered improvements that have buried their parent, it is evident that those who have been affected were the right men in the right place.

"GIVE CREDIT WHERE CREDIT IS DUE."

As an instance showing how matter published in the NATIONAL CAR AND LOCOMOTIVE BUILDER travels around the world and is copied by other papers, the publication of an article on Spanish cars in the April issue of the *American Engineer and Railroad Journal* (page 156) which originally appeared in our last June issue (page 96), is interesting, to say the least. The *American Engineer* credits the article to the *Indian Engineer*, which published it without giving credit to this or any other paper, and doubtless the *American Engineer* supposed it was getting fresh news from the vicinity of Spain, and gave credit supposedly due. The article mentioned was originally contributed to this paper by a correspondent in Barcelona.

Our English contemporary, the *Practical Engineer*, was

an offender in this respect in its issue of March 23, in which it republished without giving credit a liberal extract from "A Method of Analyzing Bituminous Coal," which article was contributed to this paper by the testing laboratory of a large American railroad, and appeared on page 26 of our March issue.

We have no objection to our contemporaries at home and abroad republishing all of the interesting contents of the NATIONAL CAR AND LOCOMOTIVE BUILDER they want to, but must insist on due credit being given.

ARBOR DAY.

To all workers in wood the import of the observance of Arbor Day is significant, and it should be to all who feel an interest in the future prosperity of our country; for this will depend more than is generally understood upon the extent of our forests and upon the number of trees that adorn the sides of our hills and mountains and fringe the banks of streams and rivers. The flow of these is affected very largely by the presence or absence of the trees and forests mentioned. Where these abound the flow of streams is normal and continuous, because the rain and snowfall, which are their source, are stored by the influence of the trees preventing the rapid melting of the snow on the mountains and the rapid running off of the rain from the lowlands. The absence of trees permits destructive floods that are followed by more destructive droughts and disastrous changes in the distribution of rain, the latter sometimes changing fertile countries into barren deserts. Railroads are prominent sufferers in the annual spring and summer floods which are apparently becoming more destructive every year, and trestles and bridges are washed away and roadbeds are undermined, jeopardizing the lives of passengers and causing fatal wrecks. Some years ago the government of Bavaria sent to this country an expert forester to study the various kinds of timbers of the United States, their habits of growth, etc. When asked as to the nature of his mission, he replied: "In fifty years you will have to import your timber, and as you will probably have a preference for American kinds, we shall now begin to grow them, in order to be ready to send them to you at the proper time."

Arbor Day has for its object the correction of tree and forest abuses and the encouragement of tree planting. It originated in Nebraska in 1872 by the State Board of Agriculture naming, on the motion of the Hon. J. Sterling Morton, the day, and offering premiums to societies and individuals for tree planting. Over a million trees were planted in that State on the first Arbor Day, April 10, 1872. The following table shows the dates of the day's observance in the different States and Territories:

STATES AND TERRITORIES OBSERVING ARBOR DAY.

States.	Year of First Observance.	Time of Observance.
Alabama	1887	22d of February.
Arizona	1890-1	First Friday after 1st of February.
California	1886	
Colorado	1885	Third Friday in April.
Connecticut	1887	In Spring, at appointment of Governor.
Florida	1886	January 8.
Georgia	1887	First Friday in December.
Idaho	1886	Last Monday in April.
Illinois	1888	Date fixed by Governor and Supt. of Public Instruction.
Indiana	1884	Date fixed by Superintendent of Public Instruction.
Iowa	1887	Date fixed by Superintendent of Public Instruction.
Kansas	1875	Option of Governor, usually in April.
Kentucky	1886	Option of Governor, usually in April.
Louisiana	1888-9	Option of Parish Boards.
Maine	1887	Option of Governor.
Maryland	1889	Option of Governor in April.
Massachusetts	1886	Last Saturday in April.
Michigan	1885	Option of Governor.
Minnesota	1876	Option of Governor.
Mississippi	1892	Option of Board of Education.
Missouri	1886	First Friday after first Tuesday of April.
Montana	1887	Third Tuesday of April.
Nebraska	1872	22d of April.
Nevada	1887	Option of Governor.
New Hampshire	1886	Option of Governor.
New Jersey	1884	Option of Governor in April.
New Mexico	1890	Second Friday in March.
New York	1889	First Friday after May 1.
North Carolina	1893	
North Dakota	1884	Sixth of May, by proclamation of Governor.
Ohio	1882	In April, by proclamation of Governor.
Oregon	1889	Second Friday in April.
Pennsylvania	1887	Option of Governor.
Rhode Island	1887	Option of Governor.
South Carolina	Uncertain	Variable.
South Dakota	1884	Option of Governor.
Tennessee	1875	November, at designation of County Superintendents.
Texas	1890	22d of February.
Vermont	1885	Option of Governor.
Virginia	1892	
West Virginia	1883	Fall and Spring, at designation of Superintendent of Schools.
Wisconsin	1889	Option of Governor.
Wyoming	1888	Option of Governor.
Washington	1892	

Only the following four States or Territories fail to observe Arbor Days—Arkansas, Delaware, Oklahoma, and Indian Territory.

As announced on another page, the New York, New Haven & Hartford has been fined $7,000 for violating the New York law forbidding the use of stoves in passenger cars. The fine was imposed as a result of the Park avenue tunnel collision in New York City, Feb. 20, 1891, in which the cars took fire from the stoves used, and four passengers were burned to death. The work of equipping its passenger cars with a steam-heating system was being pushed by the road for some time previous to the accident, but as it had about 1,400 such cars to equip, it is evident that the work could not be accomplished in a day. Before it was half finished the unfortunate accident occurred and drew a great deal of adverse criticism upon the management, which was largely undeserved, as the heating arrangements were in process of transition from stoves to steam, as like arrangements on many other roads were at that time. About a year afterward the equipping of its cars with steam-heating apparatus was completed, and the cars have been heated by this means exclusively for the past two years.

The *Railroad Gazette* has removed its offices from 73 Broadway to 32 Park Place, New York. We welcome our esteemed contemporary to our neighborhood, and the more gladly because we have feared for its safety in the old Arcade Building since Narcross tried to blow up Russel Sage right under the nose of the *Gazette*. For over 20 years the offices of the *Gazette* have faced Trinity Church yard, of Revolutionary fame, where lie the bones of Alexander Hamilton and the famous Captain John Lawrence. Doubtless the association has been at times inspiring, but we are sure our friends on the *Gazette* will find Park Place a much more convenient locality for themselves and their out-of-town acquaintances.

Literature.

The "Practical Engineer" Pocket Book and Diary. 1894. Edited by W. H. Fowler. Pages 293. Pocket size. Flexible cover. Price one shilling. Technical Publishing Company, Ltd., 6 Victoria Street Approach, Manchester, England.

This pocketbook of useful information is arranged specially for the use of mechanical engineers, and contains a mass of such information arranged in a way that is very easy of access. The book has a good index, is light in weight, and contains a well-arranged diary, and all the tables, rules, etc., that engineers have frequent occasion to consult.

The Oriental Republic of Uruguay. By Carlos Maria de Pena and Honore Roustan. English. Pages 54. Can be obtained of Prudencia de Murguiondo, Consul-General of Uruguay, Washington, D. C.

This pamphlet contains a fine map of Uruguay (21 × 22 inches), and a small map (7 × 7 inches) of Montevideo and vicinity. The map of the country shows the location of railroad and telegraph lines that are in operation, and the railroad lines that are under construction and those that are proposed. It also shows the lines of submarine cable that traverse the Rio de la Plata. The pamphlet treats of the geography, rural industries, commerce and the general statistics of the country. The text is very nicely translated from the Spanish by J. J. Rethore. The pamphlet gives a great deal of interesting information about the climate of the country and its rivers, minerals, vegetation and animals, and about the language and customs of the people, the political organization, population of departments (counties), schools, newspapers, railroads, forms of worship, and wages paid to different artisans. Such information as this work contains is of great interest to any who may contemplate going to Uruguay. Several years ago when the writer contemplated and did take such a trip, this pamphlet would have been considered as worth its weight in gold. It may be as valuable to others in a like situation, although we understand it will be presented free by Señor Murguiondo.

While the pamphlet gives explicit information about the matters named above, it modestly abstains from extolling the beauties of Uruguay's delightfully temperate climate and the wonderful fertility of its soil, as it also does the courtesy of its men and the beauty of its women—each unsurpassed in any country on the globe.

The International Fruit Dispatch Co. has given an order to the Missouri Car and Foundry Co., of St. Louis, for 100 cars.

The Chicago & Southwestern has decided to move its shops from Lebanon to Muncie, Ind. This will be done as soon as the new shops can be built.

The Haskell & Barker Car Co., of Michigan City, is building 1,000 cars for the Great Northern and 500 cars for the Louisville, New Albany & Chicago.

The Michigan Central dining cars serve lunch *à la carte*, the waiter announcing that "European lunch is now ready in the dining car." Those who patronize the dining car on such occasions can select what they want from a very liberal bill of fare at ordinary restaurant prices.

The Schenectady Locomotive Works are replacing their old machine shop with a new two-story structure built of steel framework and brick filling. The new building will be 80 feet by 363 feet. The old machine shop, now demolished, was built in 1866, replacing a structure which at that time was destroyed by fire.

Traveling Engineers' Association Circular.

Clean Engines—Economical Use of Supplies.

The following are some of the questions of a circular issued by the committee of the Traveling Engineers' Association on "What Relation Does a Clean Engine Bear to the Economical Use of Oil and Supplies?"

Are your engines wiped every trip, or at certain stations on their arrival there? Do freight and switch engines get the same care engines in passenger service do? If not, please state how each class is treated. Do you use oil of any kind to loosen dirt and grease when wiping engines? What are your observations on this subject when engines are chain-ganged or pooled—is any more wiping needed? Do you think an engineer's pride in a clean machine will make him careful of supplies used on the same? Is discipline maintained any better among extravagant men in the matter of supplies with clean engines? Is the total amount of oil, waste and cleaning material used for each engine any less where they are not wiped? Will the better opportunity of discovering cracks or defects in machinery more than repay cost of cleaning without counting cost of oil? Will it not require a greater per cent. of oil for lights if such articles are uncleaned? In doing repairs, will the work be done as cheap on an unclean engine as on a clean one?—the time of machinist and helpers to be taken into consideration. In breakdowns on the road, will supplies and time be saved in proportion to the amount of grease and dirt on the parts to be removed? Does good wiping prolong the wearing parts? What are the particular parts which should be kept well cleaned, painted and polished, to impress the engineer and fireman with need for economy in the use of supplies? Is it not a fact that engineers will take better care of a neat, clean engine than of a dirty one? and will not the engineer tighten up loose nuts, set up wedges, and key-up rods which he would not do on a machine covered with grease and dirt, especially if he has on clean over-alls? Does not a clean boiler, flues and grates effect a saving of oil and coal to a very great extent; also improve the steaming qualities of engines? Please state the average expense of wiping an engine clean each trip or stated number of miles.

J. W. HALL, Chairman, Commerce, Tex.; J. B. JOHNSON, CHAS. H. HOGAN, C. W. POOLE, P. E. RILEY.

ON HIS DIGNITY.—"Is Mistah Gwaynus in?" asked the sable caller. "He is, sah," replied the dusky functionary at the door, "but he is occupied." "How soon, sah," said the caller, pulling up his shirt collar, "will Mistah Gwaynus be vacant?"

A decision rendered in the United States District Court at Detroit, Mich., April 10, declared the Martin steam heating apparatus, which had been somewhat extensively used on the Michigan Central Railroad, to be an infringement of the patent granted to E. D. Cody, Oct. 27, 1885, and owned by the Consolidated Car-Heating Company.

The Standard Supply & Equipment Company has been organized in Philadelphia, and will have offices at No. 22 South Fifteenth Street, near the Broad street station. The company will deal in railroad equipment and specialities, and will represent several prominent manufacturers of this class of goods. It will also deal in second hand cars and locomotives.

Young Lady: "Give me a ticket to Sackfather."
Ticket Agent: "What did you say, miss?"
Young Lady: "A ticket to Sackfather"
Ticket Agent: "There is no such station on this road."
Polite Stranger: "The lady wants a ticket to Bagdad."
Young Lady: "Thank you, sir."
Polite Stranger: "Don't mention it. I am from Boston myself."

Beginning May 27, the New York Central road will place in service a fast train between New York and Chicago, having the equipment of the famous "Exposition Flyer," with an additional private-compartment sleeping car, and making the run, each way, in twenty-four hours' actual running time. This train will leave the Grand Central Station, New York, at 11 A. M., arriving at Chicago at 10 A. M.; returning it will leave Chicago by the Lake Shore & Michigan Southern Railway at 5:30 P. M., reaching Grand Central Station, New York, at 6:30 P. M.

The big tunnel at Niagara Falls, by means of which the power of the falls will be used to generate electricity, is a marvelous piece of engineering work, and it is estimated that the company will be able to develop no less than 450,000 horse power by means of its several turbine wheels. The power is to be carried to great distances. For instance, a contract has been entered into to furnish power to mills in the eastern part of the State, several hundred miles from the falls, at the low cost of $12 a year per horse power, running night and day.

The felling of trees by means of electricity has been ried out to a considerable extent, according to *Engineer* and has proved a handy and practical method. It is done by means of a platinum wire stretched between two poles; the use of a continuously incandescent wire is much easier than that of a saw. In addition to the reduced amount of work, there is another advantage, inasmuch as there is no sawdust, and the fact of the surface of the severed trunk being slightly charred, materially tends to preserve it. Electrical tree-felling saves both labor and time, the respective time as compared with sawing the trunks through in many instances being about one to eight.

Personal.

Mr. T. H. Fennell has resigned as General Superintendent of the Northern Division of the Lehigh Valley system.

Mr. Otto L. Hayes has been appointed Receiver of the Columbus, Lima & Milwaukee, to succeed Mr. John Blyth, resigned.

Mr. C. A. Skinner has resigned as Master Mechanic of the Mississippi division of the Baltimore & Ohio Southwestern.

Mr. W. H. McDoel, General Manager of the Louisville, New Albany & Chicago, has been appointed Vice-President of the company.

Mr. Percy Lyons has been appointed Superintendent of Motive Power of the Chicago Great Western, succeeding Mr. W. T. Reed, resigned.

Mr. L. P. Ligon, General Foreman of the Norfolk & Western, at Radford, Va., has been appointed Master Mechanic at Bluefield, W. Va.

Mr. H. D. Taylor, formerly connected with the New York, Pennsylvania & Ohio, has been appointed Engineer of Tests of the Lehigh Valley.

Mr. George O. Manchester, formerly of the Atchison, Topeka & Santa Fe Railroad, has been elected Vice-President and Treasurer of the Sargent Company, of Chicago.

Mr. S. W. Huston, of the Brooks Locomotive Works, has been appointed Master Mechanic of the Buffalo & Susquehanna at Austin, Pa., in place of L. T. Johnson, resigned.

Mr. Thomas Millen, formerly Superintendent and Master Mechanic of the New York & Northern, has been appointed Master Mechanic of the Metropolitan Street Railroad of New York City.

Mr. J. S. Chambers has been appointed Master Mechanic of the Illinois Central at Clinton, Ill., and is given jurisdiction over the machinery department of the Springfield and Amboy divisions.

Mr. James McNaughton, Superintendent of Motive Power of the Wisconsin Central, has also been appointed Superintendent of the Car Department of that road, with headquarters at Waukesha, Wis.

Mr. C. M. Leonard, formerly General Master Car Builder of the Chicago, Rock Island & Pacific, died at Davenport, Ia., April 10. For two years past he had been Superintendent of a thresher factory at Davenport.

Mr. Charles F. Choate has resigned as President of the Old Colony Steamboat Company, and has been succeeded by Mr. J. R Kendrick, who is Third Vice-President of the New York, New Haven & Hartford.

Mr. J. H. Moore, General Foreman of the New York, Lake Erie & Western shops at Elmira, N. Y., has been appointed Master Mechanic of the shops at Buffalo, N. Y., to succeed James P. Hubbard, deceased.

Mr. J. M. Egan, President and General Manager of the Chicago & Great Western Railroad, resigned April 18. Mr. A. B. Stickney has been elected President, and his son, Mr. Samuel C. Stickney, will act as General Manager.

Mr. W. E. Looney has resigned as Master Car Builder of the Louisville, Evansville & St. Louis, and that office has been abolished. Mr. J. K. Lape, Superintendent of Motive Power, will have charge of the motive power and car departments.

Mr. J. S. Turner, formerly Master Mechanic of the Mexican Central and Mexican International railways, has been appointed Superintendent of Motive Power and Machinery of the West Virginia Central & Pittsburgh, with headquarters at Elkins, W. Va.

Mr. E. E. Jenks, formerly connected with the engineering department of the Cleveland, Cincinnati, Chicago & St. Louis road, has been appointed Master Mechanic of the Mississippi division of the Baltimore & Ohio Southwestern, to succeed Mr. C. A. Skinner, resigned.

Mr. William Byrd Page has been promoted from Road Foreman of Engines to be Assistant Master Mechanic at the Jersey City shops of the Pennsylvania Railroad. Mr. Page succeeds Mr. C. M. Mendenhall, who has been promoted to be Assistant Superintendent of Motive Power at Jersey City.

Mr. Joseph K. Bole, of Cleveland, has been elected President of the new American Steel Casting Co. Mr. Bole is well and favorably known to railroad men from his long connection with the Otis Steel Co., of Cleveland, of which he was up to last January one of the managing directors. He is one of the Receivers of the Valley Railroad of Ohio.

Col. Joseph Hill, General Superintendent of the Vandalia line, has retired from that position, after a railroad service of over 40 years. He is now 70 years old. Colonel Hill has been General Superintendent of the Vandalia line since 1881, when he resigned as Superintendent of the Pittsburgh, Cincinnati, Chicago & St. Louis Railroad. In 1887 he was appointed Assistant General Manager. That office was abolished recently.

Mr. Henry T. Gallup, General Superintendent of the Boston & Albany, has resigned, his resignation to take effect May 1, and he will be succeeded by Mr. William R. Robeson. Mr. Gallup retires on account of ill health. He is now 59 years old and has been in the service of the road 41 years. He began as brakeman on the Boston & Worcester, now a part of the Boston & Albany, and was for many years a passenger conductor. He was appointed General Superintendent in 1886.

Mr. Robert Harris, Vice-President of the Northern Pacific, died suddenly at Rochester, N. Y., April 21, while returning to New York from a meeting of Northern Pacific officers at Tacoma, Wash. Mr. Harris was born in Portsmouth, N. H., July 29, 1830. He was President of the Chicago, Burlington & Quincy line from 1876 to 1879, when he was elected Vice-President of the Erie. In 1884 he succeeded Henry Villard as President of the Northern Pacific. Eight weeks ago he visited California for his health, but shortened his stay to attend the Tacoma meeting, and this may have brought on a premature death. His trouble was pulmonary.

Mr. Edward B. Wall died suddenly Sunday evening, April 1, in the Homœopathic Hospital at Pittsburgh, Pa., from the effects of an operation performed a few hours previously for appendicitis. At the time of his death Mr. Wall was Assistant General Manager of the Pennsylvania lines west of Pittsburgh. Mr. Wall was born April 25, 1856, at Kingsboro, N. Y., and was graduated from the Stevens Institute in 1876. He immediately began his railroad work as an apprentice at the Altoona shops, where he served in various capacities for six years. Then he became Assistant Master Mechanic on the Western lines of that road, and in 1883 was appointed Superintendent of Motive Power of the Southwest system. In the spring of 1893 he was sent to Chicago as assistant to the First Vice-President of the Pennsylvania lines, and after the close of the World's Fair he went to Pittsburgh as Assistant General Manager. Until his promotion out of the mechanical department Mr. Wall was one of the most active members of the Master Car Builders' and Master Mechanics' associations.

The Locomotive's Whistle.

[The following lines by Henry Crocker, in the Boston *Beacon*, nicely portray the music of the locomotive's whistle when heard at a distance sounding the warning for road crossings in the country.]

I hear a faint sound far away—
Two long, and two short notes at play,
As soft and sweet as silver flute,
The locomotive's first salute:
"T—o—o—t, t—o—o—t, toot—toot!"

I hear again the tuneful sound,
Now waking woodland echoes round,
The locomotive seems to say
"We are coming—coming, clear the way!"
"T—o - o—t, t—o—o—t, toot—toot!"

And now a rumbling noise I hear,
And clouds of smoke and steam appear,
The locomotive seems to shout:
"We are coming fast. Look out! Look out!"
"T—o—o—t, t—o—o—t, toot—toot!"

* * * * * * * *

With clanging bell and clattering steel
And flaming breath and flashing wheel,
The lightning train goes flashing by,
Like fiery bolt from stormy sky,
"T—o—o—t, t—o—o—t, toot—toot!"

A whirlwind follows on behind,
With clouds of dust our eyes are blind;
Yet from the curve around the hill
Is heard the engine whistle shrill,
"T—o—o—t, t—o—o—t, toot—toot!"

Again, a faint sound far away—
Two long, and two short notes at play—
The locomotive's farewell call:
"We are chasing time. God speed us all"—
"T—o—o—t, t—o—o—t, toot—toot!"

A Railway Mistake.

A man went to a certain railway station in New Jersey to buy a ticket for a small village called Morrow, where a station had been opened only a few days previously. "Does this train go to Morrow?" asked the man, coming up to the office in a great hurry, and pointing to a train on the track with steam up and every indication of a speedy departure.

"No; it goes to-day," replied the ticket agent curtly. He thought the man was "trying to be funny."

"But," rejoined the man who was in a great hurry, "does it go to Morrow to-day?"

"No, it goes yesterday, the week after next," said the agent, sarcastically, now sure that the inquirer was trying to make game of him.

"You don't understand me," cried the man, getting very much excited, as the engine gave a warning toot; "I want to go to Morrow."

"Well then," said the agent sternly, "why don't you go to-morrow, and not come fooling around here to-day? Step aside, please, and let that lady approach the window."

"But, my dear sir," exclaimed the bewildered inquirer, "it is important that I should be in Morrow to-day, and if the train stops there, or if there is no train to Morrow to day"—— At this critical juncture, when there was some danger that the mutual misunderstanding would drive both men frantic, an old official happened along and straightened out matters in less than a minute. The agent apologized, the man got the ticket and the train started for Morrow to-day.—*Youth's Companion.*

American Railway Association.

The American Railway Association met in New York City, April 12. The President, Colonel H. S. Haines, of the Plant System, occupied the chair, and delivered an address on "Economics in Operating Railways." About 100 officials were present. The Executive Committee reported that 142,000 miles of road were represented by the membership. Statistical reports on safety appliances and car service were read. The main discussion was upon the advantages of the interlocking system, and the sentiment prevailed that a uniform block system should be adopted.

The following officers were elected: President, H. S. Haines; First Vice-President, E. B. Thomas, Vice-President of the New York, Lake Erie & Western Railroad; Second Vice-President, W. F. Merrill, General Manager of the Chicago, Burlington & Quincy Railroad; Executive Committee, C. W. Bradley, General Superintendent of the West Shore Railroad, and G. W. Stevens, General Manager of the Chesapeake & Ohio Railroad; Committee on Train Rules, Pennsylvania Railway, Lake Shore & Michigan Southern and the Seaboard and Roanoke.

The next meeting of the association will be held in New York in October. May 13 was the date agreed on for making the spring changes in the time-tables.

Report of the Pennsylvania Lines.

Mr. S. M. Provost, General Manager of the Pennsylvania Railroad, issued on April 20 his report of the operations of the company in the year ending Dec. 31, 1893.

The gross earnings of the Pennsylvania Railroad division, comprising the main line from Philadelphia to Pittsburgh and including the branches connected therewith, for the year 1893, were $40,119,356.05; the operating expenses, including rentals and interest on equipment, were $27,171,809.47, leaving net earnings for the year $12,947,546.58, a decrease of $853,280 compared with 1892.

On the United Railroads of New Jersey division the gross earnings last year were $18,488,617.56, and the operating expenses were $14,487,683.37, leaving net earning of $4,000,937.10, an increase over 1892 of $136,199.83. On the Philadelphia and Erie division the gross earnings were $7,450,108; operating expenses were $5,005,056; net earnings, $2,445,052, an increase of $89,104 over 1892.

Pat's Impression of the Locomotive.

The following is a veritable "chestnut," as it is taken from the Boston *Post* of March 26, 1837, but we consider it good enough to reproduce in 1894, as showing the impression made on an Irishman's mind by his first sight of a locomotive:

Two brothers recently from the old country, via Halifax, were lately walking up the Worcester Railroad, and their curiosity was somewhat astonished by the iron tracks, but soon the cars hove in sight and the following dialogue took place:

Mike—"Och, brither; d'ye see that quare cr-crachure a coming?"

Pat—"Troth and I do. What in the divil and his grandmother does it mane?"

Mike—"Faith an' it's not me that is to tell ye."

(The train whizzed by.)

Pat—"Och, Mike, we're completely lost; for by me mother's milk, *it is hell in harness*, and just the sort of coach I once dreampt the ould divil took the morning air in."

Ventilation of Stage Coaches.

(From the London "Mechanics' Magazine," January, 1836.)

[In view of the present agitation of the subject of passenger car ventilation, the following is of interest as showing that the subject of ventilating public conveyances is a very old one, and that it worried passengers some in the old stage coach days.]

To the Editor of the Mechanics' Magazine:

Sir—Permit me to offer to the public, through the medium of your widely extended magazine, a hint or two from an old traveler on the subject of stage coach ventilation. Many others as well as myself have doubtless been annoyed by the aerophobia of many who travel by our public carriages, and the pertinacity of such persons in keeping the windows closed for fear, as they say, of catching cold. Such persons have yet to learn that colds are more frequently the consequence of closely confined air in a badly ventilated apartment than by free exposure to the wind and weather. Some people seem to regard fresh air as poison, and do all in their power to exclude it; for my own part, I think it is the only one of the numerous blessings of Providence that cannot be taken to excess.

The mode of ventilation I would suggest is simply this, that the sashes of mail and other stage coaches, instead of being glazed as at present—the panel formed by a pane of glass—should be made with wire-gauze, such as is now extensively in use for window blinds. The vehicle would by this means be amply ventilated without annoyance to any one by currents of air; and, in case of rain, the sashes might be kept up without the choice of evils at present experienced, either to be wet through or suffocated.

An Old Traveler.

It is announced that a 10 per cent. cut in the salaries of all emyloyés will soon be made on the Grand Trunk.

Norwegian Locomotives.

According to the recent report of the English Consul-General at Christiania, Norway, locomotive building has been at a standstill in that country for a long time. The report says: Many years ago an attempt was made to construct a Norwegian locomotive engine. It was unsuccessful, and since then Norway has procured her locomotives from England or Germany. It appears, however, that there is soon to be a departure in this respect, for a few days ago two engines built in Nyland's workshops, Christiania, were finished and delivered to the State railways. According to local journals the trial trips of these locomotives have yielded the most satisfactory results. In a couple of months two more similar engines will, it is said, be ready. These four locomotives are said to have been contracted for in open competition with foreign makers, and the price agreed upon for all four is 160,000 kroner ($42,000). They are reported to compare most favorably with the class of engines received until now from Germany and England. Ordinary passenger trains in Norway run at about the rate of 30 kilometers per hour, and in the trial trip, which lasted 17 minutes, on a curved and irregular line, the speed attained was at the rate of 81 kilometers (or about 50 miles) per hour. Referring to this, the Norwegian journal, *Verdens Gang*, observes triumphantly, "It is now perfectly clear that Norwegian makers can construct quite as good engines as foreign firms, and at as cheap a rate."

Repairing Locomotives.

BY J. T. HEFFERNAN.

(*Continued from page 53, National Car and Locomotive Builder for April.*)

Driving Wheels.

This paper will treat on driving wheels and Figs. 88 and 90 show some of the different forms of wheels in use. Fig. 88 shows the wheel made up of two parts, a cast iron center and a steel tire. In this form of wheel the arm is cored out hollow and the counterbalance is cast solid. In this country nearly all driving wheel centers are made of cast iron, and as all the wheels use steel instead of iron tires we will only describe a steel tire.

Fig. 89 shows the manner of turning a wheel for putting on the tire. Generally the first operation is the boring out of the wheel in a powerful lathe. Sometimes this style of lathe has the foot-stock geared up, and then, after the hole for the axle is bored, the key way is cut before removing the wheel from the lathe.

Fig. 90 shows a somewhat similar wheel, excepting that the arms are cast solid. In this wheel there is a recess cored in the counter-weight, and this is afterward filled with lead, the object being to increase the weight in a given place.

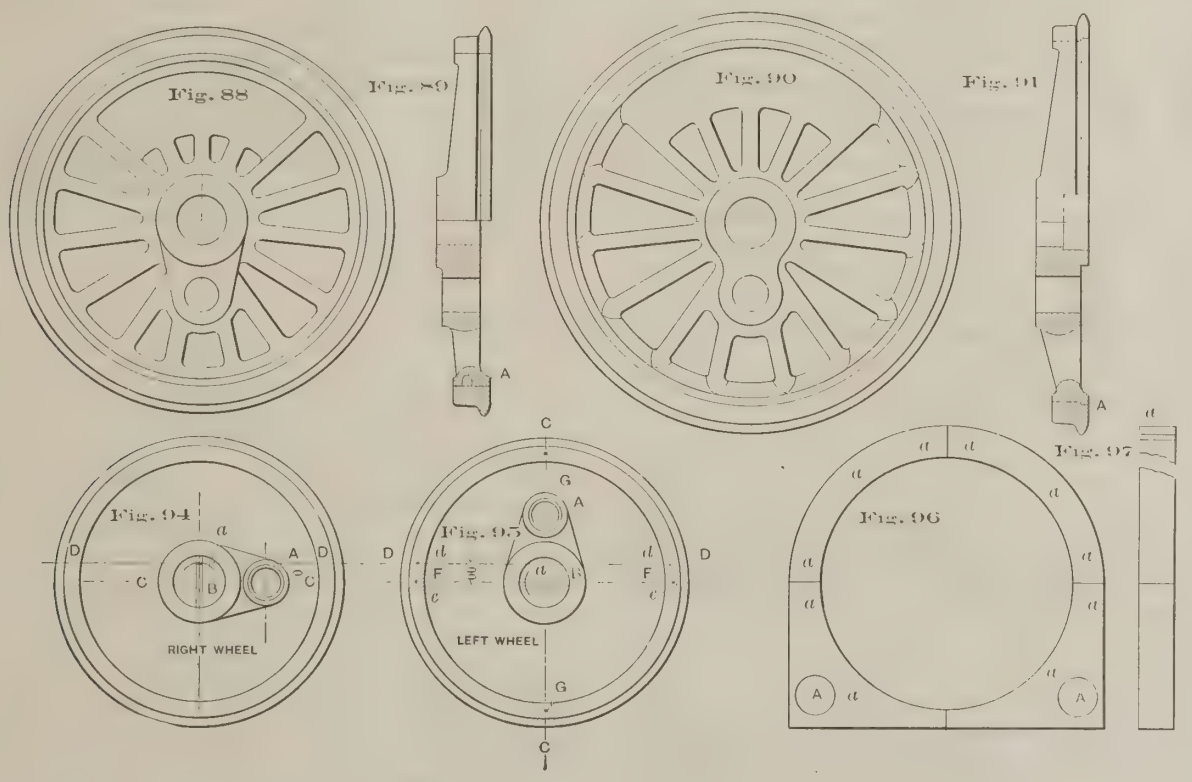


Fig. 91 shows a method of fastening a tire on this style of wheel. As will be seen by the drawing, the cast iron center, instead of being turned straight across, as in Fig. 89, is turned straight across to within about ¾ inch of its inner face. The remaining distance is then left about ⅛ inch larger. The tire is bored out to fit accordingly, with the exception that the principal fit is made on the straight part, and where it fits on the shoulder of the wheel standard it is left a trifle full, so that when the tire is shrunk on we are sure of a good fit on the main body of the wheel.

The object of turning a wheel in this manner is that in case the tire gets loose the shoulder will prevent it from working in, and of course it cannot work out, as the flange prevents it from doing so. After the tires have worn a good deal, especially on an engine where driver brakes are used, if the brakes are left on for any length of time they have a tendency to heat the tire, thus causing it to expand, and when the tire is in this shape from the action of the brakes used, should the engine strike a curve, it perhaps might have a tendency to shift the tire inwards were this shoulder not turned on.

This is a very good way to turn wheel centers, but for all practical purposes the method of turning them straight across, as shown in Fig. 89, will be found satisfactory. It is less expensive to fit a set of tires on a wheel center when it is turned straight across than any other way, and nowadays the use of driver brakes is so well understood that it is a rare thing for an engineer to apply the brakes and leave them set long enough at one time without releasing to heat the tire.

To put on a tire as shown in Fig. 91, turn the wheel up on end, then lay the tire on some brick so as to keep it about one foot from the ground and kindle a wood fire around it. Of course, in a building shop they have every appliance necessary to do this work, such as up ending the wheel, handling the tire when hot, etc. In putting on a set of tires in a division shop or roundhouse, and there is a wrecking car with a derrick on it in the yard, you can use it to very good advantage. I like to use a wood fire for heating a tire in preference to coal, for where coal is used it forms a sutt around the inside, which is rather hard to get off, and when handling hot tires it is necessary to handle them very quickly. Where you use a wood fire all that will be required to clean the inside will be a few strokes of a broom and the tire is then clean enough to drop into place. Of course, with this wheel (Fig. 91) the measurement of how far the tire shall go on is made in the lathe, so all we need to do is heat the tire and put it in place.

In putting on a set of tires as shown in Fig. 89, our first move would be to measure where the face of the tire would come on the face of the wheel center, that is, if we had the wheel up-ended it would be the under or inner side we would take our measurements from. We would bolt straps on the under side of the wheel center so that when the hot tire was dropped in its place it would rest on these irons and be in its correct position and would require no hammering to bring it in place. To find the distance the tire must fit on the wheel center, all that is necessary is to lay the wheel gage across the wheels before putting on the tires, then center it even with the inner face of the wheel centers, measuring from this space to the flange will give us the right distance to put the tire on, allowing enough to take a cut off the flange when trueing up the tire. Do not make the tire any hotter than actually necessary to expand it so it will go on freely. The tire may be cooled off with water.

In taking off a set of tires where you have no special appliance for it, roll the wheel out into the yard to some place where you have either cinders or gravel to build the fire on, then up-end the wheel, blocking it up off the ground about 6 inches. When heating the tire to remove it we do not want to heat the center, so to avoid this we shovel cinders or gravel around the spokes and rim of the wheel and wet them, then when we build the fire around the tire an occasional bucket of water will keep the cinders or gravel damp. If we are careful in doing this there is no need of even spoiling the paint on the wheels. When tires are allowed to wear very thin, that is to about 1⅛ inches thick, and when the wheel has a space extending around its rim the tire has a tendency to wear into this space, thereby forming a small shoulder, so that when the tire is heated for removal the use of a sledge may be necessary to drive it off.

In the wheel shown in Fig. 91, there is rather a novel method used in the axle fit. Instead of boring the wheel straight, two different diameters are used, the inside one being from ⅛ inch to ¼ inch larger than the outside one. The claim is made that by this the axle secures better hold in the wheel. Of course, the axle has only to travel half the distance under pressure when making a fit in this wheel that it does when the wheel is straight. Take, for instance, the axle as it just enters a hole that is bored straight, that axle is forced in under pressure and the pressure is on it all the time until it is home. The outside edge of the axle, so the claim is made, has a tendency to wear itself a trifle as it advances through the wheel, and the inner edge of the wheel has a tendency to wear because the axle has passed through it, while with this style of wheel the same error is said to exist but to only one-half the extent, because the axle only has to travel one-half the distance. I believe that while in theory this appears all right, still in practice I prefer the straight hole, for it is cheaper to bore out a straight hole and also cheaper to turn a straight axle than where there are two fits to make. If the material in the wheel center is made of good strong cast iron, and unless it is good it should not be used, a straight axle put in under a pressure of about ten tons per inch of diameter will never come loose.

Fig. 98.—Wells Light Arranged to Heat Tires.

A, Fig. 92 shows a band, fitted around the hub of the axle and the hub of the crank pin, and is the usual method of repairing where the hub is cracked. The band should be made of as heavy iron as can be gotten in place. To do so it may be necessary to chip a place for it around the hub; when ready to put this band on allow for a shrinkage on it of about $\frac{1}{16}$ of an inch per foot of circumference, then the band can be heated red hot, slipped on in place, and when it begins to contract and close down on the hub hammer it gently all around to set it well in its fit.

A job that has to be done occassionlly is shimming a tire. In the days when iron tires were used, this was one of the jobs that had to be done quite frequently, but with steel tires it is not very common as they rarely get loose. The first thing required for this job is eight small steel wedges about 1 inch wide, made of good steel and drawn down very thin. If the tire is not very loose Russian iron all around will probably be enough, but sometimes iron of No. 20 or 16 gage will be necessary. Supposing now that it is a back wheel that is loose, our first object is to get both side rods down and then arrange for heating the tire. If there is liable to be much tire work done it will pay to make a rig like that shown in Fig. 96. This cover is made in four pieces so as to be handy and convenient to put around the wheel, and it is just wide enough to fit over the tire sideways. Put a couple of jacks under the axle and a couple under the back end of the frame and take off the weight, then shove these covers in place. Black oil and waste make a very hot fire and one that will heat the tire up fast. The pins *aaa* around the cover are to fasten pieces of waste onto, and the holes *AA* at the bottom are large enough, so that a good handful of waste can be put in through them. As soon as the tire gets hot pry the wheel around without moving the covers, so as to get an even heat all around on the tire. Having cut your strips into pieces about 2 feet long, drive in a couple of wedges and then drive in a shim. Turn the wheel a little and repeat this operation until you get a shim in all around the wheel.

In case you are caught some time and want to shim a tire quickly and have no covers or any other appliance on hand, just put some pieces of sheet iron around over the top of the wheel, protecting the outside of the wheel of course as much as possible so as not to damage the paint work, and build a fire out of pieces of waste, letting the fire extend up around the wheel. After you get the tire pretty hot this way, pull the fire out and leave the rods in place and the full weight of the engine on the drivers. Now the tire is up solid on the bottom of the wheel because the weight of the engine is on it, and whatever slack there is will be around on the top. Drive in some wedges and put a good long shim in, then pinch the engine along and put in another piece, and so on all around the wheel. It may be that you cannot get shims as long as two feet; if not, put them in any length you can get them in.

For doing this work nicely the Well's light as shown in Fig. 98 is one of the nicest things I have seen. It was first used in England, but of late has been introduced into this country with very good success. One can make a very good rig by taking an old airbrake reservoir and filling it about half full with gasoline, then connect it with an air pump and apply pressure of 35 or 40 pounds, and in addition to this pressure have the air and gasoline pipe both run into one common pipe; this pipe can then be connected to a pipe bent to the shape of the wheel, having a number of small holes drilled on the inner side of it. There are several firms in this country which make heating apparatus for putting on tires.

"Leave me now, Lobelia," said Mr. McSwatt, passing his hand nervously across his head. "I wish to be alone for the next hour or two."

"What is the matter, Billinger?" inquired Mrs. McSwatt, with some anxiety.

"I have got to consult a railway guide."

Communications.

Merrick's Proposed Passenger Car.

Editor National Car and Locomotive Builder:

I have glanced over the plans and read some of the descriptive matter in connection with Mr. Merrick's proposed design of passenger car [see NATIONAL CAR AND LOCOMOTIVE BUILDER, February, 1894], and I must say that I am strongly impressed in favor of the points which he has brought out. Undoubtedly practice would suggest some modifications of the details of his construction, but I believe the general principle of doing away with the weak platform timbers, and of extending the sills of the car so that the main parts of the car bodies are brought close together, is a thoroughly practicable and advisable plan; not only do you get the benefit of more carrying capacity in the cars, but also any source of loss in the way of great friction in trains passing over the road is done away with, and you get almost the same effect in an ordinary car as you would in a vestibule car. The construction surely, it seems to me, is stronger than with the old method, and I think that a few years' time will see some decided improvements in the way of construction of cars in a manner similar to that advocated by Mr. Merrick.

A. M. WAITT,
Gen. M. C. B., L. S. & M. S. Ry.

Steam Distribution for High Speed Locomotives.

Editor National Car and Locomotive Builder:

I have read with considerable interest your editorial comments on the paper relating to steam distribution for high speed locomotives in your April issue. They have added interest because written by one who, beside possessing theoretical knowledge, has had the advantage of considerable practical experience in handling locomotives. I wish to call attention to a misunderstanding of the paper when commenting on the comparison made between the engine with 5½-inch valve travel and those with 5 inch travel, made in appendix D of the paper. The editorial assumes that the comparison is drawn between the coal record of the engine with 5½-inch travel, made during the months of April, May, June and July, and the coal record of the engines with 5-inch travel, made during August, September, October and November, and calls attention to the great influence of the difference in temperature of the two periods, and its effect on the coal economy of the engines. I think a careful reading of the paper will show that the coal records of the two seasons were made by the same engine. That for August, etc., when her valves had 5 inches travel, and for April, etc., when they had 5½ inches travel. Nor is it claimed that the saving of 34 per cent. was due entirely or mainly to the increased travel. The following is quoted frow the paper:

"The most satisfactory comparison would be between the records of the same engine with 5 inches and 5½ inches travel. Unfortunately this cannot be given with strict justice to the 5-inch travel, because, about the time the travel was increased, a system was put in practice rating the enginemen largely on their fuel record, which makes the record for the 5½-inch travel higher than it would have been. There is, however, a margin of saving, after making considerable allowance for this factor, amply large to warrant the conclusion that the longer travel has effected a considerable saving."

I am persuaded that the influence of summer and winter temperatures on the coal pile are not sufficiently taken into account by railroad men, and that the editorial comment on this fact is timely, and worthy of consideration and investigation.

C. H. QUEREAU.

AURORA, Ill., April 9.

Passenger Car Ventilation.

Editor National Car and Locomotive Builder:

In your last issue I see you make reference to the appointment of a committee by the Master Car-Builders' Association at the last annual convention, to investigate and report in June next on the subject of ventilation for passenger cars. Without wishing to discourage the effort in this direction, which is certainly most commendable and of the utmost importance, may I be permitted to ask is it possible for the convention to accomplish anything? The sleeping car companies "rule the roost" on this subject, and the M. C. B's have but little influence with the distinguished gentlemen who control the sleeping cars.

They also are superior to the railroad officials, who have nothing to say about sleeping cars. At the same time, if there is one department of car service more than another that requires ventilation of the best attainable kind it is the all-night sleeping car, and yet to-day, in point of fact, it is more poorly ventilated than the average day coach. There are day coaches, and a good many of them, that are well ventilated, but the ventilation of sleeping and parlor cars is uniformly bad, and it cannot be doubted but that the owners know it.

Railroad cars are now built almost entirely by contract shops, and bargained for by the higher officials of the companies. Naturally they know nothing of sanitary matters, and quite as naturally they take it for granted that the sleeping car proprietors do, and so follow their example. The sleeping cars, as is well known, have nothing but the open sash in the upper part of the car. This is poor enough as every one knows, but the sleeping car companies are strongly committed to it, and to adopt anything else would involve considerable expense, and besides would be an admission of previous ignorance.

The situation, then, as it appears to the writer is one of extreme difficulty. Until the owners of sleeping cars can be induced to adopt some other method than the open windows they now use it seems almost a hopeless task to urge anything else. At the same time the present imperfect methods cannot exist forever. Good will come from a constant agitation of the subject by the press. There is hardly a reasonable doubt but that if a sleeping car was put on any train of our leading railroads, and it was known that the car was perfectly ventilated the night through, a large proportion of the passengers would willingly pay 25 cents extra for a berth in that particular car.

The method of ventilating a car after it arrives at its destination by opening doors and windows, which is a necessity with present constructions, is not good practice. The true ventilation would be to change the air constantly while the car is in motion. No argument should be necessary to impress upon the railroad companies the importance of better air. The medical, scientific and hygienic journals are full of articles on the subject, but it is extremely doubtful if they are ever read by transportation officials.

If the committee on this subject would get together a day or two before the convention assembles, having collected all the information possible, and would then decide upon some plan which they would indorse and recommend, they would undoubtedly accomplish something. The list of questions that have been issued is comprehensive enough to cover the whole ground. The underlying theory of ventilation is to produce a constant change of air without drafts. Second, to combine the inlet of fresh air in cold weather with the heating apparatus. Third, as to the method of admitting fresh air: It must be taken in at a point on the car where it is most free from cinders, smoke or coal gas. Fourth, the admission device should be so constructed that the impurities which will come in can be trapped and quickly removed. Fifth, the exits should always exhaust, and to this end should be of strong suction power. This will aid the inlet arrangements.

I am not particularly hopeful of results from any action that may be taken. The thing to do, however, as the famous O'Connell said, is to "*Agitate, agitate, agitate.*" The time will surely come when a traveler can ride any distance on a railroad car in as much comfort as if in his own easy chair at home, and in a pure atmosphere.

G. W. C.

Locomotive Boiler Tubes.

Removing Tubes and Scale.

BY JAMES F. HOBART.

Whenever it becomes necessary to remove the tubes from a boiler, either for inspection, repairs to shell, or the mere scaling of the tubes themselves, two ways are open. The tubes may be let free from the tube sheet by means of a cape chisel, or they may be cut off just inside the tube sheet by means of an inside tube or pipe-cutting device, one or more of which are now in the market.

By most boilermakers, the hammer and cold chisel method is preferred, the claim being made that, when the cutter is used, the chisel and hammer must afterward be used to remove the ends of the tubes, and that it is about as much work to cut out the tube ends as it would be in the first place to remove the entire tube. They also claim that the "inside" cutter must be operated by a rotary motion, and that when cutting the tubes near the outer edge of the tube sheet (or shell of boiler) there is great difficulty in using the cutter.

On the other hand, a few boilermakers (repair hands) claim that if the rotary cutter be used, the short tube ends may be knocked out with slight chance of injuring the tube sheet, which is frequently done by the careless or improper handling of the cold chisel when cutting out tubes therewith. Very often, tube sheets can be seen so badly cut up by the chisel that extensive reaming and bushing are necessary to make a tight job. The use of the copper ferrule is generally accepted as good practice, but we do not want to be obliged to keep on hand a stock of bushings ranging from one-sixteenth to three-eighths of an inch in thickness, just to patch up poor workmanship with.

If the chisel is to be used in removing tubes, grind off the corners so they cannot mutilate the tube sheet. Make an oval cross section to the tool if necessary, and then the worst "chump" in the boiler gang cannot drive the corner of his chisel into the tube sheet, even if he tries to do so. The corners on a tube-removing chisel should be looked after just as closely as on a calking tool. They are a source of trouble, if not of danger, on either tool.

When the water is such that a scale formation is deposited, it must be removed by some mechanical means.

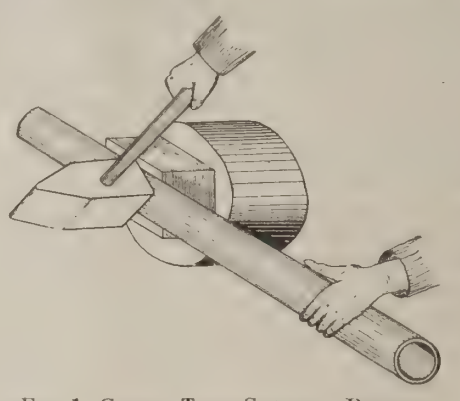


FIG. 1—CRUDE TUBE SCALING DEVICE.

In some shops the very crude method, illustrated by Fig. 1, is employed for this purpose, the "elements" employed being a boiler tube, an old chisel, a hammer, and a "cub."

It is possible for an intelligent and industrious man or boy to scale a large number of tubes in this manner in a week but it is a slow process at best, and one that does not add to the life of the tube. I have seen a boy, doomed to a period of "tube whacking," thoughtlessly strike such heavy blows as to dent the tube, and form defects which caused the tube to fail when being tested after welding.

A very good tube scaling machine is shown in plan and elevation by Fig. 2. The machine as illustrated is "home-made," is cheap, simple, easily operated, and is capable of being greatly improved and made partly or wholly automatic in its action. A machine much like the illustration is in use in the shops of the Kings County Elevated Railroad, Brooklyn, N. Y. The machine was built in the blacksmith's shop, being made of flat bar iron, a couple of pieces of angle iron being used for the ways of the machine bed, as seen in the end elevation.

Any old lathe bed could be used to make one of these machines, but if such be not at hand the bar iron may be used. Note the very ingenious method of forming the legs, a single piece being bent up to form each leg and its brace, which is in turn strengthened by being braced to top and bottom of bed. The chuck used for catching the end of tube is an old "Universal" concern which had been relegated from the machine shop to the scrap heap. The tool holding rig, mounted on the slide rest, is also made of bar iron, and the construction is very plainly shown in the end elevation. An old worn out lathe screw (indicated by the dotted lines in side elevation) serves to impart a slow and regular motion to the tool carrier on the slide rest.

A hand wheel transmits motion from the operator to the the screw. This part of the machine could easily be made automatic, but it is claimed by men who have operated the machine in question, that more work can be done by hand, as it is possible to hurry the tools over such parts of the tube as have no scale on them, whereas, were the feed screw geared to the driving motion, the tool would have a uniform motion over the whole tube, and it would require just as long to scale one tube with two or three little spots

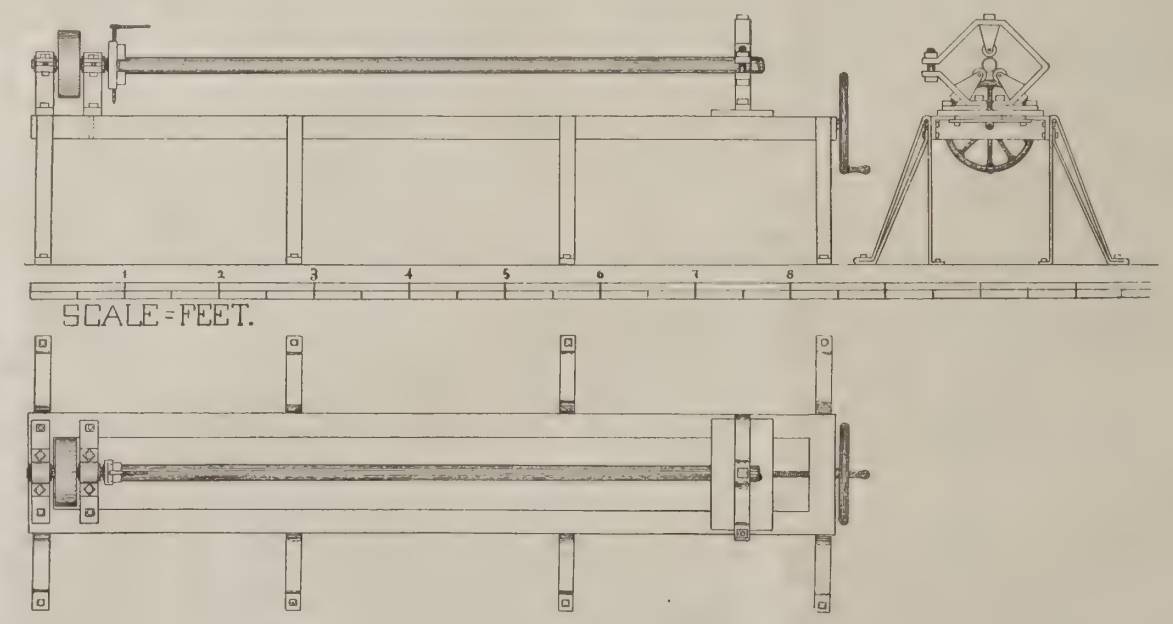


Fig. 2.—Elevation and Plan of Tube Scaling Machine.

of scale on it as to clean one heavily coated over its entire length.

The pressure of the tools upon the tube is regulated by adjusting a nut upon the bolt which clamps together the upper and lower sections of the tool carrier, shown in the end elevation. By making this bolt longer, and putting on a stiff spiral spring as a washer, the tools will yield to any slight irregularities in the tube, and when the scale is very heavy and hard, the tools can ride over it at first, being gradually forced down by the spring on the bolt until they have reached the iron (or steel) surface.

Fig. 3 illustrates the construction of tools and tool holders. The former are made of tool steel, corrugated or milled as shown, and are about 2 inches in diameter by 1¼ inches long. The rolls used for truing up grindstones may be used for this purpose, they may be bought in the market, and are equally as good as the home-made tools, and cost only a fraction as much.

The cutting wheel is plainly shown at *a* and *b*, and it will be seen that the tool holder is merely a piece of flat steel cut triangular, and bent up as shown in the engraving. Being attached only at one point (to the holder) the wheel can spring when it reaches a heavy cut. Such a form of construction is faulty, and when the spring is put upon the tension bolt as noted above, the form of holder can be used as shown at *c*, this is also made of flat iron, but it is doubled twice instead of once and is a much more mechanical form of construction.

The usual way of scaling tubes is to put them into a big

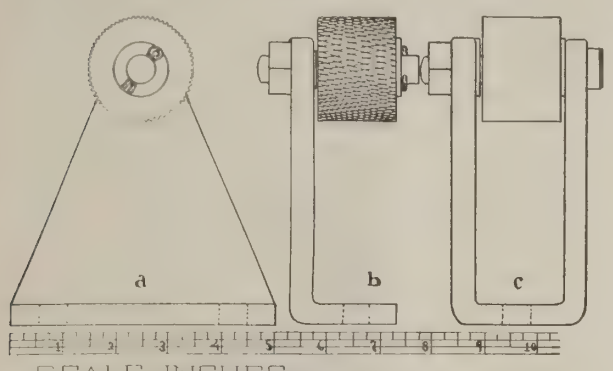


FIG. 3.—TOOL AND TOOL HOLDERS.

tumbling barrel or foundry "rumbler," and let them fall against and pound each other until the scale has been knocked off. This method cleans the tubes, and does not injure them to any extent, but it does make such a thundering noise that it should be banished to the desert or to the mountains. It has became a frequent occurrence to have the coroner's jury bring in a verdict when a man is killed at one of these shops: "*Run over by limited mail. Deceased stepped on track in front of train. The tube tumbler was running, making it impossible for him to hear the approaching train.*" "Exaggerated?" Not a bit. Listen to the noise of the tumbler, and you will be convinced of the possibility of such an occurrence.

New England Railroad Club.

Railroad Switching and Yards.

At the April meeting held in Boston, April 11, the Fitchburg Railroad extended to the members of the club the courtesies of the road to and from the Master Car-Builders' and Master Mechanics' conventions, to be held at Saratoga, June 12 and 18, respectively. Mr. E. K. Turner read a paper on "Railroad Switching and Yards." He said that owing to the prevailing need of economizing, many points which have been heretofore neglected as of minor importance must now be followed up, and the elements of waste and extravagance eliminated from them.

One of the most important subjects which, on many railroads, has not received the attention which it merits is that of switching, and the yards in which it is to be done. The expense incurred in switching is one of the largest items entering into the cost of operation of railroads. On the New England railroads the mileage charged to freight switching is over one-third as great as the mileage run by freight trains on the road. On some of the railroads the proportion is even larger. Local cars for each point must be placed together, so that in making up a train the cars can be put in station order, as it is called. Those for the first station are placed next to the engine, those for the second station next to them, and so on, in order that the locomotive may move as few cars as possible when it sets cars from its train on to the side track at a local station. A little work and care in this direction may save much time and work to trains on the road, as the small yards at local stations are not adapted to switching, and the less movements there are made at such points, the better the results with regard to both safety and economy.

The cost of freight movement on five roads entering Boston was, in 1892, $11,754,002. The total miles of freight and freight switching was 19,889,873, and the cost per mile 59.1 cents, and the total cost of switching $3,407,554.11; a large sum to spend for this purpose, and one that shows the need of studying closely this branch of transportation, to prevent unnecessary expense.

It has generally been found that the yards provided in the early days are entirely inadequate for the greatly increased business of later times, and it has been necessary to enlarge them. This has often been done by adding to the yards a little here and a little there, as the pressure for more room became too great to be longer resisted. The result is that the yards have grown into great collections of tracks without order or system, in many cases covering more territory and containing a greater aggregate length of tracks than would be needed if the tracks were properly arranged, and adding greatly to the perplexity and expense of doing the work. Another item of cost, which every one who has given attention to this subject will admit is a very important one, although it cannot, without more trouble than any one has yet seen fit to take, be definitely separated from the general cost, is the large proportion of damage to cars caused by switching. Taken on a locomotive-mileage basis, the damage to cars by switching is much greater than by regular movement in trains, so that figures already arrived at, being made on a mileage basis, are certainly not larger than they should be.

To reduce the cost of switching, the yards must be so located and laid out that the least possible movement of both cars and locomotives will be required to get the cars into proper order for forwarding. In every yard where switching of cars is done, a certain organization must be maintained, consisting of a yardmaster, with a day foreman, a night foreman, switch engines and crews for both day and night work, trainmen, transfer men, clerks, and office men. If the work can be all done in one yard, but one organization of this kind is needed; while with several yards, as many organizations as yards must be maintained.

The higher employees, such as yardmasters and foremen, can take care of a large amount of business as well as a small one. Engines can be kept at work to better advantage and have less lost time in a large yard. The cost of construction and maintenance is generally less for one large yard than for several small ones having an aggregate capacity equal to a large one. So that as a measure of economy it is better to construct one good yard, well designed and well built, than several small ones. For these reasons, concentration is one of the main points to be kept in view.

If the yard and all accommodations connected with it are designed with the object constantly in view of economy of movement, the result must be economy of expenditure, as all movement causes expense, even that of light engines to and from their work. This is a point which should always be impressed upon all employees having anything to do with movement of rolling stock. No wheel can be turned without cost. No unnecessary movement of any kind should be permitted. In designing a yard everything should be so arranged that cars will always move in the direction of their destination. No backward movement should be made if it can possibly be avoided.

With the older yards and the old method of switching, there is a great deal of lost movement. A large proportion of the car-switching movement is without good result. As an instance, take a train of 20 cars, in an old yard, to be sorted and placed on four tracks, each pair of cars being cut from the train: what will the movement be? Each movement made by the locomotive covers about 500 feet in each direction. At first, with the whole train, each successive movement reducing the number of cars attached to the engine and moving with it. Adding the movements, gives an aggregate of 2 locomotive-miles and 21 car-miles.

With a well-arranged yard these movements can be very much reduced. If the yard and engine are fitted for poling the cars—that is, starting them as cut off from their train by pushing with a pole or stake attached to the engine—with the train of 20 cars noted above, the total car-mileage is reduced to six, making a saving in movement of 15 miles. In the process of poling or staking cars the train to be sorted is placed on a track from which the switches lead to tracks on which the cars are to be placed. Parallel with this track is another on which the engine moves back and forth. The train being placed, cars are cut off from the end nearest to the switches, and as cut off, are pushed by means of a pole or stake fastened to the engine, only enough motion being imparted to them to carry them on to the sorting tracks. Having started one cut, the engine runs back and starts a second cut, and so on until all of the cars in the train have been disposed of. The writer has been informed that in one yard where this method of switching has been followed for some time the same force handles one-quarter more cars than by the old method.

This method of switching can be introduced into a large proportion of the yards now in use, for a portion of the work, with less outlay for change of tracks and new appliances than would be required for any other departure from the old methods of working; but to reap the full benefits of the change in method would generally require the complete reconstruction of the older yards.

In England and other countries of Europe the same conditions have been met in the past that now are becoming so prominent with us. Competition has been so great, and the margin of profit has been so cut down, that close study of the details of operation has been necessary. Work has been done and money spent on a large scale to reach permanent economy in operation, rather than a temporary saving for the time being. From such studies results have been reached that have enabled the companies to show profits from business which, done under the old methods, would have resulted in loss, proving that economical management does not always consist in not spending, but in spending judiciously.

The business now done by the railroads has so changed from that of the earlier days that the old facilities and methods are entirely unsuited to the work. It can almost be taken for granted that an appliance or method is not to be used now *because* it was used in those earlier days. While everything else has changed, our methods of switching, and yards in which to do it, have in most instances remained the same. A reorganization in both is needed, and the railroads which carry out such reorganization, on the proper lines, will at once note a good effect upon their expense account.

Air-Brake Men's Association.

The first annual convention of the Association of Railway Air-Brake Men was held in Columbus, O., April 10. About 40 members were present. The membership has increased to 93, there being but 10 members when the association was organized, a year ago.

Committees reported upon the following subjects:

Air-Brake Instruction; Maintenance of Freight and Passenger Brakes; Cleaning of Triple Valves and Brake Cylinders; Air-Pump Repairs; Handling of Freight and Passenger Trains.

The Committee on Air-Brake Instruction reported that:

Great care must be exercised by the instructor to give in the first lesson *only* the most general ideas of the system. The mistake most frequently made is to bring in too much detail. A man cannot be expected to understand the beauties of excess pressure until he knows that the stored pressure in the main reservoir is the force that is utilized in releasing the brakes. Nor can any one be expected to comprehend the action of the graduating valve in the triple until he knows and clearly understands the general functions of the triple.

The enginemen, if anything gets out of order, should be able to report it intelligently, as any defect intelligently reported is as good as half repaired already. Engineers should have instruction in regard to the engineer's valve, and the uses of the gage and the pump governor; and be held responsible for the adjustment of the latter and the care of the air pump; necessity for draining the main reservoir and cleaning the pressure-reducing valve of the signaling apparatus should be thoroughly understood. The misuse of the emergency application, especially at water tanks, and the failure to release brakes at the proper time to avoid the disagreeable shock to passengers, should be explained and overcome. The necessity for carrying the excess pressure that brakes may be promptly released, and thus decrease the tendency for brakes to stick and slide wheels, and how to carry excess with leaky trains, should be understood. Carelessness in releasing at the wrong time, using the emergency application when it is not needed, and giving the air cylinder of the pump too much oil are the most objectionable practices to which engineers are addicted, and should be emphasized accordingly.

The Committee on Handling Trains Wholly and Partially Equipped with Air-Brakes made an interesting report from which the following is taken:

Freight trains partly braked and trains all braked are in many respects alike; with the part-air train, the shocks caused by rough handling are felt at the rear of the train instead of the head. Such a train is the most difficult to handle, and air-brakes must always be applied gradually or shocks are sure to result. Here especially train pipe leaks increase the difficulties. The fact that they will assist in applying brakes must be taken into consideration. When applying brakes on an all-air train it cannot be said which way the slack will run, but with part air there is no doubt.

Except in emergencies, hand brakes at rear of train should not be used in making stops, as by so doing the number of break-in-twos are increased. Neither should they be used when holding down a grade, as when air is released the train might break in two, and, as has occurred, collide with serious results when air was again applied.

In making stops with a train all air-braked, the brakes should always be applied gradually. It cannot be said which way the shock will run, but either way, if it take place gradually, no harm will result. With loads ahead and empties at rear the train would stretch, and the same would result if all were loads, or all empties, and rear cars had much shorter piston travel than head ones. Reversing the conditions would also reverse results. In making stops at water tanks and coal chutes with long trains, the safest plan is to cut engine off from train, though if care is used this is not absolutely necessary. Under no conditions should the brakes on a long freight train be released just before stopping. The brakes on passenger trains should be released sufficiently before stopping, to prevent that disagreeable recoil, due principally to the truck tilting in stopping and then righting itself again.

With passenger trains, in applying for stop, the braking power should be early increased to near the amount necessary to complete the stop, instead of making a light application until near the stopping point and then a much heavier one. The heavier application acting over the longer distance exerts more retarding power with less expenditure of air, and is less likely to slide wheels.

The use of the conductor's valve, except in cases of emergency, should be discouraged. If necessary to use it, because of inability to get signal to engineer by usual methods, it should be opened gradually until noticed by engineer and then closed, permitting him to complete the stop.

The use of sand increases the stopping power of brakes considerably, and should always be used in case of emergency. Its correct application in a service stop when the rail is slippery is also of benefit. The proper method is to commence its use before brakes are applied at all hard, and continue up to stop. Commencing to use it when near stop, to prevent going by, is very liable to result in bad flat spots in wheels which have commenced to slide before sand was used.

Carry maximum train-pipe pressure if possible; no more, no less. Apply so as to run in or out carefully, and after bunching or stretching train endeavor to keep it so while holding. Avoid emergency except in case of danger. Cut in all cars in good order and report all those not so. Do not practice using full braking power (20 pounds reduction) for service stops. Always endeavor to have a reserve. Do not fail to test brakes before starting, after switching and at all dangerous places. Do not expect too much from a few air cars in a long train. Release on passenger trains before stopping, but not on freight. Run the pump as slowly as possible.

The Air-Brake Situation.

We have received from the Westinghouse Air Brake Company the following circular letter in reference to the 'air-brake situation," which is a subject that has during the last few months claimed a good deal of public attention:

"Below is a copy of a circular sent out by the New York Air Brake Company.

[*Copy.*]

THE AIR-BRAKE SITUATION.

NEW YORK, March 1, 1894.

The Westinghouse Air Brake Co. has inaugurated, for the express purpose of crushing out competition, a policy of intimidation and costly litigation toward the New York Air Brake Co., which company has, on account of superior quality of apparatus, succeeded in obtaining a share of the business. Their latest scheme in this direction is to try to persuade all the railroads to sign a contract that they will not purchase any air-brakes or air-brake supplies, for one year, from any company except the Westinghouse company, promising a rebate at the end of the year provided the railroad company has excluded all other companies. The object of this one-sided scheme is plain. It is to deprive their competitors of all sales for one year, in the expectation that they could force a surrender on their own terms during that time. After that the railroads would again be at the mercy of the Westinghouse Co., and would have to pay such prices as the monopoly thought the traffic would bear. It is not strange that they are willing to pay a small percentage of their profits for one year if thereby they can regain absolute control of the air-brake business. But are the railroad companies willing to give up all hopes of further advancement in the art, or of moderate prices in the future, for the paltry rebate allowed for one year? The terms of the contract explain the motives, for they offer a rebate of 10 per cent. on freight-car equipments, in which they have competitors, and only 5 per cent. on passenger-car equipments, of which they have the practical monopoly, whereas their profit on passenger-car equipments is four hundred per cent. greater than on freight-car equipments.

The New York Air Brake Company only asks of the railroad companies a fair share of the patronage, and will guarantee at all times to give absolute satisfaction. It will not expect any patronage unless it furnishes equipments at least as good and at prices as low as those of the Westinghouse company. It will not ask any contract. It will agree to prevent the Westinghouse company from ever again practicing their old-time arbitrary ways and prices.

The railway companies have already benefited largely by reason of our competition, and we will benefit them a great deal more in the future.

THE NEW YORK AIR BRAKE COMPANY.

N. B.—The locomotive and car brake equipments which the New York Air Brake Company is now manufacturing and selling are not the subject of any litigation whatever.

"The contents of the above circular justify us in making the following remarks:

"FIRST.—The New York Air Brake Company has been a persistent and willful infringer of the patents of The Westinghouse Air Brake Company, has been defeated in litigation, and is now attempting to make a new triple valve which is also an infringement on our patents and is the subject of further litigation. The course of the New York Air Brake Company, on account of the injunction which the courts have issued against the use of their apparatus, has involved a number of railways, and the defective character of much of the apparatus furnished by them has been disadvantageous. They have, therefore, in no manner effected a saving to railway companies.

"SECOND.—During the past two years numerous attempts have been made by parties interested in the New York Air Brake Company to bring about some arrangement between the two companies, and it has been urged by New York Air Brake Company representatives that such an arrangement would enable the combination to maintain higher prices for brakes. Our answer has invariably been that under no circumstances would The Westinghouse Air Brake Company enter into any arrangement which would add one dollar of expense to the business, and thereby prevent it selling brake apparatus at the lowest possible prices when its manufacture and sale is no longer controlled by important patents.

"The pretence, therefore, of the managers of the New York Air Brake Company that they are seeking to benefit the railway companies is sheer nonsense. They seem most to desire to make money, and have not hesitated to try to do so by the sale of apparatus which they have had no right to make.

"THIRD.—The Westinghouse Air Brake Company believes that it is entitled to the exclusive manufacture and sale of quick-acting automatic Air-Brakes and Brake material, and that it is advantageous to the railway companies to purchase exclusively from it in order that there may be only one class of apparatus to maintain: It believes that if brakes and repair parts were to be made indiscriminately by a number of manufacturers, there would be increased risk of accident, and that the money heretofore expended for air-brake equipment would be greatly jeopardized.

"The special contract referred to in the circular of the New York Air Brake Company is for the purpose of giving the most advantageous terms to those companies who purchase exclusively from us, and it has been, and will continue to be, the policy of this company to so conduct our business as to encourage railway companies to respect our rights and business methods.

"THE WESTINGHOUSE AIR BRAKE CO."

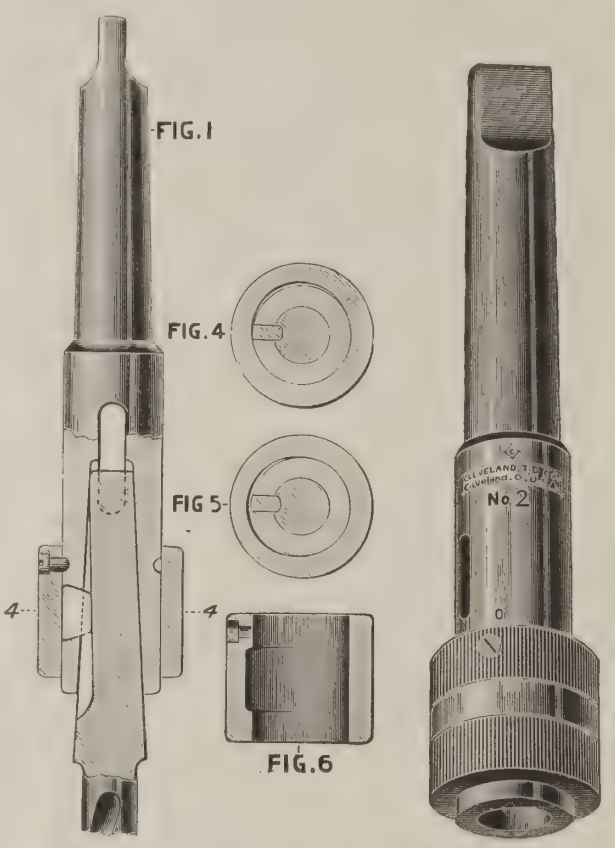
The Cleveland Steel Company, of Cleveland, O., has purchased the entire plant of the Britton Iron and Steel Company, of the same city, who were manufacturers of plates, black and galvanized sheets, both iron and steel. A recent letter from the Cleveland Steel Company says:

We have closed down the entire plant for the purpose of remodeling and replacing the old facilities with the latest improved methods for the manufacture of sheet steel in all its branches, and we are now erecting a steel department in connection with the works for the manufacture of the highest grades of steel.

Realizing the many new purposes for which sheet steel is being used, we wish to place ourselves in position where we can supply these growing demands of the trade.

A New Method of Driving Drills.

The weakest point about the ordinary taper shank drill is the flattened end of the shank, which frequently twists off long before the drill is worn out, or if it does not, it will often cut or ream out the flat recess in the socket. In either event the drill or socket is rendered useless until repaired. The Cleveland Twist Drill Company, of Cleveland, O., has designed what it calls a "grip socket" that entirely overcomes this weak point in the modern system of taper shanks. This grip socket is fully shown in the accompanying illustrations. A steel key is let into one side of the ordinary socket and its inner side engages in a groove or flattened place prepared for it on the shank of the drill. A slight turn of the eccentrically counter-bored sleeve or collar fastens or locks the key securely in its seat, and then the drill cannot be turned in the socket or pulled out. This key is so located in the body of the socket that the tang on the drill will fit into the usual slot or recess prepared for it, and in this way the socket has a double driving power. The advantages arising from the fact that the drill cannot be pulled out till the collar is turned back and the key released are many, as heavy tools have a provoking way of dropping out of their sockets at most inopportune times, and many drills are dulled or spoiled by tapping them into place with a hammer. If this simple drilling device is put directly onto the drilling machine spindle heavy under-cutting can be done with boring bars, and the labor necessary to turn over heavy castings can be entirely avoided. These grip sockets will hold perfectly and securely straight shank drills, and can be furnished with ½, ⅝, ¾, ⅞ and 1-inch holes for such drills. The manufacturers propose to put this necessary groove in the shanks of all of their



SECTIONAL VIEWS, CLEVELAND TWIST DRILL COMPANY'S "GRIP SOCKET."

drills so that they can be used in these grip sockets. A drill that has had the tang twisted off can be made as good as new for use in this grip socket by milling a half-round groove in the shank, or if it is not convenient to mill it a flat place can be filed or ground on the shank, care being taken that such groove or flat place has a taper the reverse of that on the outside of the shank, as shown in the sectional drawing. The small cut illustrates the reducer or shell sockets used with the grip. The Cleveland Twist Drill Company has applied the gripping device directly to several drill press spindles, and will furnish collars properly constructed for that purpose on application, at a very small expense. The company has put in special machinery for making these "grips"; and as all parts will be made to jigs or standards, duplicate parts can be furnished at any time.

A patent has been applied for on this device.

At present these grip sockets are selling faster than they can be made. The United States Government has just purchased six of each size from No. 1 to No. 5, inclusive, for the Washington Navy Yard.

Mr. George O. Manchester, formerly of the Atchison, Topeka & Santa Fe, has been elected Vice-President and Treasurer of the Sargent Company, Chicago.

Handlers of shade rollers should not fail to closely examine the Hartshorn new groove tin roller, recently put on the market by the Stewart Hartshorn Co., E. Newark, N. J. This firm is the pioneer in the invention and manufacture of self-acting rollers, and its products are invariably of such sterling worth as to insure satisfaction.

Mr. William C. Baker, inventor and manufacturer of the Baker car heater, has issued a revised edition of his book giving full information for the erection and use of Baker car heaters. The book also gives some very good advice to trainmen about the care and management of these heaters, that if properly carried out would add greatly to the comfort of passengers in cold weather. Mr. Baker will furnish as many of these books as are desired to his patrons.

Testimonial to the Excellence of Magnolia Metal.

The Magnolia Metal Company, of New York, has received the following letter from the Fairbanks Standard Scales Company:

Office of the FAIRBANKS COMPANY,
83 Milk Street, Boston.

Magnolia Metal Company, New York, N. Y.:

GENTLEMEN—We are compiling a new catalogue, comprising all the articles which we are now selling in our department of railway and manufactory supplies. We desire to take this opportunity to add to the line of goods which we are handling, and would like to make arrangements with you to take up the sale of your goods and illustrate the same in our catalogue. The book we intend to issue will consist of 300 pages of the size of 8 by 11½ inches, outside measure, and will be placed in the hands of every customer of ours, both at home and abroad.

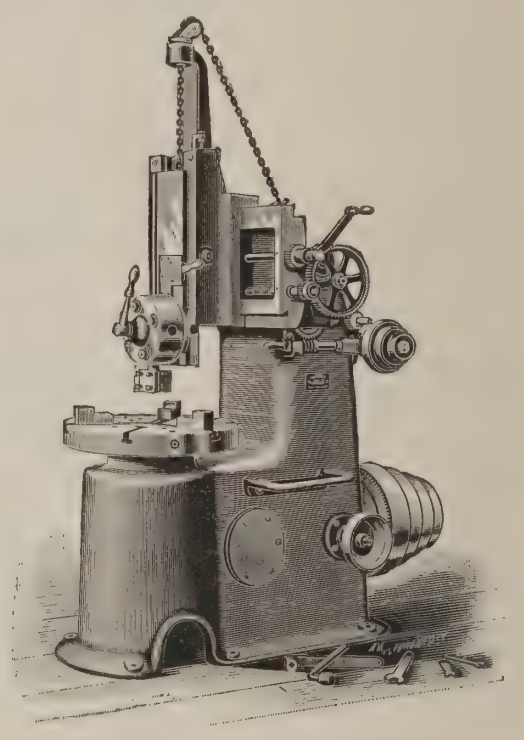
We handle only the highest grade of goods, and believing that *your manufactures are strictly first-class in every respect*, we wish to give you an opportunity to have them listed in our catalogue to the extent of one or more pages, provided you are willing to bear the expense, which will not be great. The cost of distribution will be borne by us.

Please favor us with an early reply, as we are making this offer only to a limited number of manufacturers, and our book will shortly be ready for the press.

Yours truly,
THE FAIRBANKS COMPANY,
(Signed) R. L. T. Evans.

Thirty-Inch Vertical Chucking and Facing Machine.

The machine illustrated herewith is made by the Bridgeport Machine Tool Works, of Bridgeport, Conn. Its capacity is 30 inches in diameter and 14 inches in height under the rail, and 21 inches under the turret. The table is 24 inches in diameter, and is fitted with a three-jaw universal chuck, the top jaws of which can be removed, leaving plain table. The turret is 10 inches in diameter, and has four 1¼-inch holes. It will face 24 inches in diameter, and has a downward movement of 16 inches.



CHUCKING AND FACING MACHINE.

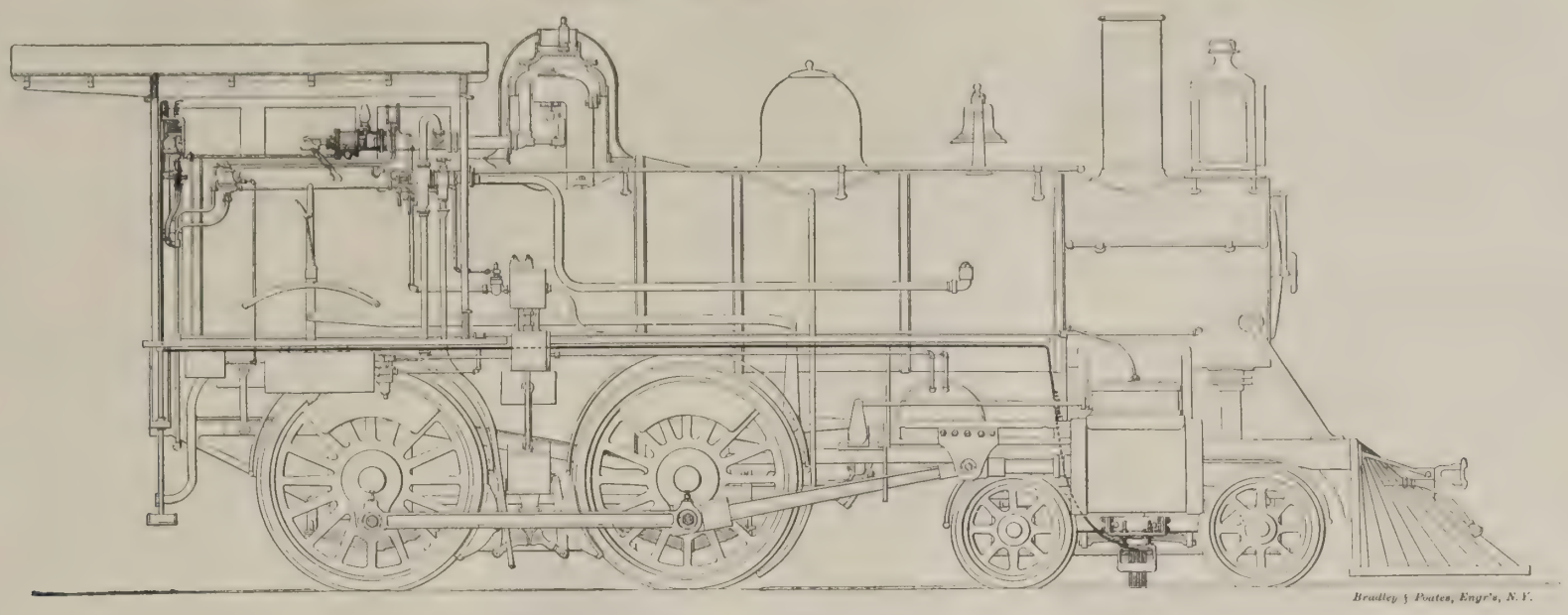
The feeds are automatic, in all directions, and are provided with automatic trips. The down feed ranges from $\frac{1}{20}$ to $\frac{1}{80}$ inch, and cross feed from $\frac{1}{10}$ to $\frac{1}{40}$ inch. The countershaft has one 16 and one 20-inch pulley, giving 16 changes of speed, 8 with cone and 8 with back gears, and is designed to run 75 and 250 revolutions per minute respectively.

The Kinsman Block System.

A good many improvements have been made in the apparatus of the Kinsman block system since the details of its operation were described and illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER in October, 1892. These improvements are simply in matters of detail, not in general design, as that has been proved on numerous occasions to be all that is required for an absolutely safe system of signaling running trains under the most unfavorable conditions imaginable. The object sought and accomplished in an admirable manner by this system is the automatic stopping of trains, independent of the engine crew, whenever the safety of the train requires. Heavy fog, blinding snowfalls and visual signals out of order cannot, with this system in operation, affect the safety of a train, because its operation does not depend upon the vision or alertness of the engineer at the throttle.

Fig. 1 shows a locomotive equipped with the apparatus for operation in conjunction with this system, and Figs. 2 and 3 show sectional views of the details of a locomotive that are acted upon in the operation of the system, which may be described as follows: On a "section" of road where the system is to operate, electric currents are employed which are generated by a battery located conveniently. One circuit operates through the track rails, and is termed the "track circuit"; others operate over wires on poles located by the side of the roadbed, which terminate in guard rails, and are termed guard-rail circuits. A special pendant contact device is carried by each locomotive near the wheels of its forward truck. Wires connect this device with a special electric relay, a special air valve, the throttle valve, and the air-brake mechanism in the cab of the locomotive.

A train or part of a train standing or running in any "section" of the road will short circuit the "track circuit" of that "section." The short circuiting renders the relay in-



LOCOMOTIVE EQUIPMENT OF THE KINSMAN BLOCK SYSTEM CO.

cluded in that particular circuit inert; as a result, its armature drops, and in dropping operates the guard rail circuits in adjoining sections. Under these conditions, a locomotive approaching another train too closely, from either direction on a single-track road, or from the rear on a double-track road, will, through its contact devices, take up the current from the guard rails and conduct it to the mechanism in the cab, where it will cause the air-brake pressure to automatically close the throttle valve, and cause a *service* application of the air-brakes, without moving or affecting the throttle lever or engineer's brake valve. No change is made in the usual methods of operating the throttle or air-brake valves, nor does the arrangement prevent the engineer from obeying any signal in the ordinary way. If the engineer decides to prevent his train from entirely stopping, he can do so by releasing the air-brakes, when his engine and train are under his full control again. An open switch or drawbridge or a broken rail will disrupt the track circuit (instead of short circuit it, as a car or train does) and thus cause the stoppage of trains in precisely the same manner as does the presence of a train.

A short circuit or disruption, or the operation of the guard-rail circuits will cause the current to be conducted to the electromagnet in the cab (shown in detail in Figs. 2 and 3) whose armature, when drawn up, permits a spring to operate in opening a valve in a pipe connection with the train pipe. Figs. 2 and 3 show the arrangement of the throttle valve, lever, etc., and the apparatus in the cab for automatically closing the throttle and applying the brakes. There are two throttle stems, one within the other, the outer one connecting with the bell crank operating the throttle valve, and the inner one connecting with the throttle lever. To the outer stem is attached a piston which is contained within a cylinder as shown. Within the piston are four springs, also shown, which act to hold the inner and outer throttle stems together during ordinary handling. When the apparatus is put in operation by the electrical connection described, while the engine is running and using steam, the armature of the electromagnet in the cab is raised, allowing of the

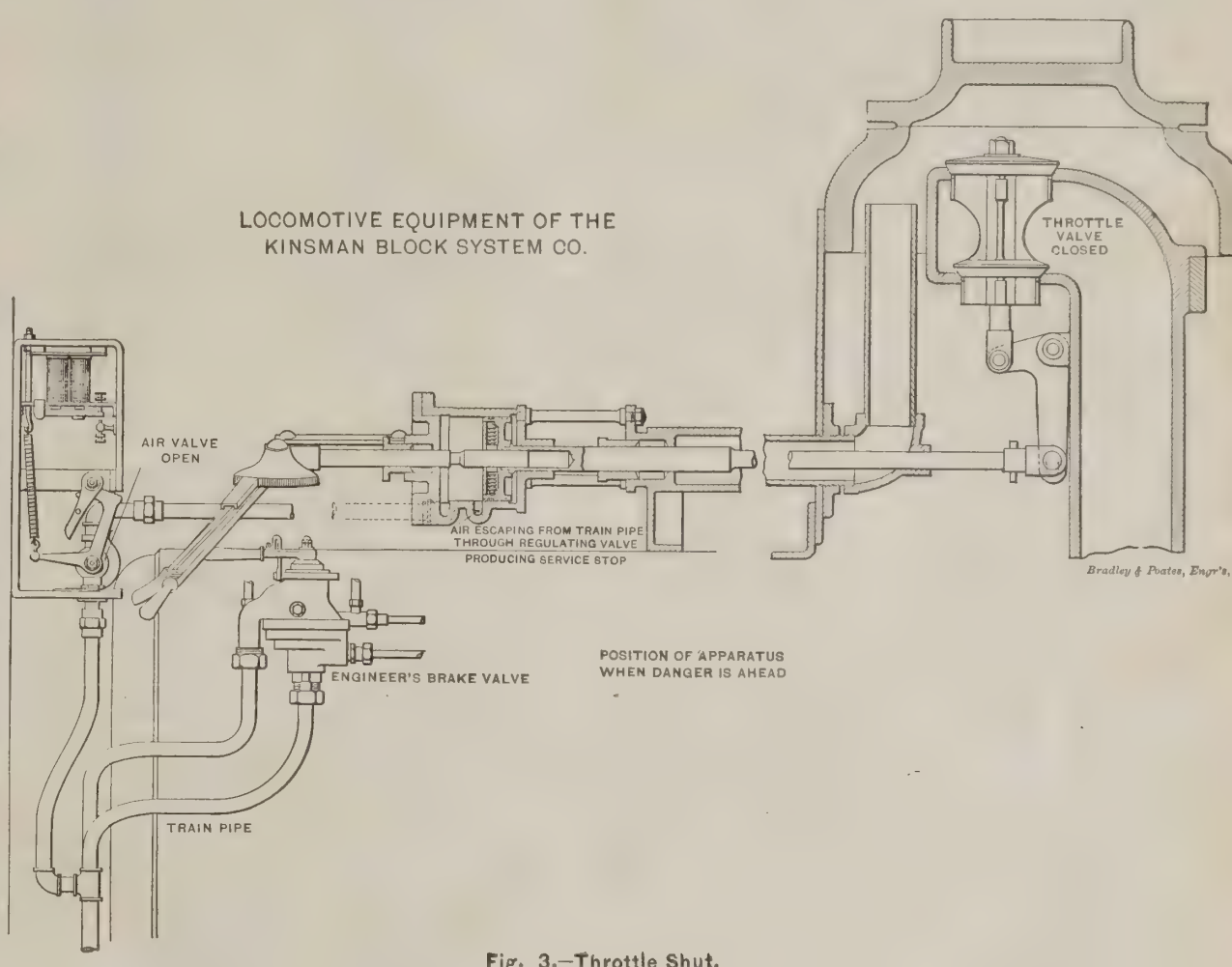


Fig. 3.—Throttle Shut.

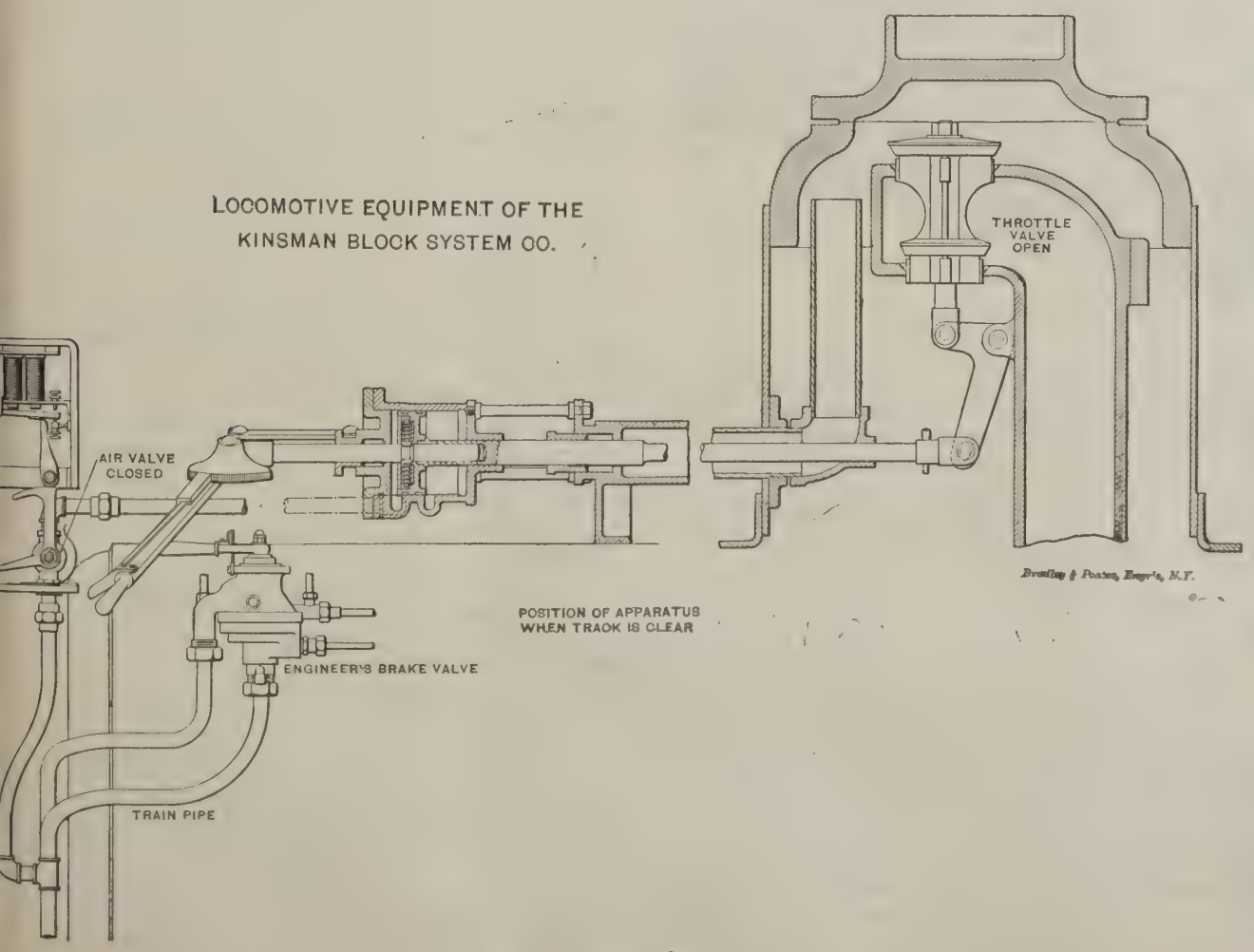


Fig. 2—Throttle Open.

opening of the valve in air-brake pipe connection, and the flow of compressed air to the cylinder surrounding the throttle stem and its piston attachment. The air pressure against the piston overcomes the grasp of the springs holding the inner and outer throttle stems together, and by forcing the piston forward closes the throttle valve without altering the position of the throttle lever. A port is placed in the bottom of the cylinder about midway, as shown in the drawings; and when this port is uncovered by the piston being forced past it, egress is given to the air from the train pipe, and the brakes are of course applied. In this manner the system acts to automatically close the throttle and set the brakes.

When the apparatus has acted to close the throttle and apply the brakes, the engineer can immediately release the latter and resume the use of steam by simply pushing the throttle lever forward and pulling it back again, during which action the springs within the piston will re-engage the inner and outer throttle stems and the normal conditions will be re-established.

It is plain that the apparatus in the cab is of a simple and substantial character, and not likely to add much to the cost of repairs, while it does not interfere with the ordinary manipulation of the throttle.

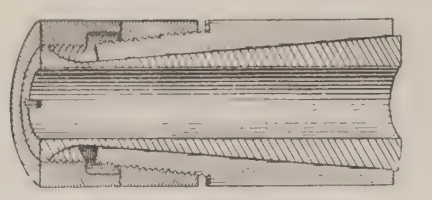
The offices of the company are at 143 Liberty Street, New York.

Mr. W. S. McMunn, formerly special agent for Messrs. Carnegie, Phipps & Co., has severed his connection with th firm, and is now connected with the Otis Steel Co., of Clev land. His address is 1425 Old Colony Building, Chicago, I

The Avery Stamping Company, of Cleveland, O., manufacturers of steel hollowware and pressed steel articles of all descriptions, have appointed Mr. A. E. Bronson, of Cleveland, to represent the firm in the West, and Mr. M. S. Near, of New York, to represent it in the East.

Adjustable Universal Shell Reamers.

The Standard Tool Company, of Cleveland, O., is having much success in the sale of a new tool shown below. It is an adjustable sheel reamer, having some excellent qualities, and has an adjustment of an eighth of an inch, making, for instance, a 3-inch reamer do for all sizes from 3 to 3⅛ inches, thereby allowing the reamer to either be kept to the standard of 3 inches, with an eighth of an inch wear, or used for any other size in its range. The sectional cut shown illustrates its construction. It is very quickly adjusted by



Adjustable Shell Reamer.

loosening the lock nut and screwing up the taper nut which screws the blades back or forth to the size required. After the lock nut has been screwed up tight to the taper nut the reamer is ready for work. It is accurately made by special tools, making each part interchangeable, so that duplicates can be supplied when worn. The blades are made from Jessop tool steel, carefully tempered and ground, and the nuts are hardened. The shell reamers are made with taper holes for standard arbors in all sizes from 2¼ to 6 inches in diameter.

Mushet's Special Steel.

The following is an extract from the address of the President of the Manchester Institution of Mechanical Engineers, delivered before the Institution, Feb. 13, 1894:

"The machine shops are the most important, as the more accurate and quick the machines do their work adds life and go to every other department. Special machining for certain parts is a necessity, and milling is of great importance, also special machine for brass mountings; the foremen of the machine shops must be continually on the alert, to scheme and experiment with special tools to expedite the work, and to keep the machines running to the full pitch of their cutting speeds, employing the best tool steel, as inferior steel keeps the machines standing, even while changing the tools is a great loss in a week's time. I have found none equal to Mushet's for any kind of material."

As is well known the representatives of the "Mushet's Special" steel in the United States are Messrs. B. M. Jones & Co., of Nos. 11 and 13 Oliver street, Boston, and No. 143 Liberty street, New York.

Shops of the Lenoir Car Company.

Large new car shops are being built at Lenoir City, Tenn., by the Lenoir Car Company. The officers of the company are as follows: W. P. Chamberlain, President; R. Z. Roberts, Vice President and General Manager, and L. A. Madden, Secretary and Treasurer.

It is expected that these shops will be ready for operation in a few weeks. The erecting shop is not yet constructed, but the foundation walls are up and most of the material is on the ground. It will be 120 by 300 feet, built of wood and covered with composition and gravel.

The smithing and ironworking building is of brick, 70 by 260 feet, with brick engine-house attached, and is now complete. The engine is in place and most of the machinery is on the grounds. The woodworking shop is of wood, 100 by 300 feet, well lighted and ventilated, with brick engine and boiler room 64 by 66 feet. The boilers and engines are in place, and most of the other machinery is on the grounds. The wareroom for general stores is 50 by 100 feet, with composition and gravel roofing and brick floor.

The wheel foundry is 92 by 454 feet, with two cupola-rooms, engine and boiler rooms, and core-oven rooms attached. This building is of heavy frame construction on brick foundations, sheathed with corrugated iron, covered with slate and thoroughly ventilated. The charging-room will be floored with steel I beams and ½-inch plates riveted thereto, and will be thoroughly equipped for car-wheel making and general castings, the car-wheel capacity being equal to 250 wheels a day.

The Westinghouse Catalogue for 1894.

The Westinghouse Air Brake Company has just issued a new edition of its catalogue, which replaces the 1890 issue. The publication is very tastefully gotten up, the composition and engravings being first class in every respect. It contains 78 pages, and in size is 9 inches by 12 inches, thus conforming to the recommendation of the Master Car Builders' Committee on standard sizes for catalogues, specifications, &c. It has flexible covers and the paper used is of a high grade. It illustrates and describes in minute detail the latest and most modern air-brake appliances as they have been practically developed for use in passenger and freight service. The work is designed for the use of railroad officers and employes who have occasion to order air-brake supplies, and to such it will be sent free by the Westinghouse Air Brake Company.

Wire, Cloth and Twine Testing Machines.

The accompanying cut, Fig. 1, shows a very neat and handy testing machine made by the Riehle Brothers Testing Machine Company, of Philadelphia, Pa., and designed for the United States Government for testing cloth or canvas (it will also test twine or wire) in lengths up to 20 inches. The machine can be modified to take in different length specimens to suit special order.

It is operated by a convenient hand wheel and screw for applying power, while the specimen is firmly and easily held in the fluted jaws of the hand vises. For testing other specimens, suitable jaws are substituted in place of the

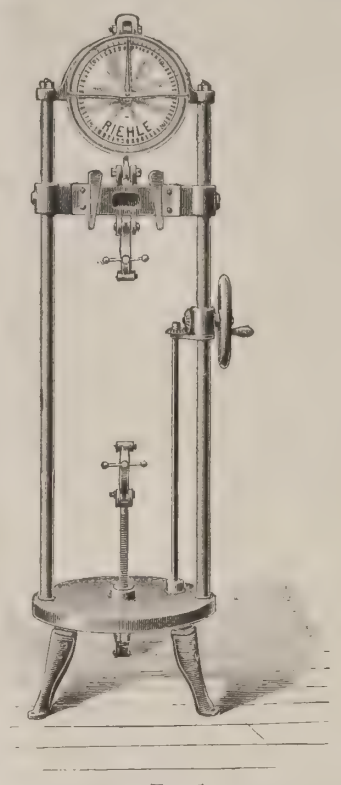


Fig. 1.

Fig. 2.

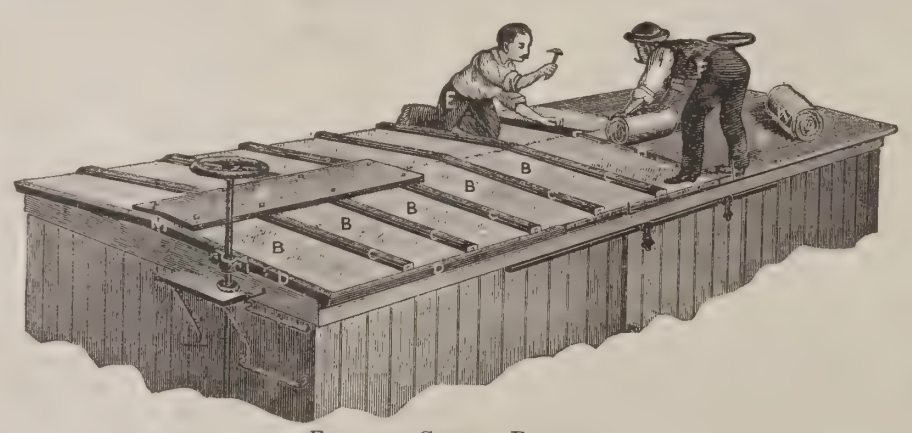
Riehle Twine and Wire Testing Machines.

fluted jaws as shown in the above engraving. The strain is measured by a spring balance, and the recoil is absorbed by a pair of wedges which follow the downward pull and prevent shock to any extent. An idle finger indicates the maximum load or breaking strain of the specimen.

The testing machine shown in Fig. 2 is a handy, reliable and compact machine for trying the tensile strength of wire. It is made in several capacities, 100 pounds, 200 pounds and 600 pounds, and will take in specimens up to 20 inches. It was designed for parties using wire in their business, and also for manufacturers of wire. It is all metal, and made in a first-class manner. These machines are made only by the Riehle Brother Manufacturing Company.

Carey's Magnesia Flexible Cement Roofing.

The accompanying cut shows the method of applying magnesia flexible cement roofing. This roofing is made by the



Flexible Cement Roofing.

Philip Carey Manufacturing Company, of 117-27 Gilbert avenue, Cincinnati, O., and it is claimed that steam, acids, gases, moisture and extremes of temperature and weather do not affect it. It is suitable for car roofs, and also for all buildings where a fire and water proof enduring roof is required.

The Huyett & Smith Manufacturing Company, of Detroit, Mich., has changed its New York office from 107 Liberty to 26 Cortlandt street.

A very satisfactory meeting of the stockholders of the Joseph Dixon Crucible Company was held in their offices in Jersey City, N. J., April 16. Out of 7,345 shares 7,215 votes were cast for the same board of managers that has conducted the affairs of the company through its years of prosperity. Mr. E. F. C. Young was elected President, John A. Walker Vice-President and Treasurer, George E. Long, Secretary. The Dixon Company was founded by Joseph Dixon in 1827, and organized as a stock company in 1868. Its manufactures are graphite products of all kinds, consisting of plumbago crucibles for melting gold, silver, brass, etc., blacklead retorts, stove polish, graphite for lubricating, electrotypers' graphite, graphite lead pencils, graphite paint, and graphite prepared in hundreds of ways for as many different uses. Graphite is one of the principal forms of carbon. It is not affected by heat or cold, acids or alkalies and is therefore one of the most useful materials known to modern industry when rightly prepared.

The New York Air Brake Company has moved its offices from No. 115 Broadway to the Manhattan Life Building, No. 66 Broadway, New York City.

The Standard Tool Company, of Cleveland, O., has issued a very nicely arranged and illustrated catalogue descriptive of the twist drills, reamers, taps and special tools it manufactures.

The Craig-Reynolds Foundry Company, of Dayton, O., has issued an illustrated pamphlet describing and showing the operation of the Dayton railway crossing gate. The Big Four road has adopted this system of crossing gates.

The Stilwell-Bierce & Smith-Vaile Company, of Dayton, O., has issued a new price list of its articles of manufacture. Some of these are also illustrated and comprise all that is needed for complete water stations, track and tool supplies, depot trucks, jacks and hoisting machinery.

The Lodge & Shipley Machine Tool Company, of Cincinnati, O., has issued an illustrated pamphlet which shows and describes a number of the metal working machines of its manufacture. Among these are turned lathes from 12 inches to 37 inches, and pulley lathes from 30 to 60 inches; a pulley drilling and tapping machine, a triple facing machine, and a universal brass worker.

Messrs. Watson and Stillman, proprietors of the "W. & S." Hydraulic Machinery Works, of 204-210 East Forty-third street, New York, have issued a new price list, which gives a great deal of information about hydraulic jacks, almost every conceivable shape of which is made at these works. Those having occasion to use such tools, and those desiring information concerning them should send for one of these pamphlets.

A rear collision on the Williamsport & North Branch road near Pennsdale, Pa., April 21, caused the immediate death of Miss Miriam Welsh, daughter of the general manager of the road, Mr. B. G. Welsh. Two other passengers were fatally injured.

It was announced in our last issue that Mr. W. M. Wilson, formerly of the Otis Steel Company, was engaged by the Carbon Steel Company, of Pittsburgh. Mr. Wilson will represent this company at Chicago, and will have his office in Room 408, Western Union Building.

The Western Railway Club held its regular monthly meeting in the Rookery Building, Chicago, April 17. Proposed changes in the Rules of Interchange were discussed at considerable length. Mr. D. L. Barnes read a paper on the "Present Utility of Electric Motors on Railroads."

Our Directory

OF OFFICIAL CHANGES IN APRIL.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Atlantic & Western.—R. T. Goff is appointed Superintendent, vice W. L. Crawford, resigned.

Baltimore & Ohio Southwestern.—C. A. Skinner, Master Mechanic Mississippi Division, has resigned.

Boston & Albany.—Henry T. Gallup, General Superintendent, has resigned, and is succeeded by William R. Robeson.

Buffalo & Susquehanna.—S. W. Huston succeeds L. T. Johnson as Master Mechanic at Austin, Pa.

Central Ohio.—J. D. Riddle, General Superintendent, has resigned.

Chicago & Great Western.—Samuel C. Stickney is appointed Acting General Manager, vice J. M. Eagan, resigned.

Chicago Great Western.—Percy Lyons is appointed Superintendent Motive Power, succeeding W. T. Reed, resigned.

Columbus, Lima & Milwaukee.—Otto L. Hayes is appointed Receiver, succeeding John Blyth, resigned.

Concord & Montreal.—B. A. Kimball is appointed Managing Director, vice T. A. McKinnon, resigned. D. C. Prescott is appointed General Superintendent.

Elkhart & Western.—E. C. Bickel, General Manager, has resigned, and is succeeded by H. E. Bucklin.

Findlay, Fort Wayne & Western.—C. G. Patterson is appointed General Manager. B. W. Fenton is appointed Master Mechanic.

Florida Central & Peninsular.—E. Ford, Superintendent of South Bound Bivision, has resigned.

Illinois Central.—J. S. Chambers is appointed Master Mechanic at Clinton, Ill.

Kingston & Pembroke.—B. W. Folger is appointed General Manager, with office at Kingston, Can.

Lehigh Valley.—T. H. Fennell, General Superintendent Northern Division, has resigned. H. D. Taylor is appointed Engineer of Tests.

Louisville, Evansville & St. Louis.—W. E. Looney, Master Car Builder, has resigned. The jurisdiction of J. K. Lape, Superintendent Motive Power, is extended over the car department.

New York, Lake Erie & Western.—J. H. Moore is appointed Master Mechanic at Buffalo, succeeding James P. Hubbard, deceased.

New York & Northern.—Thomas Millen, Superintendent and Master Mechanic, has resigned.

Norfolk & Western.—L. P. Ligon is appointed Master Mechanic at Bluefield, W. Va.

Pennsylvania.—C. M. Mendenhall, Master Mechanic at Jersey City, is appointed Assistant Superintendent Motive Power at same place, and is succeeded by Wm. B. Page.

St. Louis, Vandalia & Terre Haute.—H. I. Miller is appointed General Superintendent, vice J. Hill, resigned. F. T. Hatch is appointed Superintendent of the Michigan Division.

West Virginia Central & Pittsburgh.—J. S. Turner is appointed Superintendent of Motive Power, with office at Elkins, W. Va.

Wisconsin Central.—The jurisdiction of James McNaughton, Superintendent Motive Power, is extended over the car department.

NATIONAL CAR LOCOMOTIVE BUILDER

JUNE, 1894.

CONTENTS.

The Missouri, Kansas & Texas is in the market for 10 locomotives.

Kansas City, Osceola & Southern will build new shops at Clinton, Mo.

New shops are to be built by the Kansas City, Pittsburg & Gulf Railroad at Pittsburg, Kan.

On May 1 the Chicago, Burlington & Quincy formally dedicated its new bridge across the Mississippi River at St. Louis.

The New York, New Haven & Hartford has given an order to the Rhode Island Locomotive Works for 10 passenger locomotives.

The shops of the Seaboard Air Line at Portsmouth, Va., are to be closed and all the repair work of the company is to be done at Raleigh.

The Barney & Smith Car Company, of Dayton, O., has recently furnished the Buffalo & Susquehanna road with four new passenger coaches.

"Ha! Another railroad tie-up!" ejaculated Signor Bonnstommer, the renowned tragedian, stumbling over it, and digging his nose in the gravel.

The earnings of the Chicago, Milwaukee & St. Paul Railway for the third week in May were $476,619. For the corresponding week in 1893, $600,297, a decrease of $123,678.

President Chauncey M. Depew, of the New York Central, is to address the American Railway Master Mechanics' Association, which will hold its annual convention in Saratoga June 18.

The Lodge & Davis Machine Tool Company, of Cincinnati, are furnishing the machinery for the new shops of the Cincinnati, Georgetown & Portsmouth Railroad at Columbia, Ohio.

The Pullman Palace Car Company has delivered to the Long Island road 40 of the 55 cars ordered by that company last year. The delivery of the balance of the order is delayed by the strike at Pullman.

The North Carolina Car Company, of Raleigh, N. C., will soon begin the erection of its new plant. The foundry will be 82 by 172 feet, with cupola; and the furnace and car-erecting shop will be 86 by 120 feet.

A fire in New Haven, Conn., on May 16, destroyed 30 loaded cars of the New York, New Haven & Hartford, and part of a freighthouse. The fire is said to have started in a car containing naphtha. Total damage, about $50,000.

Trackmen on the Lehigh Valley Railroad engaged in replacing rails ditched a passenger train near Oswego, N. Y., May 14. The train was allowed to proceed at usual speed over loosely spike rails which turned over. One person was killed and 12 injured.

All the street railways of Detroit have been purchased by a syndicate. There are 80 miles of road in the city, 30 of which are trolley lines. The syndicate will capitalize the lines at $10,000,000 and equip them throughout with the trolley system and extend them.

The Buffalo & Susquehanna is going to build new shops, and the plans for the buildings have been prepared. Some new shop tools have been recently ordered from the Niles Tool Co. and others, and the Master Mechanic, Mr. S. W. Huston, has set these up at the shops at Austin, Pa.

A railroad which the Germans have built in Asia Minor, extending from Ismid, a harbor about 60 miles east of Constantinople, east by south to Angora, has as little wood in it, perhaps, as any in the world. Not only the rails and the bridges, but the ties and telegraph poles, are of iron.

The Rogers Locomotive Works are buildiag a number of engines for a Cuban railroad. They are to be delivered this fall, and the order includes five 8-wheeled passenger locomotives, cylinders 18 by 24 inches, and two switching locomotives, Forney type, with cylinders 16 by 24 inches.

On May 1 the Board of Directors of the Pennsylvania Railroad held a special meeting and declared a semi-annual dividend of 2½ per cent., payable in cash, clear of State taxes, on and after May 31, to the shareholders as they stood registered on the books of the company April 30.

Suit for $1,000,000 damages was begun in the United States Circuit Court May 25 by the French Republic against the World's Columbian Exposition. The litigation grows out of the French Government's claim for damages to exhibits of French subjects injured during the Manufactures Building fire.

The latest information in regard to the status of foreign commerce in China shows that there are now in the Celestial Empire 543 foreign firms established, belonging to the following nationalities; England, 363; Germany, 78; America, 31; France, 29; Russia, 15; Portugal, 7; Austria, 4; Spain, 4; Italy, 4; Denmark, 3; Holland, 2, and other countries, 3.

Last November the employés of the Mobile & Ohio suffered a cut in wages of 8 per cent According to an agreement, the former rate of pay was restored March 1, but the men were warned that because of the general bad condition of business the reduction might soon be made again. A reduction of 10 per cent. has now been ordered to take effect June 10.

The Cold Blast Transportation Company of Kansas City, Mo., has recently placed an order for 100 refrigerator cars with the Missouri Car and Foundry Company. These cars will have the Schaffer cast steel bolster, which was illustrated in the April issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER. The same company is asking bids on 100 stock cars, 50 refrigerator cars and 50 common box cars.

A rather startling industrial development is reported from Victoria, where women have now been substituted for men at no fewer than 200 railway stations. The average wages paid to a station-mistress is £20 per year, whereas "the objectionable male' used to receive £150. But, as the Sydney *Telegraph* asks, "How is the Victorian woman going to support a husband and family on £20 a year?"

Another branch line of the great trans-Siberian railway has been decided upon and is to be built soon. It will be an extension of the Riazan-Ouralsk line, and will run as far as the Aral Sea and the Amoor Darya, one of the two great streams received by that sea. The construction of this line would be specially profitable and advantageous for the Khiva region, which is too distant from the trans-Caspian railroad line.

An American traveling in Spain writes that the trains in that country are the slowest on earth. A rate of 10 or 12 miles an hour is considered good average speed for passenger trains. When the Spanish officials wish to put on style and show visiting foreigners what they really can accomplish in the way of rapidity, they offer express trains which dash madly across the landscape at an average rate of 15 to 18 miles an hour.

The New York Central & Hudson River Railroad has put on a new fast passenger train to run, via the Michigan Central Railroad, between New York and Chicago. It leaves New York daily, at 4:30 P. M., arriving at Chicago, by way of the Michigan Central, at 4:30 P. M. next day. On the return trip it leaves Chicago by the Michigan Central at 9 A. M., reaching New York at 11 A. M. the next day. The equipment of this train is new and handsome throughout.

The difficulty of mounting blueprints on cardboard for use in shops, in such a way that the card or straw board will not warp, has been a common experience. A correspondent in the *American Machinist* says in reference to this matter: "For pasting on the prints, about the best paste I know of is patternmakers' glue, and if the mounts are shellacked on *both* sides they will remain straight. For shellacking use the same kind as for patterns, of course without lampblack in it. Drying them under a weight will not keep them straight."

From returns prepared for the Prussian State Railways, says *Engineering*, it appears that the freight cars on those lines are used more largely as warehouses than as a means of transport. The average mileage of cars is only some 10,347 miles per annum, which, at the somewhat high speed of 18.6 miles per hour, would correspond to only 23 days' work per annum, and the cars were thus standing by far the major portion of their time. The average number of runs per car was, however, 150, of which 51 were made in the unloaded condition.

The Supreme Court of Massachusetts has decided that a locomotive engineer takes the risk of being struck by things within four feet of the tracks over which his train is moving. This rule is laid down in the action of George W. Thain, an engineer on the Old Colony, against the railroad company. While on duty, Thain was struck by being carried against a post standing four feet from the tender where he was standing at the time. The post had been put up as a temporary support to a bridge about a week before the accident, and Thain had no knowledge of it.

The plan of whitewashing structures by compressed air as used on the Union Pacific and described in our last issue, is also in use on the Delaware, Lackawanna & Western. A couple of air tanks and three air pumps have been fitted on to a freight car on this road. The steam to work the pumps is taken from a locomotive or other convenient boiler. The air is taken from the tanks through a line of hose to an ejector, which is connected to the whitewash tank by a second line of hose. The ejector nozzle is fixed at the end of a long arm, enabling the operator to reach heights otherwise inaccessible without scaffolding.

In view of the scarcity of bituminous coal in consequence of the prevailing general strike of miners, it is suggested that large consumers mix two tons of anthracite with one ton of bituminous coal, and burn the mixed fuel, and it is said that the mixture will need no change in the grates. In fact, the mixture up to 75 per cent. of anthracite to 25 per cent of bituminous will give much better results than either burned separately; and it has the further advantage of having no smoke, as the hydrogen in the anthracite consumes the extra carbon that in bituminous passes off in the form of smoke. Any fine size of anthracite will do, from fine buckwheat up to chestnut size.

Herr Heinrich Ehrardt writes from Vienna that the practice of using steel instead of copper as a material for fireboxes is not, as generally thought, an exclusively American feature. In Austria this is very frequently practiced. Herr Ehrardt gives some details on the selection and testing of the steel used for making fireboxes in Austria. The steel plates are not used as they come from the works; previous to bolting, they are heated so as to teliminate any vestige of brittleness. The excellence of the results obtained is shown by the fact that the coefficient of dilatation is 34 per cent., while in the case of American plates the average is 30 per cent.—*Engineering Review.*

The Chicago, Burlington & Quincy is experimenting with petroleum as fuel on some of its switch engines at Chicago, and on some of its locomotives running between Chicago and Galesburg. On one of the latter engines the oil exploded at Kewanee, Ill., May 24, scattering the burning fluid over the engineer and fireman. The fireman was enveloped from head to foot in flames, and jumped into the water tank. The engineer leaned from the cab and set the brake with his foot, and then rolled off into the wet grass. His clothes were burned off and his left hand badly hurt. It is reported that the engineer is so badly burned that he cannot recover. The fireman was also badly burned about the face, neck and breast.

The head of the car department issues instructions in reference to the care of passenger trains, the nature of the work, etc., but it remains with the foreman in charge of the work to see that the proper inspection and repairs are made, and that the trains leave the coach yard with everything in and about the cars in proper condition. A competent coach inspector should possess the faculty of observing the smaller details on the interior of cars as well as the exterior of them, and be able to detect missing parts or those in need of adjustment or repairs. While it is true in some cases that inspectors achieve a certain degree of success, too many of them have such positions "thrust upon them." I believe that strictly first class coach inspectors are born, not made.—*Mr. E. A. Williams, before the Northwest Railroad Club.*

The tank-car system is about to be employed in France for the transportation of wine. The Paris, Lyons & Mediterranean Railway Company is about to try this American method of cheap transportation for liquids. That railroad, more than any other in France and in Europe, runs across wine-producing regions; and the conditions of trade have lately made it imperative to lower the cost of carrying wine from the vintage to the cities where it is consumed. The new tank-cars of this railroad will have about the capacity of 12½ barrels. The subject of adopting tank-cars for the transportation of wine has several times been discussed in California, but Mr. H. J. Small, Superintendent of Motive Power and Machinery of the Southern Pacific company, informs us that the wine producers there are averse to using tanks for this purpose.

The Largest Mogul Locomotive in the World.

The engraving on this page shows the general construction of a mogul locomotive recently built for the Delaware, Susquehanna & Schuylkill Railroad by the Baldwin Locomotive Works. It is the largest engine of this type ever built, its total weight in working order being 151,000 pounds, and the boiler being 72 inches in diameter. It is a simple engine, with cylinders 22 inches in diameter and 26-inch stroke. The driving wheels are 62 inches in diameter, the driving-wheel base being 14 feet, the total wheel base 22 feet 5 inches, and the total wheel base of both the engine and tender being 50 feet.

The boiler is of cast steel plates $\frac{5}{8}$-inch thick, all longitudinal seams being butt jointed, double riveted, and having double covering strips. The throat sheet is made $\frac{1}{8}$-inch thicker than the shell sheets to prevent undue thinning where flanged. A working pressure of 160 pounds of steam is carried. As before stated the boiler is 72 inches in diameter, is made straight and has the dome at the center. It contains 270 iron tubes, No. 13 wire gage, $2\frac{1}{4}$ inches in diameter and 12 feet long.

The engine is designed to burn lump anthracite coal, and the firebox is $132\frac{7}{16}$ inches long and $41\frac{7}{8}$ inches wide inside. It is formed of cast steel plates that were annealed after flanging. The side and back sheets are $\frac{5}{16}$ inch thick and the crown and flue sheets are $\frac{3}{8}$ inch and $\frac{1}{2}$ inch thick respectively. The water space is 3 inches at the sides and back of the firebox, and 4 inches in front. Staybolts of $\frac{3}{4}$-inch iron are screwed and riveted to the sheets. All short staybolts are drilled at the sides, front and back. The crown is supported by radial staybolts one inch in diameter, screwed in and riveted over. As shown in the engraving the smokebox is of the extended type, with a straight stack having a flanged steel base. The frames are of hammered iron. The front rails are bolted and keyed to the main frames, and have front and back lugs forged on for the cylinder connections. The truck is of wrought iron, fitted with a swinging bolster. The wheels are of wrought iron with steel tires, and are $35\frac{1}{2}$ inches in diameter. The axle is of steel with journals 6 inches by 12 inches.

The pistons are of cast iron with steel rods. Metallic packing is used in the piston and valve-stem stuffing boxes. The crossheads are of cast steel with Ajax bearings. Balanced valves are used. The driving wheel tires are of Krupp crucible steel, the driving axles being of hammered iron with journals 9 inches by 12 inches. The driving boxes are of "steeled" cast iron with brass bearings. The connecting and parallel rods are of hammered iron, the latter having oil cups forged on. The pins are of steel. The boiler is fed by two 1889 Rue "Little Giant" injectors, and the cylinders are lubricated by Nathan triple sight-feed lubricators placed as usual. The cab is made of steel plates, and has a ventilator. The engine is equipped with the Leach sanding apparatus, a Pennsylvania Railroad whistle and a compressed air bell ringer. The headlight has a 17-inch reflector. The Westinghouse-American airbrake with a $9\frac{1}{2}$-inch air pump is used, and applies to the driving and tender truck wheels. The cylinders and boiler are lagged with wood, the boiler jacket being of planished iron and secured by beaded brass bands. All bearings are made of Ajax metal. All threads are of United States standard.

A distinguishing feature of this engine is its 6-wheel tender. The frame is built of iron plates $\frac{3}{4}$ inch thick, with wood bumpers. The six wheels work in jaws formed as shown in the engraving by the legs of the frame. The wheels are 42 inches in diameter, steel tired, with wrought iron centers. The axles of these are of steel with journals $6\frac{1}{2}$ inches in diameter and 10 inches long. As is well known, this form of construction is common on European locomotives, but this is the first instance of its adoption in the United States. The Rogers Locomotive Works recently built several six-wheel tenders somewhat similar in design for the State Railways of Chile. The advantages claimed for this form of construction are that it permits the use of larger tender wheels, giving lower rotative friction on bearings, longer wear of tires, etc., and lightness and simplicity of construction.

As showing how much larger this mogul is than others, it may be stated that the largest engine of this type known to us weighs 61 tons. This engine weighs 76 net tons in working order. The engine truck, tender and driving axles are of steel. The balanced valves are of the Richardson pattern. The valve motion is the ordinary Stephenson link motion.

LARGEST MOGUL LOCOMOTIVE IN THE WORLD—DELAWARE SUSQUEHANNA & SCHUYLKILL RAILROAD.

Difficult Railroad Construction.

The railroad of the Congo Valley is one that is being built from Matadi to Stanley Pool. The worst part of the road is built across the great ravines that run into the Congo River. There have been several terrible accidents on this railroad. The builders have had to use much dynamite, and by some carelessness there was recently a terrible explosion of dynamite that shook the whole region and killed many. The trains are running over the part of the road already finished, but not long since one of these plunged into the ravine below as it was passing round a sharp curve. The consequences were fearful. Much native help is being used in building this railroad. Many Africans from the Kroo Coast are there, and they make some of the best men for this kind of work. Many Europeans have died while working on this railroad. It is a very expensive undertaking, but it is being pushed through with much vigor. When it is finished the upper Congo and many of its large tributaries will be open to steam navigation with all the rest of the world.

A Chesapeake & Ohio Southwestern freight train ran into a gravel train in Standing Rock Tunnel, ten miles east of Princeton, Ky., May 19. Seven men on the gravel train were killed and several injured.

One hundred and eighty-six conductors and 654 porters of Pullman's Palace Car Company have been made to feel that the company appreciates their services. These have served in their respective capacities from five to twenty-five years as follows: Conductors—131, 5 years; 25, 10; 14, 15; 11, 20; 1, 25. Porters—331, 5 years; 91, 10; 31, 15; 15, 20. The men are to have a badge of honorable service, to be wore upon the left sleeve of the uniform, which will consist of an embroidered bar, gold for conductors, and silver for porters, and an additional bar for each five years of service; and each conductor or porter who has served 10 years or more will hereafter be presented with two uniforms a year by the company.

Structural Changes in Wrought Iron.

BY HOWARD STILLMAN.

The matter of structural change in wrought iron caused by torsion or twisting is but one of other means by which an altered structure may be produced. The object of this paper is to present the subject as it occurred to the writer in a practical way, and relates only to manufactured rolled or fibrous wrought iron. I will first present facts, and afterward attempt to give the reason why or the phenomena of structural change based, of course, on known physical laws.

Some time since the question of adding tensile strength to wrought-iron bars by twisting them was suggested, and various were the opinions advanced. Several tests were made with bars twisted hot and cold to prove or disprove the statements, care being taken in these first tests not to twist them enough to upset the fiber—a very necessary condition, as was afterward shown. Nothing came of these first attempts until the suggestion was made that they should be twisted cold as much as they would stand, when results were obtained that put a new light on the matter and led to a series of tests being made with merchant bar iron twisted at or near its limit of torsional strength. Accordingly a number of bars of one-inch square iron were taken from the same run of rolling mill, being known as merchant bar, and rolled from hammered scrap slabs. For testing, the bars were cut into 24-inch lengths and milled to $\frac{7}{8}$-inch square at the center, leaving a test section $\frac{7}{8}$-inch square and one foot long, with six inches at either end to twist by, also to grip in pulling. The object in having a test section one foot long was to insure a stated number of twists per foot in length.

It is evident that in twisting a given bar the portions farthest from the center will travel most and be subject to a degree of extension depending on the distance from the center of the bar. The condition of the twisted bar will depend much on the nature of the material and its elasticity. A lack of homogeneity would therefore be expected at different diameters, and for tensile strength of twisted bars the cross section should not be diminished by the test-section common to tensile specimens. Figures per square inch can only be reliable for a homogeneous material when figured up from reduced sections, as is usually done. For these reasons no further reduction or "test-section" was made of the bars we have described as milled for 12 inches in middle by $\frac{7}{8}$ inch square. Of these bars five were laid aside, the remainder twisted as follows:

A 30-inch lathe was provided with a square socket on the spindle and a similar one on the tool post. The tool carriage was thrown out of gear and left free to move on the lathe bed should the bar draw or extend in twisting. The sockets were well oiled to further admit of movement lengthwise. The cold bars were then inserted, leaving the 12-inch milled section free to twist. The number of twists per foot were thus subject to actual measurement, and the lathe head was stopped at requisite turns, the same being necessarily in slow speed. The first bar twisted off at $2\frac{5}{8}$ turns. The remaining bars stood each 2 turns without apparent flaw. No appreciable change in twisted length occurred. A contraction was looked for, but such was not the rule. After being thus twisted, the bars varied less than 1 per cent. in 12 inches, some in contraction and others in extension. Probably both occurred on either

ide of a neutral axis, having much to do with the structural change that occurred.

On the day following, both plain and twisted bars were pulled in the Olsen tensile machine of 200,000 pounds capacity.

A little time was given to allow the contracted fiber to set, as it were. Doubtless the length of this period would have affected results and the strength in one month would have varied from that in one year. The untwisted bars pulled in the usual manner, with no appearance unusual to ordinary wrought iron, being of requisite strength and proper ductility. The area where they parted showed a completely fibrous iron with the dull gray luster of a torn fiber. The twisted bars were somewhat of a surprise, as they showed much greater strength and broke with explosive violence. No reduction at the fractured area could be measured, and the elongation was extremely small. The elastic limit of these bars could not be determined, but must have continued almost to the point of rupture, which accounts for the violence with which the material parted. The broken section was completely crystallized and in no wise resembled the untwisted bars laid aside from the original number.

In the table the strength per square inch for twisted bars is not given, for the reasons previously stated, as such would express per square inch what could not occur for a square inch. It is evident that the amount of twist given a bar must depend on its size : small iron will stand more turns per foot than large. Experiments made with the same iron showed that one-inch square bars would not stand two turns per foot without twisting off.

Tensile tests of Merchant Bar Iron twisted to near its limit of torsion. All bars have test section of stated size, and one foot in length.

Testpiece.	Size bar.	Number of twists per foot.	Area before test.	Tensile strength.	Tensile strength per sq. in.	Per cent. elongation in 12 in.	Per cent. reduction of area.
	Inch.		sq. in.	Lbs.	Lbs.		
No. 1.....	⅞ × ⅞	.....	76	39,200	51,202	21.87	30.39
No. 2.....	⅞ × ⅞	.....	76	39,950	52,181	22.92	36.91
No. 3.....	⅞ × ⅞	....	76	40,400	52,770	21.87	27.58
No. 4.....	⅞ × ⅞	.....	76	39,820	52,012	23.95	37.81
No. 5.....	⅞ × ⅞	.....	76	39,810	51,999	22.92	36.00
Average...	⅞ × ⅞	.....	76	39,836	52,033	22.71	33.74
No. 6	⅞ × ⅞	2⅝	Broke in twisting				
No. 7.....	⅞ × ⅞	2	76	41,620	.....	2.58	1.12
No. 8.....	⅞ × ⅞	2	76	53,370	.....	Br. at clamps	
No. 9.....	⅞ × ⅞	2	76	54,620	.....	Br. at clamps	
No. 10.....	⅞ × ⅞	2	76	56,330	.....	4.00	3.41
No. 11.....	⅞ × ⅞	2	76	55,545	...	2.92	5.51
Average..	⅞ × ⅞	2	76	52,301	.....	3.17	3.35

SUMMARY OF AVERAGES.

Gain in tensile strength by twisting bar..... 31.28 per cent.
Loss in permanent elongation by twisting bar. ..... 86.15 per cent.
Loss in reduction at fractional area by twisting bar. 90.07 per cent.

Other tests were made with iron of different sizes and number of twists per foot. The results were very similar to these stated, and a repetition here is hardly necessary.

It is shown that by twisting wrought-iron bars toward their torsional limit an increased tensile strength may be given them; the same being borrowed, as it were, at the expense of ductility.

A newly established molecular condition is set up and its grain may thus in a few moments be altered from a good fibrous ductile material to one thoroughly crystalline. The process may be said to age iron in a brief time, as when crystallized from age, assisted by vibration, it will exhibit much the same peculiarities, becoming harder, brittle and less reliable, therefore of doubtful value for engineering purposes. The structural changes in wrought iron can best be understood by a brief reference to certain laws of matter and the phenomena of crystallization.

All matter is made up of infinitely small particles, atoms or molecules, as they are called. These molecules obey certain fixed laws of attraction and repulsion in regard to each other that are peculiar to the substance itself, and are dependent on outside conditions as the degree of temperature. We may have a substance in solid, fluid or gaseous form depending on outside conditions whereby the relative coherence of the particles is changed. In liquid form the particles lose their coherence and are free to move among themselves. Reverse the conditions and the substance becomes solid. In passing from fluid to solid the molecules obey their common law and become coherent in the form of crystals, the many forms of which are known to the science of crystallography.

A discussion of this science is unnecessary here, but we have from its study an invariable rule, though it takes almost infinite forms, that in passing from a fluid to a solid state the molecules form or group themselves in certain shapes known as crystals, composing in the aggregate the substance itself. Now, while the laws of crystallization are general, we are apt to be deceived by what we mean as a fluid state. The definition of a fluid does not state how free the particles may be to move among themselves, and, therefore, we have different states of fluidity, as water, tar, lead and iron. Wrought iron is to a degree fluid, and we have produced crystallization in a few minutes within it by applying a considerable degree of force at right angles to the length of the bar and thus disturbing its molecules.

It remains for us now to briefly consider the manufacture of wrought iron. We know it to be a comparatively pure state of the metal produced by working and puddling the decarbonized mass to free it from impurities, nd that in a hot, plastic state it is then hammered or rolled. The effect of this working is to force the particles into an unatural state instead of allowing them to set in crystalline form as nature had planned. They are squeezed and strung out, as it were, into filaments or threads and our product is a bar of fibrous iron. The particles will remain in this form if hammering or rolling is continued until the mass has cooled off below a white heat, otherwise they will take their natural shape and the structure become crystalline. Many failures in ordinary blacksmith work have resulted from overheating as when in welding, the bar being heated to what approaches a welding heat too far back from where the iron is worked at the weld.

Heat does not seem to be a necessary condition of this structural change, as we have seen that we could twist a cold bar to such an extent as to induce the crystallization, or in other words, cause the molecules to assume their natural or permanent state. The interlocking of this structure doubtless lends the increased tensile strength shown, and the loss of ductility would be naturally expected.

At best, we can consider fibrous wrought iron as but a temporary state of the metal. The crystallization of iron bridge rods, locomotive frames, straps or bolts, and steamship or other shafting, are but examples showing how slow structural change will occur—produced by small vibration or motion extended over long periods of time. The vibration of bridge rods or torsional power applied to shafting implies a motion among the molecules of the mass at right angles to their length, the effect of which will bring about the structural change to its permanent condition.

The examination of a piece of old broken wrought iron will show a coarse crystallization. In the case of our twisted bars, the crystallization is quite fine. This again shows a coincidence with known laws, as crystals when slowly formed are always larger than when quickly formed with the same substance.

SACRAMENTO, Cal., May 20, 1894.

Some Compressed-Air Devices for Railroad Shops.

Mr. F. M. Twombly, Master Mechanic of the Old Colony at Roxbury, Mass., related some of his experiences with compressed-air devices in shopwork at the May meeting of the New England Railroad Club. He said: I commenced the use of compressed air some two and a half years ago. The first thing I did was to make a hoist out of brass tubing, using for a piston rod cold-rolled steel shafting. I constructed the hoist for experimenting. At that time we were taking up our rails on the Providence Division, and they were to be shipped to Cape Cod for a second track. We had to drill two holes in each end of the rail, and two men were employed with a suspended drill for this purpose, one man receiving $1.50 a day and the other one $1.75 a day, and at night they were pretty tired with their work. The rails were raised with a chain and fall, which had a one ton lift, and cost $35. The hoist which I constructed and put upon this work, cost $28. I kept an account of the whole matter and found that the hoist paid for itself in 15 days. I put up hoists all over the shop for lifting all kinds of machinery and 42 inch passenger wheels. I rigged a radial-run hoist for various uses, and I propose to put up one in place of the derrick we have been using. I have used the air for elevating purposes, for lifting a cab through the floor, laying the hoist horizontally. The power can be multiplied or divided, as on any block and fall. The one we use for lifting through the floor has a cylinder 15 feet long. In the first hoist I spoke of the diameter of the tube was six inches and its capacity 1,500 pounds. I put a cylinder under the floor of the room to lift up wheels. I force oil out of the barrels into the tank by means of this power, using a sliding pipe, letting a little compressed air on top of the oil in the barrel, and it is forced into the tank. A barrel of water can be emptied very quickly in that way. I am constructing a machine to take sand into a tank the same as water. In the tank shop, where we build tanks for the whole system, we construct a great many, and they are built upside down. We have formerly turned them over with a block and fall, but now we have got some hoists to handle those tanks by means of air. I use this power on a copying press ; also to force oil onto a bolt when cutting it. I take an auxiliary reservoir and fill it with oil, letting a little compressed air onto the oil, and it can be applied to the work as you like, and when you want to run it into the tank again you remove the pressure and let it run back by gravitation.

There are thousands of things it can be used for, and there is no difficulty in running it up and down the yard ; it is only the cost of the pipe and the slight labor of putting it down. I have an overhead railroad in the yard, with hoists to load and unload cars, and for taking ashes out of tubs into cars, ann I use this power in many other ways. I am indebted to Mr. Medway for the plans for a pit for a pneumatic turntable.

Tramps stealing a ride on a Chicago, Milwaukee & St. Paul passenger train tried a new method of train wrecking near Minnesota City, Minn., May 15. They robbed the tool box on the rear of the tender of all its links and pins, and dropped these on the track while the train was running, in the hope of ditching it, apparently quite regardless of personal consequences.

Restoration of the Purdue Laboratory.

The work of restoring the engineering laboratory of Purdue University, which was destroyed by fire Jan. 23, has been rapidly pushed forward, and the faculty announces that the portion of the building which contained the foundry, woodworking and machine shops, and which was damaged in the fire, has been repaired, and all machines and tools originally contained therein have been replaced and are now in use by students. A new and larger cupola-furnace has been added to the equipment of the foundry. The engineering laboratory contained a large variety of machines, some of which were very heavy. These heavier machines were not destroyed, but all were more or less damaged. The triple expansion engine, the Westinghouse engine, the boilers, and some of the heavier hydraulic apparatus are being reconstructed upon the ground. The Locomotive "Schenectady" is to go through the shops of the Pennsylvania Railroad at Indianapolis.

The locomotive plant will be removed from the general laboratory to a new building especially designed to receive it. The new plant will be larger and much more complete than the original. Its parts will be made adjustable to receive any locomotive, and in order that the whole may be available for testing the performance of locomotives from any part of the country, the building will be connected by a track with the New York, Lake Erie & Western R. R.

The three years' experience with the original apparatus has been made the basis of a careful revision of the details of the locomotive plant. A new traction dynamometer, made up of the weighing portion of an Emery testing machine of 30,000 pounds capacity, has been specially designed, and is now under process of construction by Messrs. Wm. Sellers & Co. The possession of this fine piece of apparatus will insure great accuracy in the determination of drawbar stresses. Much other new apparatus will be connected with the plant. The steam engineering equipment of the general laboratory will be increased by the addition of the two engines of a Vauclain compound locomotive, arranged to be mounted as a stationary engine upon a foundation, and to be run with steam, under the load of a friction brake. The exhaust will be piped to a surface condenser which will serve to give the steam consumption of the engines, and provision will be made for the attachment of all other apparatus usually employed in testing steam engines. This important piece of apparatus is supplied through the generosity of the Baldwin Locomotive Works. For testing the strength of materials there has been purchased the 300,000 pound, upright Riehle testing machine exhibited at the World's Fair, and at that time the largest upright machine in the world. This machine will accommodate specimens up to ten feet in length, either for tension or compression.

The Trans-Siberian Railroad.

The construction of the Trans-Siberian Railroad was begun about two years ago, by the Russian Government, and a short description of the proposed line was then given in the NATIONAL CAR AND LOCOMOTIVE BUILDER. The work of construction is rapidly advancing and when completed it will be the longest railroad in the world. It will be about 5,000 miles long and is estimated to cost about $300,000,000. It will reach from Nijni-Novgorod, Oronburg and ports on both the Black and the Caspian seas to Vladivostock, on the Japanese Sea, and Okhotsk, on the bay of the same name, which is an inlet of the Pacific Ocean. It is not expected that the road will pay expenses for a long term of years, but it is an investment by the Government for economic, industrial and military purposes. It is expected to aid in the development of that vast territory, much of which is still unexplored, but whose mineral, agricultural, pastoral and timber resources are incalculable, to make accessible regions which are now beyond the reach of immigration, and have no means of getting their products to market, and to furnish the Russian Government with facilities for commanding the northern boundaries of its political neighbors.

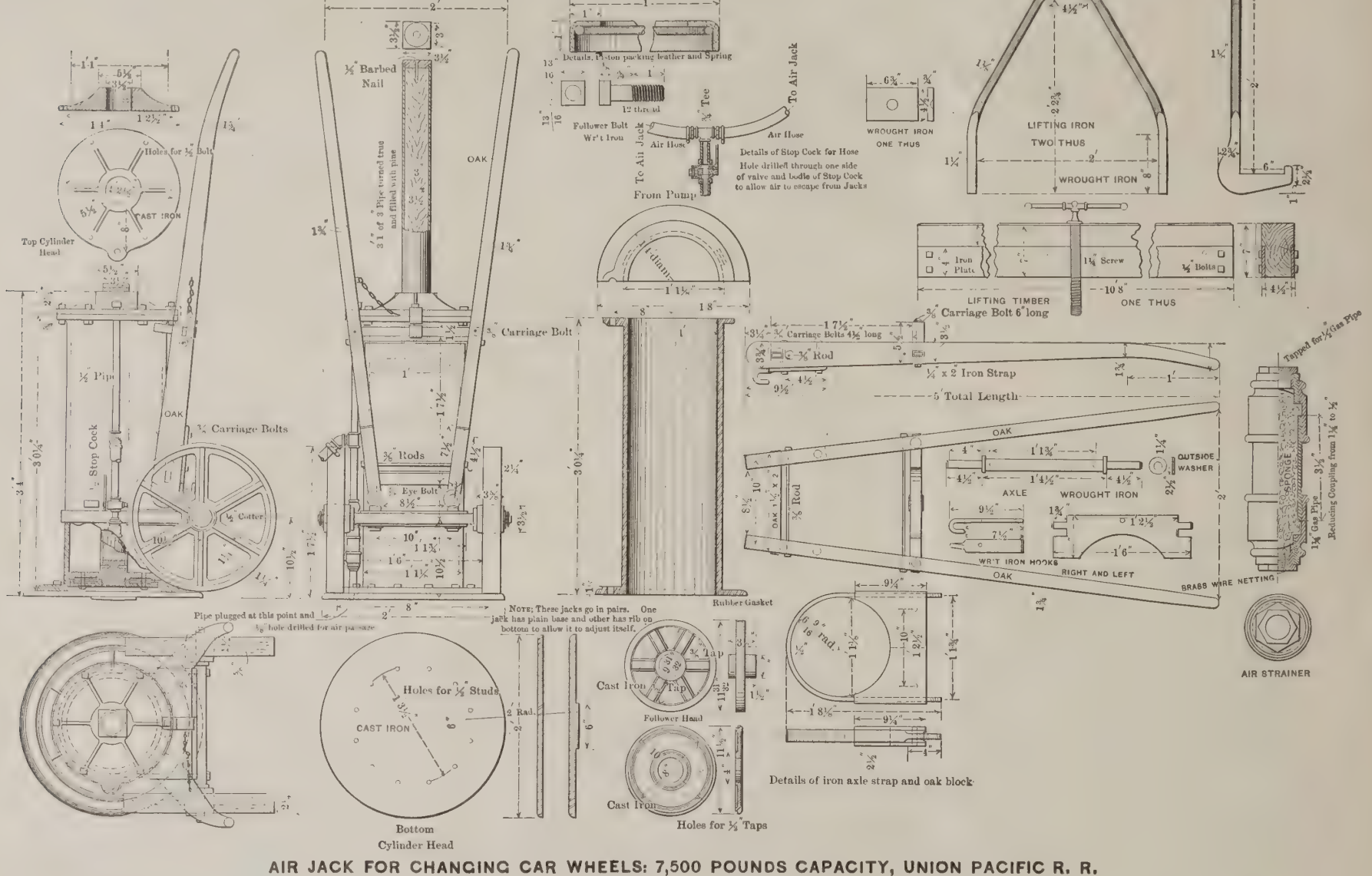
The popular idea of Siberia is that it is a barren desert extending from the frozen ocean on the north to the burning sands of the tropics, but this is a great mistake. The population of Russia in Asia is nearly 18,000,000. There are several cities with a population exceeding 50,000. The agricultural products reported, which constitute only a very small portion of the whole, are valued at an average of $30,000,000 a year. The output of the mines exported is valued at upward of $20,000,000 annually, and the furs, fish, skins and other products that come into European Russia from Siberia are worth $5,000,000 or $6,000,000. The proposed railway will open an area of about 5,000,000 square miles, not including the sterile districts of the north and south, which are not suitable for agriculture or pastoral pursuits. But the greater part of the area thus opened is either covered with forests or offers good pastures or is available for the cultivation of all the staples of the temperate zone, without irrigation.

The Baldwin Locomotive Works are building two large consolidation engines and two 51-ton passenger engines for the Buffalo & Susquehanna Railroad.

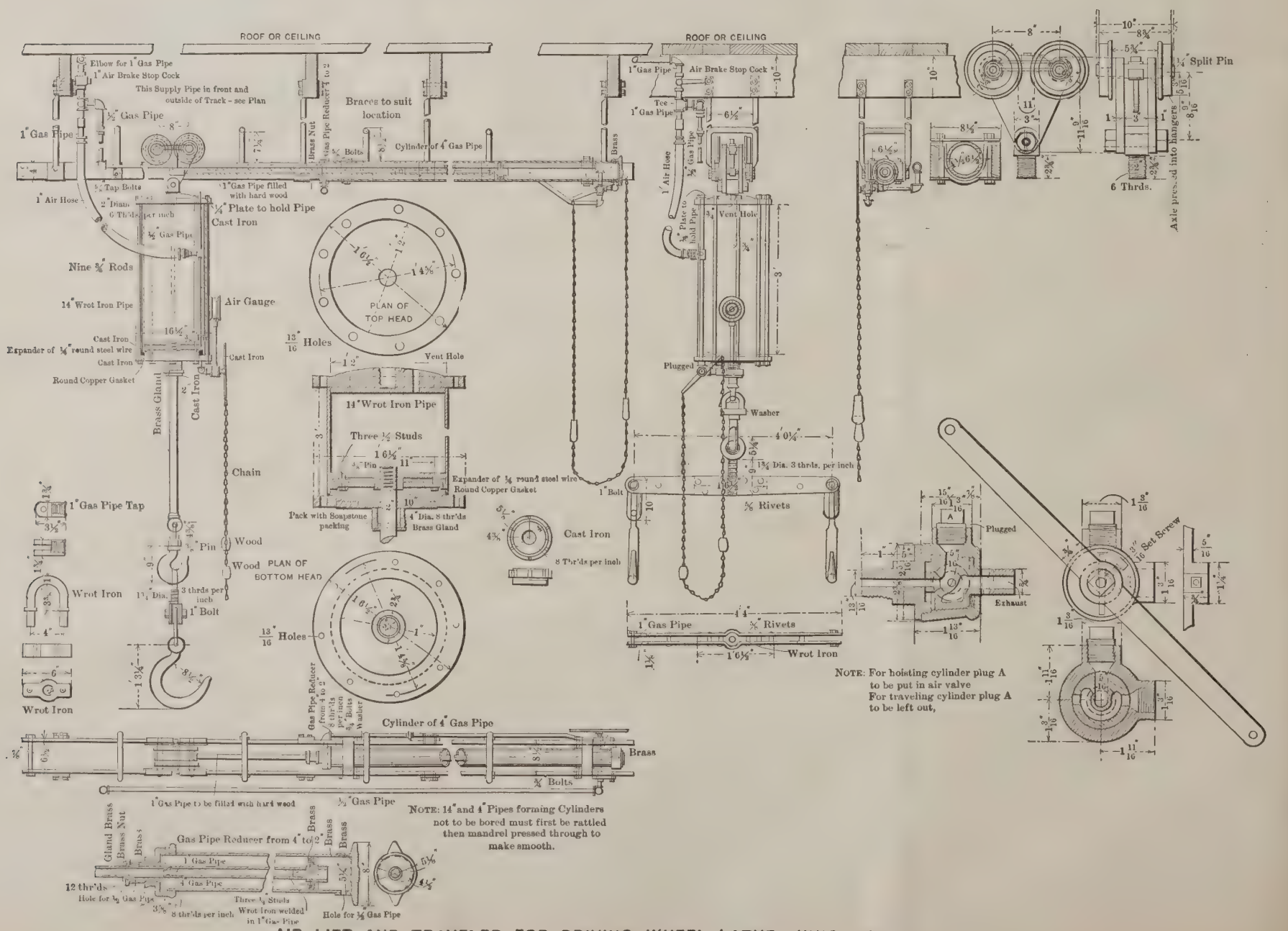
Compressed-Air Tools for Car and Locomotive Repairs.

In our last issue it was stated that compressed-air tools were extensively used in the general car and locomotive shops of the Union Pacific Railroad at Omaha, Neb. Some of these were named and their operation described in the issue mentioned. Through the courtesy of Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific, we are enabled to present herewith engravings which reproduce working drawings of two very valuable compressed-air tools that were not mentioned in our previous remarks. The first engraving illustrates a portable compressed-air jack of 7,500 pounds capacity, used for changing wheels in passenger car trucks. This jack has a cylinder 12 inches in diameter and 36¼ inches in length. The piston, follower head and top and bottom cylinder heads are of cast iron, and the piston rod is made of 3 inch wrought iron pipe, 37 inches long, turn true and filled with pine. The construction, arrangement and dimensions of these and the other details of this jack and its carriage are very plainly shown in the engraving. As thus shown, the jack is substantially mounted on an oak carriage, having cast-iron spoke wheels 19½ inches in diameter, and a wrought-iron axle 1¼ inches in diameter, with 4 inch by 1¼ inch journals.

These jacks are used in pairs for the purpose of lifting passenger car trucks clear of their wheels for the purpose of renewals, etc. A "lifting timber," made of pine, 10 feet 8 inches long by 4½ inches thick by 7 inches in diameter, is used in connection with the jacks. The



AIR JACK FOR CHANGING CAR WHEELS: 7,500 POUNDS CAPACITY, UNION PACIFIC R. R.



AIR LIFT AND TRAVELER FOR DRIVING WHEEL LATHE. UNION PACIFIC R. R.

modus operandi is to place the jacks on end at each side of, say, a 6-wheel truck. The lifting timber is extended across the truck from jack to jack, the ends resting on the piston rods of the jacks. Attachment to the truck frame is made by "lifting irons," which straddle the lifting timber and hook beneath the wheel-pieces on each side, and on either side of the jaws for the middle wheels. The air-hose having been coupled and the pedestal straps removed, the air pressure is admitted simultaneously to the jack-cylinders through the stop-cock, and the truck is lifted clear of the wheels before one can say "Jack Robinson." It is held in this position as long as desired, and finally lowered into place by turning the handle of the stop-cock, the details of which are shown in the engraving. This cock has a $\frac{5}{16}$-inch hole drilled through one side of the valve and body to allow the air to escape similtaneously from both jacks. The lifting irons are made of wrought iron, and their construction is accurately shown in the engraving. The lifting timber is reinforced by $\frac{3}{8}$-inch by 4-inch iron plates extending its full length and set in flush with each side at the bottom, and secured by two $\frac{1}{2}$-inch bolts at each end and by No. 18 screws placed zig-zag between the ends.

The next engraving shows the drawings of a compressed air lift and traveler for a driving-wheel lathe. The drawings show cross and longitudinal sectional views of the lift, traveler and roof attachments, a front elevation of the lift, and a plan and enlarged longitudinal sectional view of the traveler. These drawings are so complete and the construction and arrangement of the apparatus are shown in such various ways that an extended description would be superfluous. It is the finest arrangement of lift and traveler that has come to our notice, and it performs its work in a most admirable manner. The lift cylinder is made of a piece of 14-inch wrought-iron pipe and the cast-iron top and bottom heads are secured by nine $\frac{3}{4}$-inch wrought-iron rods that reach from head to head. The traveler has a run of 5 feet, and the range of lift is 3 feet $8\frac{3}{4}$ inches. The traveler cylinder is of 4-inch gaspipe with a brass piston and a one-inch gaspipe for the piston rod. The glands of both the lift and traveler are of brass, and the stuffing boxes are packed with soapstone.

Locomotive Boiler Tubes. II.

BY JAMES F. HOBART.

(*Continued from page 79, National Car and Locomotive Builder for May.*)

Utilizing Old Tubes.

Once a tube has been removed from a boiler it can be further utilized in just three ways. 1st. Cut off, a piece welded on, and replaced in the boiler it came out of. 2d. Put into a shorter boiler. 3d. Thrown into the scrap heap. Usually, the second way is tried first, if there be any shorter boilers on the road using tubes of the same diameter.

Next, the tubes, after removing from the short boilers, may be spliced out by welding a short piece to one end of each tube, and this operation comes up for discussion next. If there is a pipe machine in the shop the tubes may be cut off to any desired length in that machine to great advantage. We may also cut up the short pieces, to be welded onto the tube, in the same machine. If no pipe or cutting-off machine is available, take or rig up a lathe with a hollow spindle, and do the cutting with that tool.

Next the ends to be welded together must be chamfered. By hand, this is done to the long piece by giving a welding heat, then driving in a conical drift of just the right taper, and then reducing the thickness of tube with hammer and swage, as shown by Fig. 4. In this illustration, *a* represents one end of a boiler tube, and *b* the conical drift. At *c* is shown the effect of the drift. The inner diameter is enlarged to the diameter of the outer surface of the tube, and then the expanded part is swaged down while on the drift, as shown at *d*. That is, the outside of the tube is made straight again, while the bore is tapered as shown by the dotted lines, the left hand end being brought as near to a knife edge as practicable. This tube is ready for the welding operation.

The short piece of tube to be welded on is tapered on the outside, as illustrated at *e*, the tapering being done in the lathe or cutting-off machine. In welding, a tube and a short piece are driven together cold, then put into the fire, and when they get heated to redness are again driven together endwise, slightly. After the welding temperature has been reached the tube is given—in the fire—several smart blows sufficient to unite the surfaces. Then the tube is removed, an arbor shown at *f* is driven into it, and the weld smartly hammered with tools which just fit its outside diameter.

There are two kinds of tools for welding tubes by power. One works by means of a little independent steam engine. This tool welds by striking like a trip hammer, but the hammering is done *in the fire*. It is a very complicated machine and not generally in use. Another machine welds by rolling the hot surfaces together. The tube is first heated and put together as if for hand welding, then slipped onto the arbor of the machine and the rolls do the swaging act in fine style. The arbor used is about like that shown at *f*. The roll machine is very extensively used for tube welding, and is generally satisfactory in most places.

Still another method of tube welding is by electricity. In this manner of proceeding the two pieces of tube are both squared off, the edges rounded a little to squeeze out any dirt that may be caught between them; then the ends of the tube are brought in contact and an electric current of low pressure (say two or three volts) and great current strength is passed through from one piece of tube to the other. At the joint the contact is poorer than anywhere else in the tube, and the current in forcing its way through the poor contact generates sufficient heat to melt the tube at this point. The pieces are pressed firmly together and unite into a perfect weld.

Fig. 5 shows a weld made by electricity. It will be seen that a rim or ridge was raised up all around the outside of the tube. In good welding, however, the "fin" raised need be a great deal less than that shown in the engraving, but even with as large a fin as in the engraving there will be but very little metal thrown up on the *inside* of the tube; this is shown when the tube is cut away so as to expose the interior, and a longitudinal section through the weld. It will be seen that the internal fin is very slight. The reason for this is that the flow of the metal when pressed together in a semi-fluid condition during the welding operation must be nearly, if not quite, all in an outward direction. A very little thought will show why this is so. The metal, when the tube is pressed together endwise, must either go in or outward. But the inner surface of the tube forms, or should form, a perfect circle, and we all know what an enormous external pressure a very thin shell of metal will stand; we are also aware of how easily a circle or arch is destroyed when pressure is applied to the inside thereof. It must also be remembered that the conditions here are not like those under which pressure is sustained in a boiler, because the tensile strength of the material has been removed by heating; therefore, the conditions apply more nearly to those of a circular arch laid up of loose bricks. If we crush this arch in the direction of its length, the flow or movement of the loosened bricks will be nearly all outward, because the inner layer still forms a perfect arch, and offers great resistance to pressure upon the outside of it. It is much the same with the molten metal of the tube, the inner skin of the iron, and some of the particles also, form an arch which has a greater resistance to inward pressure than all the rest of the metal has to outward pressure; hence, almost all the metal flows in an outward direction and forms the heavy fin or ridge, while the inside of the tube is nearly smooth, and, by a little care in operating the welding machine, may be kept with an almost undiscoverable fin. Indeed, the internal ridge may be entirely abolished in electric pipe welding by removing with a file or reamer a very small corner of metal on the inner surface of the tube. When well done, the electrical is the best of all tube-welding methods.

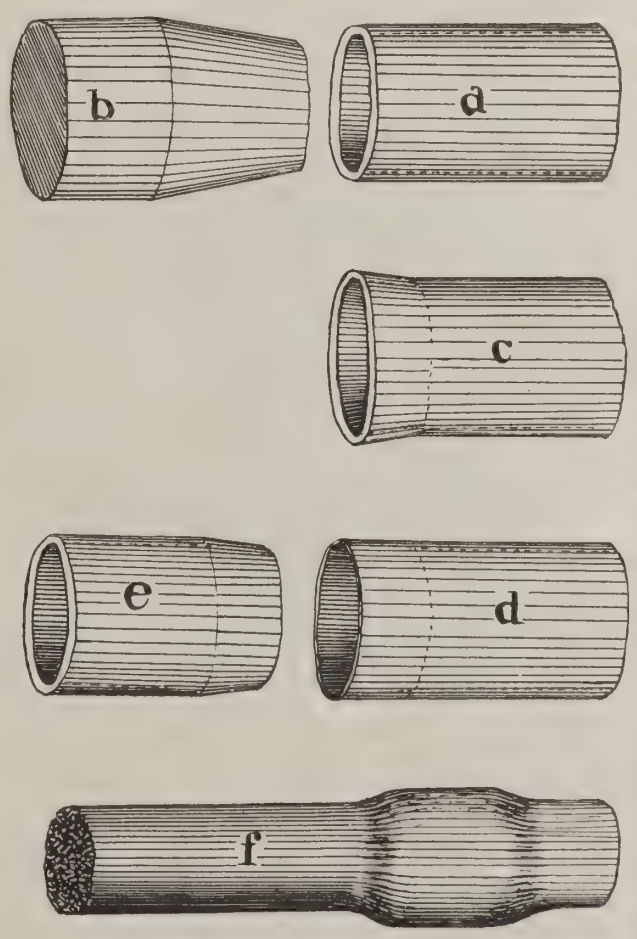


FIG. 4.—TUBE WELDING BY HAND.

I have already stated that but two or three volts pressure are required to weld iron. And even one or one-and-a-half volts will do the work perfectly. But a great number of ampères will be required. The quantity of current required to fuse any piece of iron may be found by simple caculation. The rule is :

Current equals the square root of cube of diameter multiplied by a constant for the particular metal to be melted or welded.

In other words :

$$C = ad^{\frac{3}{2}},$$

where

C = current in amperes.

a = constant, 3148 for iron.

d = diameter.

In a two-inch tube, $\frac{1}{8}$ inch thick we have a cross-sectional area of metal of .7358 square inch, just about equal to a solid rod of 1 inch in diameter, which would have an area of .7854 square inch.

Then, according to the rule,

$$C = 3148 \times 1.^{\frac{3}{2}}$$

This, luckily, comes out very easy: the square root of $1 = 1$, and the cube of $1 = 1$ also; therefore as $3148 \times 1 = 3148$, also C must equal 3148, the number of amperes required to weld one 2-inch tube. Under pressure of two volts there would be $2 \times 3148 = 6296$ watts, and as 746 watts equals one horse power it will require $3148 \div 746 = 4\frac{2}{10}$ horse power. Really, it requires no more power to weld a tube by electricity than it does to drive the blower to supply the fire required to weld the tube by hand or by machine. And the actual time of putting the tube into the machine, heating, welding and removing need not be over three or four minutes for each tube. Power will be needed only about one-half this time, merely during the time of heating.

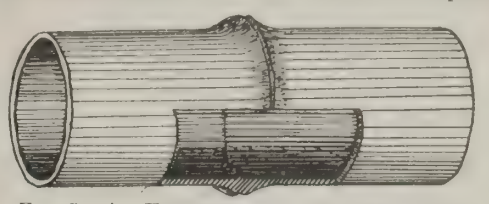


FIG. 5.—AN ELECTRICALLY WELDED TUBE.

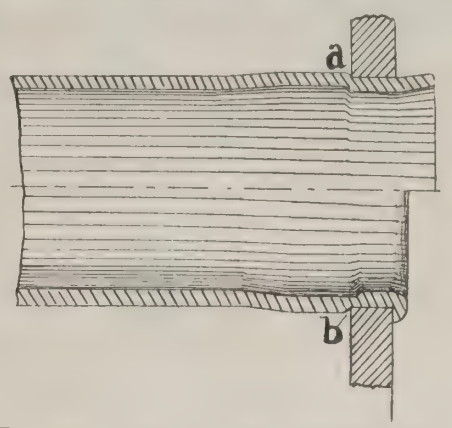


FIG. 6.—A TUBE DAMAGED IN EXPANDING.

Before being placed in a boiler every welded tube should be tested by hydrostatic pressure by at least one-half more than the steam pressure that is to be carried. The usual method of testing, where it is practiced at all, is to clamp each tube endwise between two supports faced with leather. Through one of the discs a pipe leads off to a force pump. After the tube is in place water is forced into it to the pressure required, and the tube is examined under pressure for leaks. The great objection to this method of testing is that the tube is under compression endwise while being tested, while in actual working conditions the tube is under tension. The conditions of any flaw in the weld might be very different in the two situations.

A very simple rig can be arranged for testing tubes, and if no other pump is available the wheel press pump can be utilized for this purpose. But in case that is used, do not make the mistake that one master mechanic did. He thought he might as well use the wheel press for his clamping device as well. So he made a couple of castings for the bearings at the ends of the tube. A cavity was bored out to receive the packing, and a hole was drilled through the center of one bearing and piped to the cylinder of the press. The theory advanced was that the bearings were to be hung to the upper stress rod of the press, the same as pulling off blocks and other "fixin's" were suspended. Then, when a tube was put in and the pump started the ram would force the bearings against the ends of the tubes so tightly that no water could escape, and by working the pump until the required pressure was obtained, the tube could be held in place and tested all at once without making any special clamping device.

He tried it. Spent $100 in making the necessary rigging. It was finally finished, and hung to the wheel press, piped up and a special pressure gage fitted to the water passage through the hollow bearing. The tube was put in place, the pump started, and the ram came right up and held bearings, tube and all as tight as if in a vice. But the rest of the test didn't work as well. Somehow or other he never could get 250 pounds pressure per square inch in a tube. Before he could do it, the tube was sure to buckle and break in two. After breaking half a dozen tubes in this manner, the master mechanic sat down and did a little figuring. He found that the ram was 7 inches in diameter, and consequently had a cross-sectional area of 38.48 square inches. As the tubes broke when the pressure gage indicated about 200 pounds, he found that the tube had to carry a load of 7,696 pounds, or 3.8 tons, more compression than a 2-inch tube 8 feet long could stand. Consequently the tubes broke.

In putting in tubes, both old and new, there is one point which deserves special attention. It is to have the expander fitted to the thickness of the tube sheet. Fig. 6 shows what happens when an expander is used which is made for a thinner tube sheet. The tube is reduced in thickness as shown at *b*, and is much weakened thereby. Frequently it happens that the tube is so badly cut at *b* that it breaks entirely off the first time steam pressure is put upon it. The correct form of expanding is shown at *a*.

Repairing Locomotives. XII.

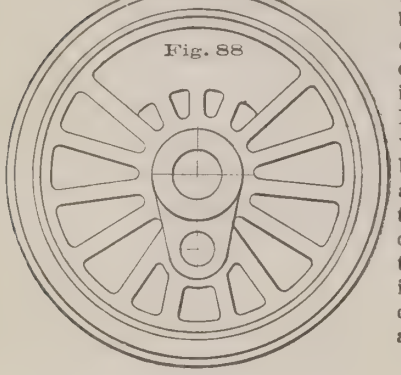
BY J. T. HEFFERNAN.

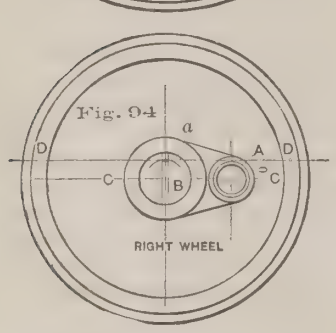
(*Continued from page 77* NATIONAL CAR AND LOCOMOTIVE BUILDER *for May.*)

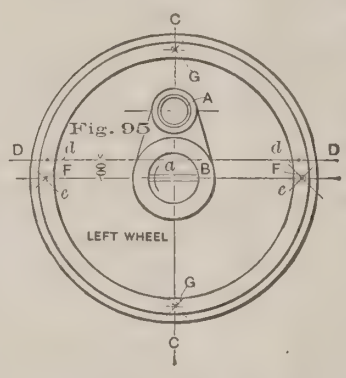
Driving Wheels.

Putting on Tires. Quartering, Counterbalancing, Straightening Bent Axles.

Figs. 92 and 93 show rather a novel form of wheel center and methods of fastening on the tire. In this wheel center is shown a very powerful wheel, one adapted to heavy freight work—I speak now of only the wheel center and not in regard to the tire. This wheel center is usually made with a solid counter-weight. Sometimes in casting a body of metal of this size there is danger of the casting cracking on account of the strains set up by unequal contraction in cooling, and to avoid this, usually at each opening the iron is parted nearly in to the rim of the wheel. The tire fit for this wheel center is turned tapering, and the tire is bored out to a corresponding fit and is held in place by hook bolts, the nuts of which draw against the wheel center, the heads drawing against the tire. Recesses are cast in the wheel center for these bolts to pass through and the tire is cut out to receive the heads, and on the opposite side on the wheel center there is a small disc cored out to allow the bolts and nuts to be placed inside the inner face of the tire. The slots—*BB*—all around the wheel center show the shape of these hook-bolts and the sectional view at *A* in Fig. 93 shows the bolt in position when the tire is in place. To put on a set of these tires no heating is required. They are put on the wheel centers cold, and the bolts are then put in and the nuts screwed up all around. Now, to avoid putting a big strain on the bolts while trying to draw the tire up into place, use only a moderate strain, but take the same strain on each bolt, then with a sledge strike the tire all around, driving it on and at the same time tighten up each bolt. Continue to do this until the tire is up into place, then set up all the nuts hard and rivet the bolt over very slightly, just enough to prevent the nut working off of itself. I only know of one road using this method of fastening on tires and they claim it gives excellent results.







In fitting up a set of new driving wheels in a shop where there is a quartering machine there is no laying out of the wheels, the only thing necessary being to put the wheels on the axle true enough so the crank pin holes will be about square with each other, as after being forced on they are put in the quartering machine and the holes for the crank pins are bored perfectly "square" and in line with the axle. But in a shop where there are no such appliances, as a division shop or roundhouse, other means and closer laying out are necessary. On American engines the right hand crank pin is always in the lead, so in Fig. 94 we show the right hand crank pin on the forward center, and in Fig. 95 the left hand wheel on the top quarter. Now we will suppose that the crank pin and wheel on the one side are in place and we we are going to put on a new wheel on the opposite side. We will suppose in this case that it is the left hand wheel we are going to put on. Our first move is to find a line central with the center of the axle and with the crank pin. Let the circle *A* represent the collar of the crank pin, then on the axle we draw an arc *a* the same size as the circle of the crank pin. Resting one edge of a straight edge on the collar, move it until it comes on a line with the axle, and draw the line *DD*, which is parallel with the line *CC*. Now in Fig. 95 draw the line *CC* through the center of the axle *e* and the center of the crank pin hole, and with a tram, using the center of the wheel as the center, draw the arcs *GG*. Our next move is to find a line at right angle to *CC*. With *G* 1 as a center, draw the arcs *ee*, and with *G* 2 as a center, draw the arcs *dd*, through the intersection of those arcs draw the line *FF*. As the line *DD*, Fig. 94, is set above the line *CC*, equal to the distance *O*, we take this same distance and from the line *FF* lay it off on the wheel and draw the line *DD*. Having the line *DD* on the right hand wheel and a line to correspond with it on the left hand wheel, all that is necessary to bring these wheels to an exact quarter is to set the right hand wheel level, then bring the left hand wheel up to the axle and enter it a little, just enough to hold it, and bring the lines *DD*, *DD* level. In fact, if you use long straight edges you can sight across and get the wheel exactly in line, and when you have them so mark the keyways, cut them in and the wheel is then ready to be forced on.

Another way of doing this same job is to lay out the right hand wheel as we have already done, but instead of laying out the left hand wheel in the manner explained, the right hand wheel is brought to a level, and a plum line dropped through the centers on the left hand wheel. I think the use of two straight edges will give closer work, because, say, with a 5-foot wheel that has a 12-inch crank, by using a plum line we only have 12 inches to detect any error in, and with the straight edges we have 5 feet or more, only limited in fact by the length of our straight edges.

Occassionally it becomes nesessary to increase the counter-balance on a pair of wheels; to do this the weights are fitted between the spokes and are either bolted or riveted together. To calculate the amount of counter-balance for each wheel according to the rules given by D. K. Clark's "Railway Machinery," we first find the separate revolving weight in pounds of the crank pin, crank pin hub, half the side rod and half the main rod. This is for the main wheel. For the other wheel just the weight of the crank pin, crank pin hub and half the weight of the side rod are taken. Now there is another weight which we must consider, namely, the reciprocating weight which includes the piston, piston rod, cross head and half the weight of the main rod. In the practice of to-day only about five-eighths of the reciprocating weight is taken and distributed over the wheels.

We had better go over the regular way of doing this so as to make it clearer. The revolving weight for each wheel is to be balanced by itself and then five-eighths of the reciprocating weight is to be divided among all the wheels. For example we will take an engine with two driving wheels, that is, an ordinary eight wheeled engine. To balance the back wheels we find the weight of the crank pin, crank pin hub and one-half the weight of the side rod. Add these several weights together and their sum will be the revolving weight on the crank-pin side, which must be balanced by a counter-weight placed diametrically opposite the crank-pin. For the main wheel the weight of the crank pin, weight of the crank-pin hub, half the weight of the side rod and half the weight of the main rod must be taken as the weight to be balanced. Now to these weights we must add five-eighths of the reciprocating weight among the four wheels, or one-fourth to each wheel. We will give an example of this to make it a little clearer. For example let us say that the side rod weighs 280 pounds and the main rod weighs 320 pounds. Now to find the amount on the crank-pin side of the main wheel, we will suppose that the main crank pin weighs 80 pounds, the crank-pin hub 190 pounds and half the main rod 160 pounds, one-half the side rod 140 pounds; then the total revolving weight to be balanced on the main wheel is 570 pounds. On the side rod we will let the crank pin weigh 70 pounds, crank-pin hub 140 pounds and half the weight of the side rod 140 pounds; in all 350 pounds. For the reciprocating weight we will say that the piston weighs 350 pounds, the cross head 170 pounds, and half the main rod 160 pounds; in all 680 pounds. Now as we only take five-eighths of this weight, or 425 pounds, to be divided among these four wheels, then each wheel would have 106¼ pounds of reciprocating weight to balance in addition to its revolving weight. Now then, the amount of counter-weight for the back wheel must be 350 pounds plus 106¼ pounds equals 456¼ pounds, and of the main wheel 570 pounds plus 106¼ pounds, or 676¼ pounds.

To show perhaps a little more clearly why we must take into consideration the weight of the piston, crosshead and rods, we will suppose the engine to be a vertical instead of a horizontal engine; then let the crank pin be on the top center: as soon as it is moved off the center a little way the effect of the weight of the rod, crosshead and piston will be to move it rapidly to the bottom center, but from the bottom centre to the top it would take a power to raise it equal to the weight of the piston, crosshead, rods and crankpin. Now, if we place a weight equal to the weight of these opposite the crankpin we can move the pin from the lower center to the top center just as easy as we can move it from the top center to the lower centre. The reason why the full weight is not employed (and on this point there is a great difference of opinion, some varying from one-half to three-quarters of the weight) is to do away with the vertical throw as much as possible, for an engine that is fully balanced when runing at high speeds strikes the rail a very hard blow as the counter-weight comes around toward the rail, and tends to lift the wheel as the counter-weight passes the top quarter. I believe, though, for a slow freight engine with small wheels that they should be balanced for the full weight.

If he could put the counter-weight at a point directly opposite the crank pin and an equal distance from the center of the axle, the weight of the counter-weight would equal the weight of the crank pin, hub, etc. But this is impossible, so we must distribute the weight around on the wheel to get in the required amount. To do this we first determine the shape of our counter-weight; usually they are shaped about like the one shown in Fig. 88; so we cut a template as shown in Fig. 99, which is about the shape we want the counter-weight to be, and through it draw a line *AB*, central from the sides of the template. A piece of sheet iron about one-sixteenth inch thick makes the nicest template. Drill a hole about one-forth inch in diameter at each corner of the template *C* 1 and *C* 2. Suspend the template on a pin at *C* 2, letting it be free enough on the pin to swing easily and through the hole, drop a plumb line; where this line meets the line *AD*, that point, *D*, will be the center of gravity of the template; to prove it swing the template from *C* 1, and drop a plumb line through it and it will be found to meet the center line *AB* in the same point as the plumb line from the hole *C* 2. Where there are two counter-weights used, find the center from the templates the same as in Fig. 99 setting the counter-weights apart to allow for the spoke between them as shown in Fig. 100.

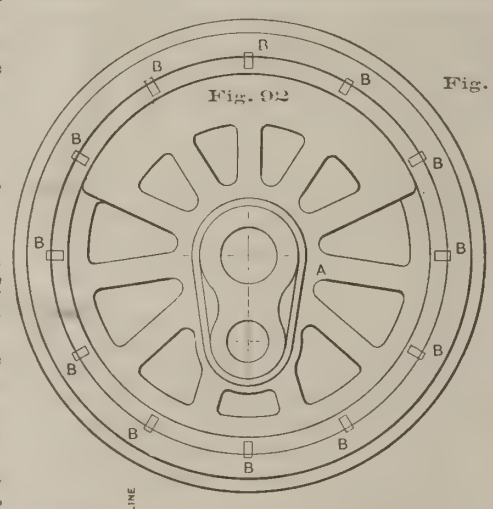
Having found the center of gravity as already explained, and with the center of the axle as a center, draw an arc *AA* through the points *DD*, then connect these points *DD* by a straight line. Draw the line *CC* from the center of the axle to the center between *DD*, and where the line *CC* meets the line *DD*, at *O*, will be the center of gravity for a two-weight counter-balance. For a three-weight counter-balance, as shown in Fig. 101, find the center of each counter-weight from the template, and through the centers thus found, with a radius from the center of the axle to the points *DD*, draw the arc *AA*; next draw the line *D'D'* from the center of gravity of the two outside weights, and divide the distance between this line and the arc *AA* into three parts. The center of gravity will be one-third of the distance apart of these lines on the line *CC*, or the point *O*, which will be the center of gravity of the three weights.

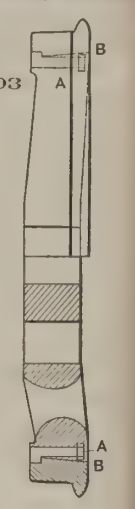
Having found the center of gravity for the counter-weights, measure the distance from it to the center of the axle; and having this distance, it is only a proportion of weight to get the correct amount. To make this clearer we will give an example. Let the distance from the center of gravity of the counter-weights be 14 inches and from the center of gravity on the crank-pin side to the center of the axle be 12 inches, and the weight to be balanced be 456 pounds. As the distance on the counter-weight side is 14 inches, while the distance on the crank-pin side is only 12 inches, we can readily see that we will not require as much counter-weight as we have weight to be balanced, so we make a proportion out of it which will read: the counter-weight is to 456 pounds as 12 is to 14. Working out the proportion we find the weight of the counter-weight to be 390$\frac{8}{10}$ pounds, or nearly 391 pounds.

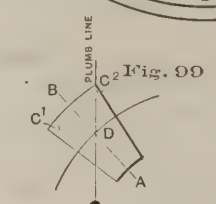
Of course, it may be that the center of gravity of the counter-weights will be closer to the center of the axle than the center of gravity of the crank-pin weights. Now in that case we see that a greater amount of weight will be needed. There is no chance of getting mixed up on this or of making any errors, if we just remember that if the center of gravity of the counter-weights is farther from the center of the axle than the center of gravity of the crank-pin weights, the actual weight of the counter-balance will be less than the actual weight of the crank pin and its weights; while if the center of gravity of the counter-weights is closer to the center of the axle than the center of gravity of the crank pin, the actual weight of the counter-balance will be more than the actual weight of the crank pin and its weights.

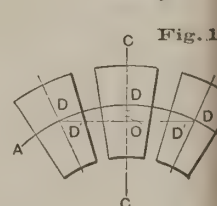
There is very little difference in driving axles, most of them being turned straight where the driving box fits and forged a little smaller toward the center. It is about an even choice as regards axles whether to use hammered iron or steel. Crank pins should not be forced in until after the tire is shrunk on. If they are put in at a pressure of about five tons per square inch of diameter, and the holes are bored out true and the wheel is a good close iron, they will never give any trouble or become loose.

It sometimes happens that through accident an axle will be sprung; and while the defect is easily detected, still to find just where the axle is sprung can only be determined by putting it on centers in the lathe. To find how much it is bent without putting it in the lathe can be done by measuring from one wheel to the other, using a tram. The wheel centers are always turned up on the axle and the inside edge near the tire fit faced off so that, if we take a measurement from four points on the wheel center close to the tire to the same place on the opposite wheel, it will show the amount of bend, and this can be done while the wheel is under the engine. If you find it is not very badly sprung do not remove the wheel, but straighten it in place. The chances are that it will be impossible to tell exactly where the axle is sprung, but if we heat it in the center we can straighten it so it will not give any trouble. A good rivet forge placed in the pit close up to the axle and a coke or charcoal fire built in it will soon heat the axle without any damage to the jacket, or if it be a back wheel without smoking up the cab. It would be well before heating the axle to take down the rods and jack up the engine so as to take off all the weight, and after getting the axle hot put the wheels in the position so that they will be widest apart at the top, then with water cool off the *top* of the axle as by doing this the bottom of the axle is drawn, for when the axle is hot if we contract the top, leaving the bottom expanded, it is sure to be drawn some. If you have had no experience with water straightening, use a couple of long bolts and pull the wheel in where it is the widest, using a jack on the axle to help. Every roundhouse should be equipped with a drop pit capable of dropping a pair of wheels, and made so the wheels can be removed from under the engine after they are dropped.









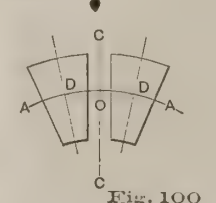


Fig. 100

The Georgia Railroad has been asking bids on 500 box and coal cars.

Argentine Passenger Cars.

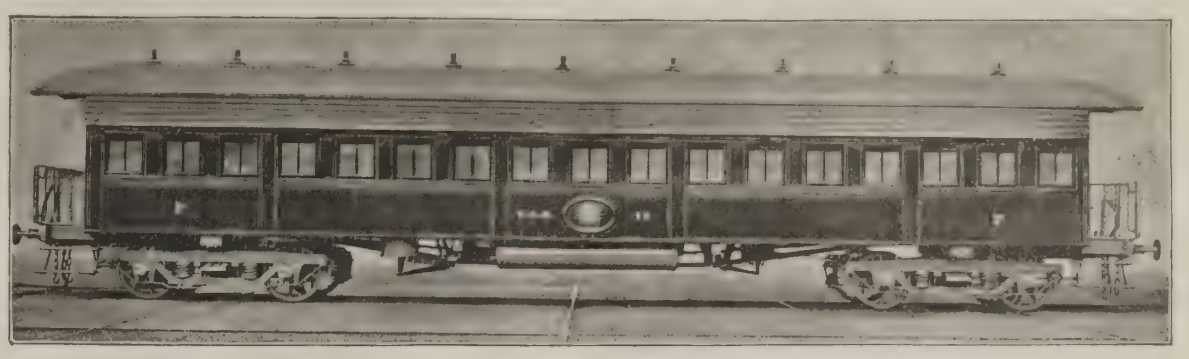
The engravings on this page are reproduced from photographs given us by Mr. F. W. Barrow, General Manager of the Southern Railway (Ferro Carril del Sud) of Argentina. This is the largest railway in South America, having 1,398 miles of track, 365 passenger coaches, 183 locomotives, and about 7,0 0 freight cars. The road runs from Buenos Ayres to Bahia Blanca, one line of the road running to Mar del Plata, a famous summer resort on the Atlantic coast just south of the mouth of the Rio de la Plata. The management of this road is very progressive, and the roadbed, bridges and other structures and the rolling equipment are kept in the most perfect order. Mr. Robert Gould is the Locomotive, Carriage and Wagon Superintendent, and Mr. Percy Grant is the Chief Draftsman. Mr. Barrow, the General Manager, and Mr. Grant are at present in the United States, and are engaged in making a tour of our principal railroads and noting the latest improvements in the art of railroading as exemplified on such roads.

Our engravings show exterior and interior views of one of a number of large first-class passenger cars designed and constructed at the company's shops in Buenos Ayres. The car is very similar in construction to American passenger cars, and would not look out of place on one of our best railroads, although the coupling and braking arrangements would give some trouble under such circumstances, as they would not gee very well with American couplers and brakes. The car is mounted on two four-wheel trucks with wrought iron spoke-wheels 37½ inches in diameter. The trucks are of the swing beam type with wheel base 7 feet 6 inches. The gage is 5 feet 6 inches. The car is 59 feet 6 inches long over the buffers, and 51 feet long over the end sills. It is 12 feet 9¾ inches high over all. It is equipped with automatic vacuum brakes, the ordinary English type of couplers and buffers, and is illuminated by the Pintsch system of compressed gas. Particular importance is given to ventilating arrangements in these cars, and the hood of lapped boards running the length of the car body just above the windows is a feature of the ventilating system. Beneath this hood there is free passage for air to and from the car, and the passengers can regulate the ventilation at will by pulling out or pushing in the knobs situated just beneath the parcel racks on each side of the car. These knobs operate valves that regulate the flow of air through the ornamental openings just above the parcel racks. In place of the monitor roof or clearstory, the sides of these new cars are carried high with a flattened roof, which gives a maximum space for the interior of the car without the clearstory, which in a flat country exposed to high winds has been found to have considerable effect on the speed of the trains.

INTERIOR OF FIRST-CLASS ARGENTINE PASSENGER CAR.

The exterior of the car is covered with varnished cedar V-matched boarding divided into panels with ⅝-inch moldings. The roof boards are of white pine ⅝ of an inch thick and covered with painted canvas. The interior finish is made up entirely of woods grown in the Argentine Republic, the inside roof being in tipa, both for panels and covering strips. Tipa very closely resembles ash and makes a fine finish. The sides of the car are beveled-edged tipa panels, with peteribi covering strips. Peteribi is very much like teak. The ends and partitions are in tipa and peteribi, with 9-inch by 7-inch photographs of interesting and picturesque parts of the line worked in, as shown on the interior view. The reversible seats, which are of special design, are trimmed with maroon buffalo hide. The arrangement of the seats is such that when the back is reversed the seat is tilted so that it is always at right angles to the back. This disposes with the uncomfortable slipping one experiences when the train is in motion with the usual types of seat. Sun blinds are fitted to the windows and are of peteribi frames and eucalyptus louvers or slats. The window frames are also of peteribi. All inside furnishings, such as parcel racks, locks, hinges, etc., are nickel-plated. There are two lavatories placed in each coach.

The longitudinal frame timbers are of pitch pine, but all other parts, such as roof sticks, posts and diagonals, etc., are in tipa. The truck bolsters are in native hard wood called lapacho. The wheel pieces are flitched with ¼-inch wrought iron plates, and are of lapacho; in fact, all the wood in the trucks is of this kind. These cars ride very easily on the road and give general satisfaction.



FIRST-CLASS PASSENGER CAR, ARGENTINE SOUTHERN RAILROAD.

Annual Convention of the American Society of Mechanical Engineers.

The American Society of Mechanical Engineers will hold its twenty-ninth meeting at Montreal, Canada, June 4 to 9 inclusive. The following named papers will be presented at the meeting:

Notes on the Theory of Shaft Governors. By Albert K. Mansfield.

The Theory of the Steam Jacket; Current Practice. By R. H. Thurston.

Cost of an Indicated Horse Power. By Decourcy May.

The Saturation Curve as a Reference Line for Indicator Diagrams. By R. C. Carpenter.

Notes on the Corrosion of a Cast-Steel Propeller Blade. By Frank B. King.

Results of Measurements of the Water Consumption of an Unjacketed 1,600-H. P. Compound Harris-Corliss Engine. By. J. E. Denton, D. S. Jacobus and R. H. Rice.

Mechanical Draft. By Wm. R. Roney.

Notes on Compressed Air. By Frank Richards.

Results of Experiments with a 50-H. P. Single Non-Condensing Ball and Wood Engine to Determine the Influence of Compression on the Water Consumption. By D. S. Jacobus.

A New Mechanical Fluid. By Chas. W. Hunt.

A New Method of Compound Steam Distribution. By F. M. Rites.

Power Losses in Transmission Machinery of Central Stations.

Rustless Coatings for Iron and Steel. By M. P. Wood.

Corrosion of Steam Drums. By Jas. McBride.

Tests of a Small Electric Railway Plant. By Jesse M. Smith.

Heat Units and Specifications for Pumping Engines. By Albert F. Hall.

The Relation of the Drawing Office to the Shop in Manufacturing. By A. W. Robinson.

A New Form of Canal Waste-Weir. By John R. Freeman.

First Stationary Steam Engines in America. By F. R. Hutton.

Effect of Varying the Weight of Regenerator in a Hot-Air Engine. By G. W. Bissell.

Cylinder Proportions for Compound Engines Determined by their Free Expansion Losses By Frank H. Ball.

The Government of Greece has canceled recently the concession granted to an English company for building a railroad between the Pirdens and Larissa, in Thessaly. The 2,000,000 francs deposited by that company as a security for the fulfilment of its contract have been confiscated, and the work already done on the road has become the property of the Grecian state.

New England Railroad Club.

Airbrakes.

The May meeting was held on the evening of the 9th in Boston, with Mr. L. M. Butler in the chair. The subject of discussion was the maintenance and repair of airbrakes. Mr. Elmer E. Chain, of the Boston & Albany Railroad, read a paper on the subject. Mr. Chain advocated the establishment of airbrake testing and repair plants at terminal points, the keeping of all air pipes in such plants out of the ground as much as possible, so as to insure dryer air. He suggested that a car could be fitted up with self-propelling mechanism for use at points where such a car could be of assistance in the inspection and repair of air-brake equipment. He advocated the use of an airbrake defect card, and the location of the dummy hanger adopted at the last convention of the M. C. B. Association. The paper expressed the opinion that a hose hung in this position kept about the same curve as when coupled to the hose on an adjoining car, consequently prolonging its life. The location of the dummy hanger on most cars being on the outside of the brake pipe gives the hose a curve when it is hung in this position—the reverse to what it is when coupled up—and will invariably kink the hose just below the end of the nipple or about the middle, or both. This immediately causes the hose to weaken at this point, and it is not long before it begins to leak. In reference to the objection of having a man go between the cars to hang up the hose in the M. C. B. location, Mr. Chain said that this was necessary anyway, to uncouple the hose, in present practice.

In discussing the paper Mr. Henry Kolseth said that in every shop where cars are repaired there should be suitable pumps and pipes, so that every car that has an airbrake could be tested and put in first-class order before it leaves the shop. After the cars are upon the road they cease to be looked after very closely. Mr. Adams said that railroad officers are not sufficiently impressed with the necessity of keeping airbrakes in good order.

Mr. W. W. Snow said that airbrakes failing to properly release were a prolific cause of broken wheels. Mr. Kolseth called attention to the fact that many cars with airbrakes have the hand brakes connected wrongly; that is, the brake is connected on the levers so that it works against the hand brake. It should be connected with the lever which is operated by the piston rod; otherwise when the engineer applies the brake it is apt to create trouble, and for that reason the brakemen are afraid to use the hand brake when they are called on.

Mr. Adams said that he found many cars such as Mr. Kolseth described, and that he knew many brakemen who were afraid to touch hand brakes for fear of being thrown from the top of the train. Several members expressed the opinion that it is just as well to let an uncoupled hose hang down as to couple it up to the dummy, wherever located.

Experiment on the Lowell Railroad in 1837.

The Boston *Post* of Saturday, March 25, 1837, states that an experiment was tried on the Boston & Lowell Railroad, with a new engine built at Lowell for the Stonington road. The weight of the engine was about 10 tons. A train of 49 "burden" cars was drawn from Boston to the turnout in Woburn, a distance of 10 miles, in 51½ minutes. The load, exclusive of engine, was as follows:

25 cars—373 bales pressed cotton and wool	177,364 lbs.
195 cars groceries, etc	26,142 "
19 cars coal, 6,000 lbs	114,000 "
49 cars, weighing	191,000 "
Tender to locomotive	14,400 "
	522,906 lbs.

or 261 tons.

The load, which occupied a length of 820 feet, was started on the bridge at Boston without assistance, was taken up planes of 10 feet to a mile, and stopped and started again on a plane of that inclination. On Jan. 18 the small engine *Patrick* of nine tons weight, also built at Lowell, took a load of 35 cars, weighing in all 201 tons, in two hours 14 minutes, from Boston to Lowell, 26 miles. In both cases the experiment was made without any previous preparation, the engines, cars and rails being in their usual working state.

The shops of the Marietta & North Georgia Railroad were burned at midnight May 1. These were the principal shops on the road. Five locomotives and several passenger and freight cars were burned.

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

THE MASTER CAR BUILDERS' AND MASTER MECHANICS' CONVENTIONS.

As announced in our last issue, the twenty-eighth annual convention of the Master Car Builders' Association and the twenty-seventh annual convention of the American Railway Master Mechanics' Association will be held at Saratogo Springs, N. Y., beginning Tuesday morning, June 12, and Monday, June 18, respectively. Saratoga is so well known to those who frequent these conventions that most of those who go will feel comfortably at home during their stay in the town. The headquarters will be, as usual, at Congress Hall Hotel, the ballroom of which will again serve a more serious purpose than "tripping the light fantastic," for in this room will be held the sessions of the two conventions to the accompaniment of chin music of a more or less entertaining character. Most of this will be serious enough, however, as the subjects that will be discussed will be of grave importance to the railroads represented. An unusually large attendance of members is probable, as doubtless the dull condition of railroad traffic will permit many members to attend these conventions who in more busy times are kept at home.

The memorable conventions held at Saratoga two years ago were the first under the new joint arrangement by which both onventions should meet as closely together as practicable, and their success and large attendance demonstrated the wisdom of the change. It was at that convention of the Master Mechanics' Association that the rules were adopted providing that "all car builders above the rank of general foreman, having charge of the design, construction or repair of railroad rolling stock, are eligible to membership in this association," and "that all questions pertaining to the repair, construction or design of the rolling stock of railways, whether engines or cars are legitimate questions to come before this association." In commenting on the adoption of these rules we then said:

In adopting these resolutions an advance step was taken big with possible future results. The requirements of modern conditions are such that the necessity of joint and harmonious action by the two associations is becoming more and more imperative in order to best serve the interests represented by the membership. The more clearly this is recognized and the more liberally and intelligently it is acted upon, the more effectually will be accomplished the objects of both associations.

In saying this we had in mind the possibility of even closer relations between the two associations than then existed, or was contemplated so far as we know. Quite recently the possibility we had in mind has been given definite shape by the suggestion, broadly made and seriously discussed, that a consolidation of the two associations into one is desirable. There is much to be said for and against the proposition, and we do not intend to enter into a discussion of it here. Whether desirable or not, the time for such a change is not yet ripe, and will not be for probably some considerable number of years to come. Eventually it may occur, and probably will, but the time is distant. The tendency of railroads and railroad management is toward consolidation, but in the professions and in societies the tendency is toward specialization. The latter is an opposing current that may long defer any movement toward closer relations between these associations.

LITTLE THINGS.

A gentleman who is well known and highly respected for his sound common sense, which in its simplicity and soundness is philosophical, said at a recent club meeting:

I do not know that I can call attention to anything which may appear vital and large, but there is nothing in mechanics more important than attention to little things. It is the piling up of the little things which brings about the great changes and great results accomplished.

The truth of this is seldom sufficiently realized. We are so anxious for big results and impressive records that we are apt to disregard small possible economies and the means for effecting them. Any one wishing to sell an improved device or material can scarcely obtain attention to the merits of his ware if he cannot claim that it will effect a large saving of 10 or 15 or 20 per cent. This is largely true of the whole range of materials, appliances and equipments of a railroad, from ties to compound locomotives. Small economies are considered too unimportant and too uncertain to deserve much consideration.

In discussing compound locomotives at the Master Mechanics' Convention two years ago, Mr. M. N. Forney, the eminent locomotive philosopher, said that a fuel economy of 10 per cent. could be obtained in locomotive practice "by painting the smoke stack sky blue." The report of the committee on compound locomotive had stated that ten per cent. was the approximate economy shown by a compound locomotive when tested with simple locomotives. What Mr. Forney really meant was that as large an economy as this could be obtained in simpler ways than the adoption of the expensive and complicated mechanism necessary for compounding. Changes as simple as "painting the smokestack sky blue" will indeed do what Mr. Forney said. A change from a careless to a careful fireman will do this, and a change from a careless to a careful engineer will do twice as well; and yet how seldom such changes are made for the object designated. The substitution of a close notched quadrant for an old style wide-notched one will save a considerable percentage of fuel if properly used. Injectors of wide range of adjustment contribute largely to fuel economy, and so do balanced valves, sight feed lubricators and water glasses; yet these are often neglected on locomotives belonging to railroads that do not make their operating expenses, and to locomotives on other roads that cannot pay dividends. There are many ways by which even well disposed engineers, firemen and hostlers waste fuel, yet these are seldom pointed out. Well recognized principles of steam distribution are neglected because the possible dependent economies are considered small. Possible improvements in combustion are neglected because brick arches and proper air spaces are not considered largely economical, although it is well recognized that these do favorably affect the economical use of fuel. Tender construction is allowed to remain unimproved because the loss of coal therefrom is considered unimportant, although admittedly a couple of hundred pounds a day.

This would be a long winded sermon if all the neglected opportunities of possible economy in locomotive operating and maintenance were even mentioned. They exist, and will eventually be recognized and taken due advantage of. They will constitute the small steps in the process of the evolution of the locomotive into a very much more economical heat engine than it is to-day.

Referring to passenger cars, the window sashes should be so arranged that the glass can be readily cleaned without removing stops and fastenings. Foot-rest supports, steam pipe supports, etc., should be so arranged that the floor can be more quickly and easily washed. The floor itself should be of quartered yellow pine or maple, and not of yellow or other pine sawed in the ordinary way—this slivers and wears out in a few years, and, even after one year, appears badly next to the end doors. Lamps, parcel racks, etc., can in most cases be improved. Seat backs should be so arranged that that they can be removed from the cars for cleaning purposes without having to undo a lot of fastenings. The steam pipes under the cars are usually so put up that it requires much labor to undo covers, hangers, boxes, etc., in order to make necessary repairs. Brake connections are in many cases badly arranged for taking up slack. Journal boxes are generally not properly looked after, both in new work and repaired work. Dust guards are too loosely fitted and are not renewed often enough, the lids being very often in bad repair, and the waste of oil from these sources is probably equal to the amount actually required to lubricate the journal. The same is true in an aggravated way of freight car journal boxes.

Freight cars constructed of green or only partially seasoned lumber should be carefully gone over three or four months after they have been built and have all bolts screwed up. This is with very few exceptions never done. If attended to, the life of the car and its parts, especially draw gears, would be much prolonged. Loose draw gears are the principal cause of their failure in service, and draw gear repairs constitute perhaps 90 per cent. of what are called light repairs. Roofs are also often neglected too long, leaky roofs being too often the basis of claims for damaged freight. Doors are often in bad order, allowing rain, snow, cinders, etc., to enter the car.

These are some of the "little things" about cars and locomotives, the neglect of which allows the existence of just so many leaks in the "strong box" of the company. Too often the drain has made the difference between dividends and a receivership. This is not a story of the past, but one of the present. These little enemies of economy and of individual and corporate success are always at work wherever they are permitted to exist.

THE MASTER MECHANICS' CONVENTION.

A new and interesting series of subjects will be reported on and discussed at the approaching convention of the American Railway Master Mechanics' Association. A committee will report on what methods of construction are best to prevent the cracking of back tube sheets, and this source of occasional annoyance and expense will be subjected to the searchlight of concentrated attention.

"Oiling Devices for Long Runs" is the subject of another committee. An interesting report will be made on this subject that will show the best practice in America and Europe.

"Locomotive Fire Kindlers" is the next subject on the list. The committee that has been investigating this matter will report on the best methods of starting fires in locomotives, and the relation of these to insurance risks. This is a matter that considerable interest has been manifested in recently, and it is probable that the committee will report some much cheaper methods of kindling fires than by the use of wood. Increased fire risks are an important consideration in this matter, where oil is substituted for wood, and this requires some exceptional precautions; but we believe these may be successfully provided.

"Exhaust Nozzles and Steam Passages" has become a rather familiar subject at the conventions of this association, but it is one about which we do not yet know enough. The committee having the matter in hand this year has been carrying on some original tests on a stationary locomotive, which Mr. Robert Quayle, the chairman of the committee, mounted in an ingenious way on an inverted engine truck at his shops. The wheels on which the drivers rested were worn out steel tired wheels with the flanges turned off. The lower part of these ran in water and the resistance was given by brake shoes on either side, the pressure being supplied by a hydraulic hand pump. In the smoke-box of the engine there was fitted an exhaust pipe, the height of which could be varied at will. A number of tests were made in this way that doubtless enabled the committee to prepare a very interesting and instructive report.

"Boiler and Fire-Box Steel." In reference to this subject a committee will report some proposed standard specifications and tests, and it is probable that the convention will adopt some such standards in order to improve the quality of this metal used for locomotive boilers.

"Sanding Devices." This matter is beginning to receive the attention it has long deserved. The crude method of sanding rails that has been practiced so long in this country is responsible for much waste of sand, and what is of very much more importance, increased resistance of trains, followed naturally by increased consumption of fuel. Heavily sanded rails have cause much stalling on grades that was entirely unnecessary. Devices that will supply to the drivers only the desired amount of sand will save money in more ways than one.

"Tire Treatment." The committee on this subject will report the results of its investigations as to what amount of shrinkage should be allowed for large driving wheels; the necessity of retaining rings, and the limit of thickness that tires should be worn to, and when they should be turned.

"Cost of Maintaining Locomotives" is the name of a subject that will probably be presented in a light that will be unusually interesting to those responsible for the cost of repairs. The methods practiced by different railroads in keeping account of locomotive repairs are so diverse that fair comparison is very often impossible. Nevertheless such comparisons are sometimes drawn, and, being unfair, they sometimes work injustice. This matter will now probably receive some much needed attention.

BURY TRAIN WRECKERS.

There will have to be some very severe examples made in this country of successful and would-be train wreckers before long, or there will be some terrible wrecks and loss of life. It is hard to understand how any human being could become so vindictive and regardless of life as to attempt the wrecking of a passenger train filled with helpless and inoffensive people; but that such devils exist we have only too frequent proof. As recorded elsewhere, there was a most malicious attempt made to wreck a passenger train on the Chicago, Milwaukee & St. Paul road early in May. The middle of the month witnessed another dastardly attempt to wreck a passenger train on the Boston & Albany road. Fortunately both attempts were unsuccessful. In the first case tramps robbed the tender box of links and pins, and threw these under the wheels of a fast running train on which they were stealing a ride. In the second case tramps who had been put off a freight train piled a lot of fish-plates on the track at a sharp curve in the face of a passenger train.

The merciful feature of our criminal law which provides degrees of punishment for a crime attempted and a crime committed is of doubtful justice in any case, but in the matter of train wrecking it is a positive travesty of justice.

Six feet of earth should make train wreckers all of one size whether their attempts are successful or not. Public safety demands that fiends who would wreck trains must be put deep under the sod in short order. This is the only way to stop train wrecking, and it is the way that must eventually be adopted. The sooner the better.

THE MASTER CAR BUILDERS' CONVENTION.

As six new subjects will be reported on at the coming convention by the respective committees to which they were assigned, there is assurance that the proceedings will not be less interesting than those of previous years. The committees on Tests of M. C. B. Couplers, and Airbrake Tests, will probably report the results of a year's watchful consideration of their respective subjects. Tests have been made by both committees, the reports of which, it may be taken for granted, will advance knowledge concerning these appliances.

The Committee on Steel-Tired Wheels is one of those continued from last year. It then reported that the chief objection to spoke wheels was the raising of dust, and that solid wrought centers were largely preferred. When continued it was instructed to include in its investigations all types of steel-tired wheels in use, and to specify the best limit of wear and illustrate methods of tire fastening. Its report will probably be on these lines.

"Road Tests of Brakeshoes" is the old subject of "Metal for Brakeshoes" under a new name, set for the fourth time to be reported on by a committee, the association having been trying for as many years to get conclusive information as to what is the best metal for brakeshoes. Last year it was found impossible to organize a committee to work on the subject, and the previous year nothing was done by the committee having the matter in hand. Last year the secretary of the association collected information which showed that 100 pounds of brakeshoes were used per eight-wheel car per year, and that about 55,000 tons of brakeshoe metal are used annually under American cars, most of this being cast iron. It was also shown that between 4,000 and 5,000 tons of driver brakeshoes are used per year; in round numbers, 60,000 pounds of brakeshoe metal. The information gleaned by the secretary aroused renewed interest in the subject, and a committee of 12 very active members was appointed to make a series of comparative tests of different brakeshoes in actual service. A committee was also appointed, consisting of three members, to make laboratory tests of metal for brakeshoes. It is hoped that these committees have collected information that will enable the association to decide on what is the best metal and size for brakeshoes.

"Brakebeams" is the name of the next subject on the list. The same committee, with one additional member, has it in hand that had this subject and the standard height of drawbars in hand last year. Its instructions then were to report on a standard form of brakebeam. It reported that its instructions did not permit it to recommend any specific form of beam, but that if a standard height for the center of beam from the rail should be adopted, a beam could be designed that would meet all requirements. It is expected this year to recommend in detail what steps are necessary to secure greater uniformity in the construction and methods of hanging brakebeams.

Committees will report on a standard location and arrangement for safety chains on freight cars; on what progress is being made in heating cars by steam or other improved methods, and a committee will report on the ventilation of passenger equipment and offer suggestions as to the correct principles of ventilation.

This last is another subject that the association has been trying to get a report on for four years. It is probable that there will be an intelligent and exhaustive report this year, as the matter is in the hands of a wide-awake committee. This is a subject beset with some difficulties, and there has been much general apathy concerning it. Those who hate foul air despise those who neglect ventilation, and those who are afraid of fresh air detest the "cranks" who are always insisting on having the windows, doors or ventilators open. The more intelligent travelers, however, are beginning to insist on improved ventilation, and several railroads (among them the Pennsylvania) have been making efforts to meet the increasing demands for this improvement.

A correspondent put this new matter in a new light recently as follows:

It seems strange that a man will refuse, with disgust, to wash in water already used by some other person, yet this same man will sit complacently in an atmosphere more foul than the water he will refuse to wash in. Washing in the water would do him no injury, but he can see the foulness of it, while the air, though positively injurious, cannot be seen, so he don't seem to care if it is unfit for use.

The third subject to be considered affecting the comfort of passengers is "Lighting Passenger Equipment." If lighting, heating and ventilating passenger cars received the attention in practice that is promised them in discussion at Saratoga, passengers would be deprived of many and just grounds for criticism and complaint. The comfort of passengers depends much more on the temperature, ventilation and illumination of cars than on many other matters to which much more attention is given. Railroads that appreciate this, and act accordingly, are fast becoming the popular routes, and are gaining the lion's share of traffic.

A committee will report on "Wheel and Flange Gages." The instructions of the committee are broad and authorize it to prepare maximum gages for thickness of wheel flanges, to consider wheel gages in their relation to the track, and to offer suggestions relative to wheel and track gages. It has been shown that the relative condition of wheel and track gages has approached a condition of dissimilarity which affects the safety of trains. While the association has a minimum limit for the thickness of flanges, it has had no maximum limit, and it is known that there are many wheels running with flanges so thick that while mounted within the limits of the M. C. B. interchange rules, they will not clear the points of frogs of 4 feet 8½ inch track. Many derailments have been traced to this cause.

The instructions of the committee on "Lubrication of Cars" are to "consider the practice on different roads as to lubrication and prevention of hot boxes; also the kind and quality of lubricants used, with cost of same." This is a new subject, and was suggested a year ago by the NATIONAL CAR AND LOCOMOTIVE BUILDER. In suggesting the subject it was pointed out that less attention is paid than should be to the proper consistency of lubricating oils, and that in the use of heavy oil in cold weather little attention was paid to the action of fluid friction in the oil, although, as is well known, this is a potent influence in reducing the possible capacity of trains in winter. The committee issued a circular of 45 questions early in the year, but none referred to the usual or proper consistency of oil. Perhaps some information relative to the matter will develop in the report to be submitted.

Committees will report on what should be done to improve the maintenance and service of air and hand brakes on cars; and on the advisability of adopting standard sizes and shapes for arch-bars and channel transoms for diamond trucks. The committee on the latter subject will also report on various designs of trucks, with special reference to new forms.

A report that will probably interest everybody will be that on "Compressed Air Appliances and Hydraulic Machinery." The uses of compressed air in car and locomotive shops are attracting much attention from progressive mechanics. Many of these have been described in past issues of the NATIONAL CAR AND LOCOMOTIVE BUILDER, and this issue contains some illustrations of such tools that have proved of great value in facilitating car and locomotive repairs

This *résumé* of the work to come before the approaching convention shows that much will transpire at its session of interest to railroad men in general and car builders in particular.

In our mention of the destruction of Purdue's engineering laboratory by fire (Jan. 23) we said that if contemplated efforts to re-establish the laboratory were successful the experience of the past two years with the old plant would suggest many improvements that would make the new plant much more efficient and reliable. The complete restoration of this laboratory is announced on another page, and we are glad to record the fact that our estimate of the progressiveness of the university's faculty was not overdrawn. The plant is not only to be completely restored, but many improvements are to be made that the experience of the past two years has taught are necessary for the highest excellence of the work to be done. In place of one locomotive there will now practically be two, and ample provision is made for testing any locomotive that may be offered; also the annex containing the locomotive testing plant has been put in track connection with the railroad system of the country, thus enabling locomotives from any place to be run to the doors of the laboratory.

Literature.

Progress in Flying Machines. By O. Chanute, C. E. Pages 308. Cloth. Price $2.50. Published by the *American Engineer and Railroad Journal*, 47 Cedar Street, New York.

The series of articles on "Progress in Flying Machines," that have recently appeared in the *American Engineer and Railroad Journal*, are now presented in book form. The book gives an historical review of the effects and experiments of inventors to accomplish flight with apparatus, which by reason of its rapid movement will be supported by the air as birds are. The author has gathered all the records of such experiments which were accessible, and has endeavored to show the reasons for their failure, and to explain the principles which govern flight, and to satisfy himself, and his readers, whether we may reasonably hope eventually to fly through the air. His conclusion is that this question may now be answered in the affirmative. A full account is given of the recent experiments of scientists like Maxim, Lilienthal, Hargraves and Langley, which have so greatly added to our knowledge of this subject. The book is illustrated by nearly 100 engravings, and the treatment of its subject is in well chosen language that will prove as clear and interesting to the non-technical reader as to the aeronautical engineer. When writing the book the author was evidently thoroughly imbued with the importance of his subject, and from his investigations draws the conclusion that the advent of a successful flying machine will advance civilization in many ways through the resulting access to all portions of the earth, and through the rapid communications which it will afford.

Poor's Manual of Railroads. Edition of 1894. In preparation. 1,800 pages. Cloth, royal octavo. Price, $7.50. H. V. & H. W. Poor, 44 Broad street, Edison Building, New York.

The publishers of this valuable work are now engaged in the preparation of the 27th annual number, which will be issued in July next, or about a month earlier than usual. As usual, the work will contain statements showing in tabular form the mileage, equipment, capital stock, funded and floating debts, cost of road and equipment, investments, train-mileage, passenger and freight statistics, earnings, expenses, interest and dividend payments, etc., etc., of the entire railroad system of the country, arranged by States and groups of States. Statements are given showing the total mileage of all the railroads of the world, and numerous other selected statistics. One thousand pages of the work will be devoted to detailed statements of every railroad in the country. A number of improvements will be made in this edition. A large number of new maps will appear, and the standard features of Poor's Handbook of investment securities will be incorporated in it, as will also those of the Directory of railway officials and Manual of American street railways.

The Strike at Pullman.

The employees of the car works of Pullman's Palace Car Company, at Pullman, Ill., struck May 11, and the shops have been closed until further notice. The men demanded the restoration of the rates of pay for piecework to what these had been previous to the reduction made on account of the falling off of business. A day or two before the strike President Pullman personally addressed a gathering of the men and gave them some plain statements of the conditions which made low wages for the present necessary. At the commencement of the depression last year the company employed at Pullman 5,816 men and payed out in wages there $305,000 a month. Negotiations that were then pending for new work were stopped, orders were canceled, and it became necessary to lay off a large number of men in every department, so that by the first of November, 1893, there were only about 2,000 men in all departments, or a little over one-third of the normal number.

In the effort to keep the shops running and the workmen employed, the company made lower bids than were ever before known, and by this means secured work enough to increase the force from 2,000 to 4,300 men, which was the number employed at the time of the strike. This was done by the company eliminating from its estimates the use of capital and machinery, and in many cases going below that and taking work at a considerable loss; as much in one particular case as $12 per car and in another $79 per car. The Detroit shops of the company were closed in order to provide work for the men at Pullman, and $160,000 was spent since last August in carrying out a system of improvements in the town, which gave work to many. At the time of the strike the payroll at Pullman was $7,000 a day. As we go to press it is announced that the shops are still closed, the strike is "on," and there is no apparent prospect of an early agreement.

"There are several young men in the car," remarked Mrs. Holdstrap, with some feeling, "but they can hardly be classed among the rising generation."

An engineer remarking that the usual life of a locomotive is 30 years, a passenger said that such a tough-looking thing ought to live longer than that. "Well," responded the engineer, "perhaps it would if it didn't smoke so much."

Palace Car Porter (out west)—"Don' gub me no fee, sah, till we gets to de end of de trip."

Passenger.—"Very well. Just as you prefer."

Porter.—"Yes, sah. You see, dese train robbers always goes for me fust, an' ef I ain' got nuffin, dey say de passengers ain't got nuffin, an' goes off."

The attendance at the Midwinter Fair in San Francisco has averaged a trifle over 13,000 daily from the opening. The hard times and the high cost of transportation combined to limit the number of visitors, but, considering the scattered population of the Pacific Coast, a million and a half visitors up to date is considered a better showing than the Columbian Exposition made in the same time.

The Western Railway Club held its annual meeting on May 15, and elected the following officers for the ensuing year: President, George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Railway; First Vice-President, George L. Potter, Superintendent of Motive Power of the Pennsylvania, Ft. Wayne & Chicago Railway; Second Vice-President, David L. Barnes; Member Executive Committee, J. D. McIlwain, Superintendent Harvey Steel Car Works; Secretary and Treasurer, W. D. Crosman.

Personal.

Mr. J. F. Scott, Master Car Builder of the Evansville & Terre Haute, has resigned, and the office is abolished.

Mr. C. E. Slayton has been appointed Master Mechanic of the Chicago Great Western, at Oelwein, Iowa.

Mr. Nicholas Monsarrat, Vice-President and General Manager of the Cleveland, Akron & Columbus, has resigned.

Mr. Oscar Townsend, for some years General Manager of the Cleveland, Lorain & Wheeling road, died at Cleveland, O., May 1.

Mr. C. G. Patterson has been appointed General Manager of the Findlay, Fort Wayne & Western, with headquarters at Findlay, O.

Dr. W. T. Barnard, President of the Chicago & South Side Rapid Transit Elevated Railroad, died in Washington, D. C., May 9.

The title of Mr. John Torrence, Master Mechanic of the Evansville & Terre Haute, has been changed to Superintendent of Motive Power and Rolling Stock.

The title of Mr. E. W. Grieves, Master Car Builder of the Baltimore & Ohio, has been changed to Superintendent of Car Department. His duties remain the same.

Mr. Clarence H. Howard, Secretary of the Safety Car Heating & Lighting Company, has established his headquarters in the Union Trust Building, St. Louis.

Mr. Jeff. N. Miller, heretofore General Superintendent of the Pecos Valley Railway, has been appointed General Manager of that road. Headquarters, Eddy, N. Mex.

Mr. James Houston, General Superintendent of the Pontiac, Oxford & Northern, has resigned, and is succeeded by Mr. William C. Sanford, with headquarters at Pontiac, Mich.

Mr. L. M. Martin, General Manager of the Des Moines, Northern & Western, tendered his resignation to take effect May 1, to devote his entire time to the Lake Superior, Southwestern & Gulf, of which he is Vice-President.

Mr. William H. Young, formerly in the Lake Shore & Michigan Southern shops at Norwalk, O., has been appointed Master Mechanic of the Florida Southern, with headquarters at Palatka, Fla., vice J. Rutherford, resigned.

Mr. W. B. Coffin, who has been Superintendent of the Jacksonville, Tampa & Key West, has been promoted to be General Superintendent of that road, which is a new office. Mr. Coffin was formerly Division Superintendent on the New York, Lake Erie & Western for more than 10 years.

Mr. Theodore Voorhees, First Vice-President of the Philadelphia & Reading and General Manager of the Lehigh Valley, has resigned the latter position. All officers heretofore reporting to the General Manager will hereafter report to Mr. Rollin H. Wilbur, General Superintendent, South Bethlehem, Pa.

Mr. J. H. Winder has been appointed General Manager of the roads operated as the Seaboard Air Line. His title recently has been Vice-President and General Manager, and he is now to retain the latter title. The office of General Superintendent, until recently held by Mr. L. T. Myers, has been abolished. Mr. Winder's headquarters will be at Atlanta, Ga.

Colonel Robert E. Ricker, formerly General Superintendent of the Iron Mountain & Southern and Denver & Rio Grande railroads, died at Weeping Water, Neb., May 17. Col. Ricker was one of the oldest and best known railroad men in the country. He was Superintendent of Motive Power of the Pennsylvania Railroad in 1866 and 1867, and was at different times superintendent of several roads, being at one time General Manager of the New York Elevated. In 1880 he became General Manager of the Gilbert & Brush Car Works, at Troy, N. Y., resigning on his appointment as General Superintendent of the Denver & Rio Grande.

Mr. Luther Kendall Jewett died at his home in Boston, May 14. All who are interested in car building know something of the work and inventions of Mr. Jewett toward better and stronger methods of car construction, and toward reducing the resistance of cars to being hauled. As examples of improved construction, what are known as the Jewett truck and the Jewett composite car framing may be mentioned; and as a notable example of the reduction of train resistance the Jewett roller side and center bearings are well known, and we believe will be much better known and their merits more highly appreciated when the fact becomes better understood that every reduction of train resistance adds practically to the hauling power of locomotives. In the past efforts to increase the motive power have taken the shape of heavier and more expensive locomotives, requiring expensive changes in the roadbed, track and bridges, and stronger and more expensive car draft riggings. Mr. Jewett was one of a class of men (may their tribe increase) who have studied to increase the hauling capabilities of locomotives by reducing the needless resistance of trains.

Money Value of Hands and Fingers.

According to a scale drawn up for the Miners' Union and Miners' Accident Insurance Companies of Germany, the loss of both hands is valued at 100 per cent. or the whole ability to earn a living. Losing the right hand depreciates the value of an individual as a worker 70 to 80 per cent., while the loss of the left hand represents from 60 to 70 per cent. of the earnings of both hands. The thumb is reckoned to be worth from 20 to 30 per cent. of the earnings. The first finger of the right hand is valued at from 14 to 18 per cent., that of the left hand at from 8 to 13.5 per cent. The middle finger is worth from 10 to 16 per cent. The third finger is valued at no more than 7 to 9 per cent. The little finger is worth 9 to 12 per cent. The difference in the percentages is occasioned by the difference in the trade, the first finger being, for instance, more valuable to a writer than to a digger. —*British Medical Journal.*

A new time card went into effect May 27 on the Pennsylvania Railroad. The time of the New York & Chicago Limited is shortened to 24 hours. It will leave New York at 10 A. M., and arrive at Chicago at 9 o'clock the next morning. The eastbound train will leave Chicago at 5:10 P. M. and arrive at New York at 6:30 P. M.

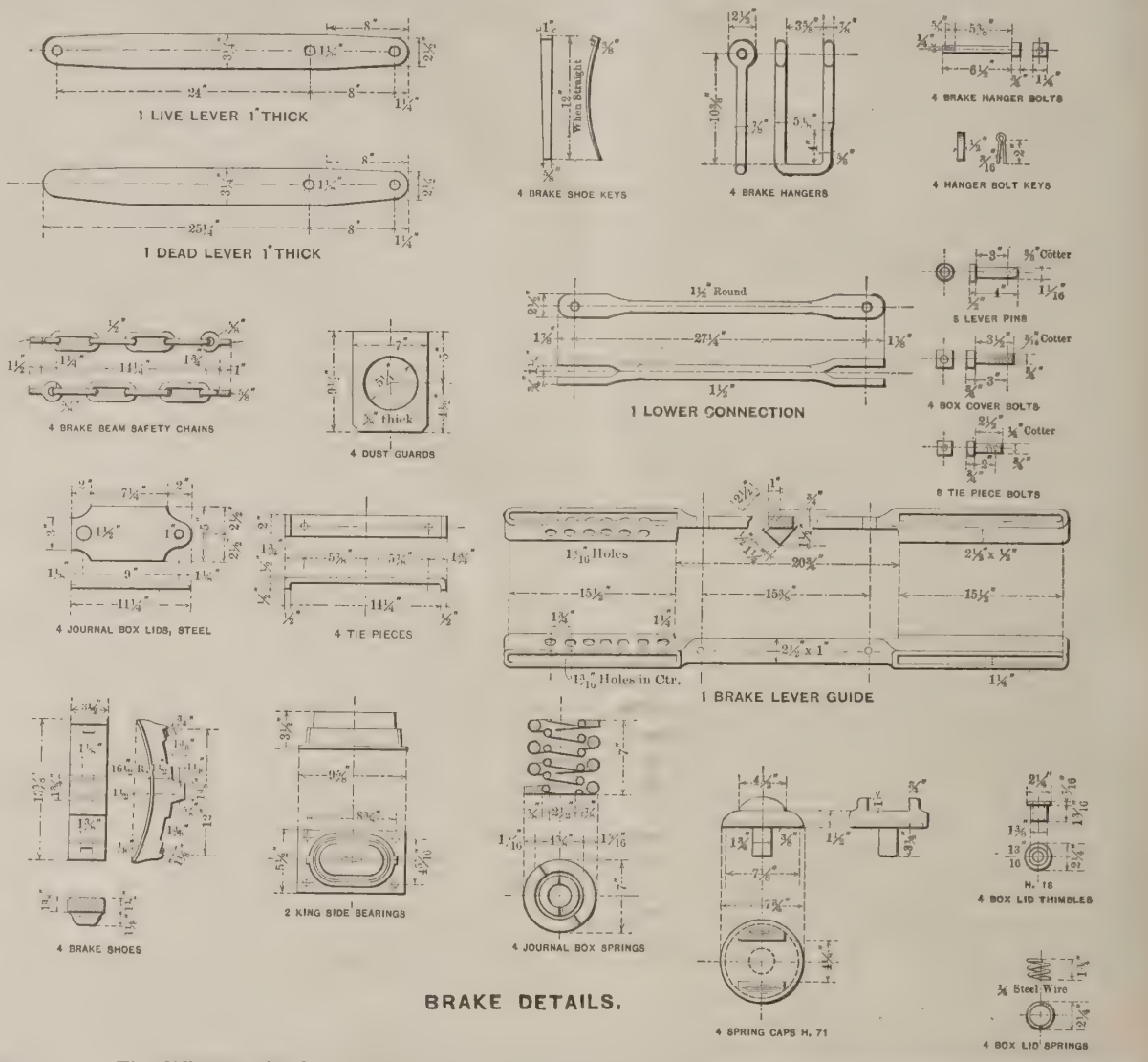
The largest stone ever quarried was recently taken from a quarry near Ashland, Wis. It is a monolith of Lake Superior brownstone, and is 115 feet long. It is to be formed into an obelisk that will be 10 feet longer than the largest Egyptian obelisk. It will be 10 feet square at the base and 4 feet square at the top. The apex will be 5 feet long, and tapered to a six-inch tip.

Standard Box-Car Details, New York Central & Hudson River Railroad.

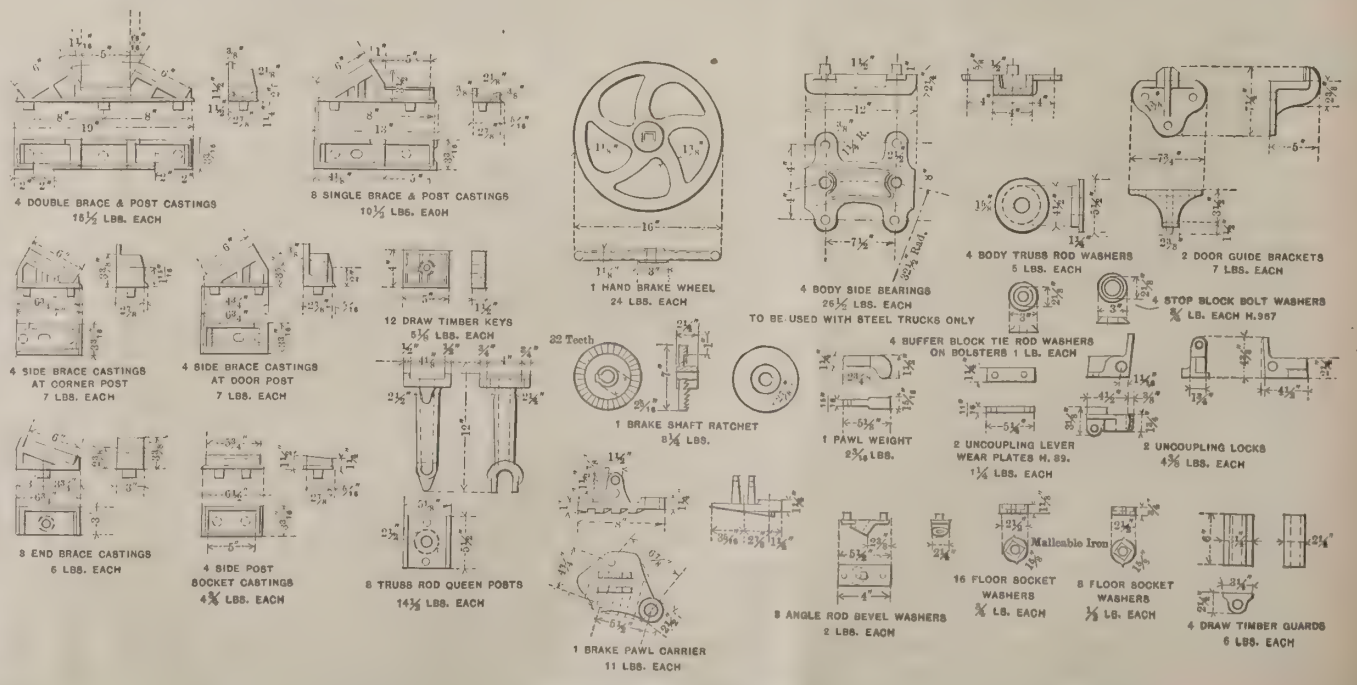
The standard 60,000-pounds capacity box car of the New York Central & Hudson River Railroad was described and illustrated by general arrangement and some detailed drawings in the May issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER. The construction of this car being very strong and of a generally advanced character, and fairly indicative of modern American freight-car construction, we present herewith full drawings of the draft gear and journal-box details, and of the foundation brake and cast-iron and wrought-iron details. The wood details were illustrated in our last issue.

As mentioned in the description of this car, its trucks are of the Fox pressed-steel pattern with 33-inch wheels, and axles of hammered iron having journals 4½ by 8 inches. The wheel base of the truck is 5 feet 2 inches. The drawings of the journal box, journal brass and journal bearing key show the adaptation of these details to this truck and weight of car. What has been found a necessary change in the bottom of the journal box will be noticed in the increased thickness of the front half. It was found that with the former thickness of $\frac{7}{16}$ inch, this part was unable to withstand the upward pressure of jacks used in replacing brasses. Hence this part was increased to $\frac{1}{2}$ inch in diameter, the rear part being allowed to remain as formerly, $\frac{7}{16}$ inch thick.

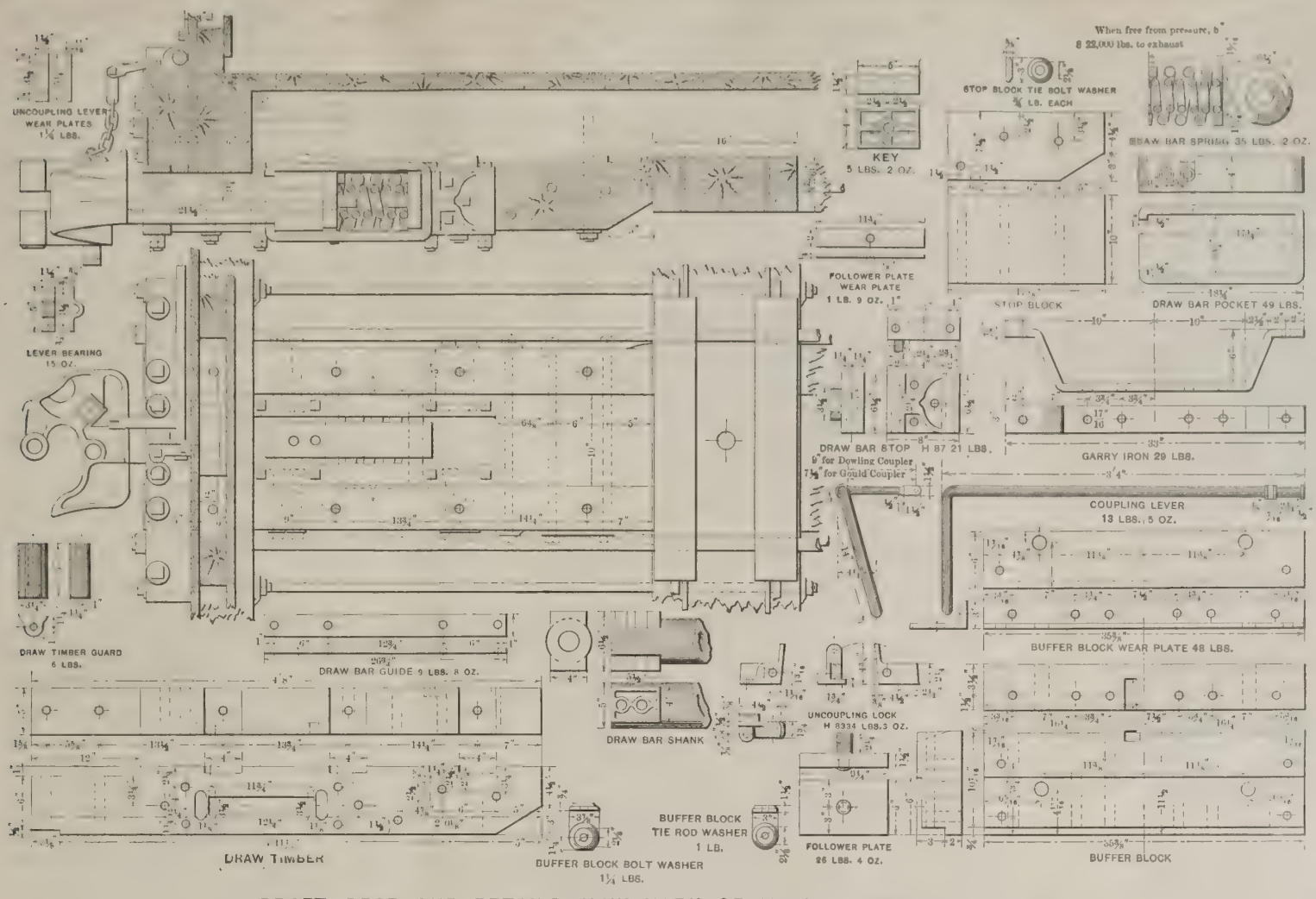
The details of the foundation brake gear and the cast and wrought iron details need no description, as full information is given on the drawings of each. The body center plates are made of pressed steel, and these are shown among the wrought-iron details. The floor-socket washers are made of malleable iron, and these are shown



BRAKE DETAILS.



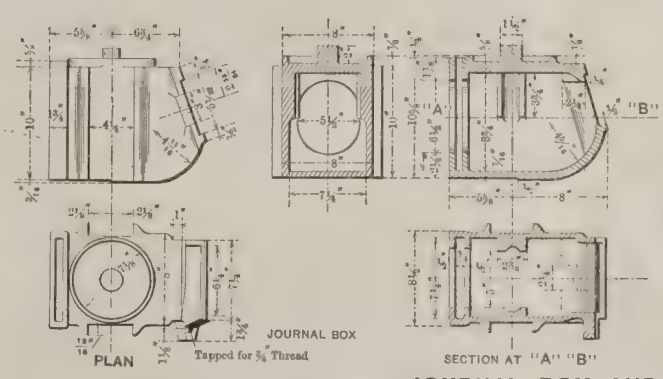
CAST IRON DETAILS.



DRAFT GEAR AND DETAILS, NEW YORK CENTRAL STANDARD BOX CAR.

among the cast-iron details. The brake guard-rail and brace shown in the engraving of wrought-iron details is a special feature. The arrangement is made of ¾-inch gas pipe and fittings, and is placed at the hand-brake end of the car to give brakemen greater security from being thrown off the top.

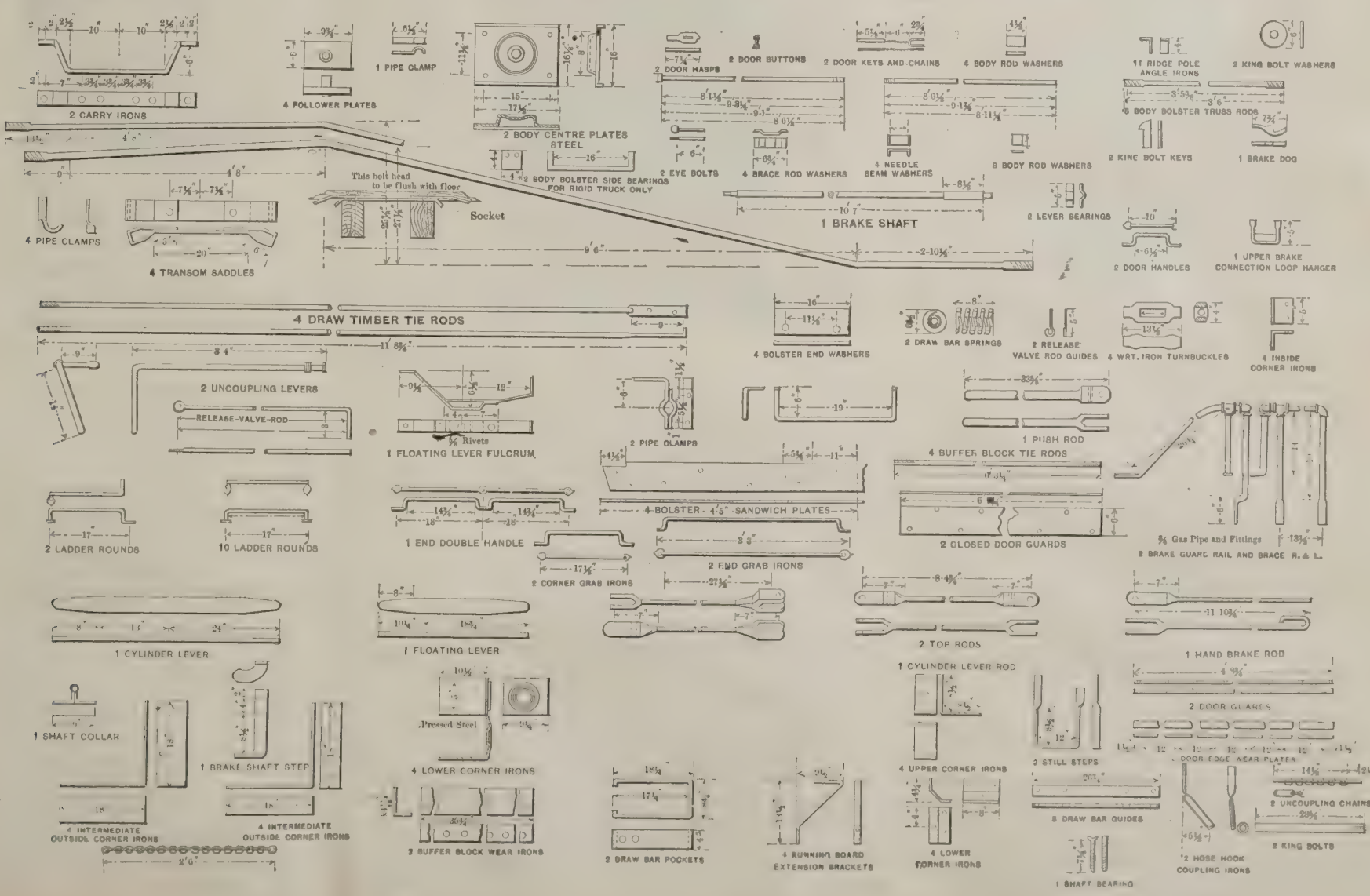
This car may be briefly and generally described as one 35 feet long over the end sills, and 36 feet 8¾ inches long over the running board. It weighs 30,000 pounds, of which the body weighs 19,376 pounds, and the trucks 10,624 pounds. Its capacity, as before mentioned, is twice its total weight, or 60,000 pounds. The car is 8¾ feet wide inside the lining, 8 feet 10 inches wide over the side sills, and 9 feet 7¾ inches wide over the roof; and is 12 feet 4 inches high measuring from the top of the rail to the top of the running board, and 13 feet 4 inches high measuring to the top of the brake wheel. The Westinghouse quick-action brake is standard for these cars.



JOURNAL BOX AND DETAILS.

The Kansas City & Beatrice Railroad has been sold under foreclosure proceedings for $100,000. The Missouri Pacific was the purchaser. The line is 35 miles long.

New shops are to be built at Clinton, Mo., by the Kansas City, Osceola & Southern Railroad. These are to be made ready for occupancy within four months.



WROUGHT IRON DETAILS OF STANDARD 60,000 POUNDS CAPACITY BOX CAR NEW YORK CENTRAL RAILROAD.

Rest Up Gradually.

When a man dies from heart failure, after excessive exertion, it is because he rests too completely after the effort and allows too great a rush of blood to the left lung and region of the heart. Athletes early learn by experience that they must rest up gradually after heavy exertion. If a man runs a mile rapidly when overburdened with flesh, and then lies or sits down, he experiences a choking sensation, which sometimes leads to the rupture of a blood vessel. If, on the other hand, he walks around until he cools off a little, the unpleasant sensation is not felt at all. When a man runs rapidly to catch a train he ought to keep on his feet for a few minutes after he is through with the exertion, and if he cannot conveniently keep in motion he should breathe as freely as possible and be careful to keep the whole of his lungs busy for at least a minute. When he does this all risk is averted.

A railroad train in Spain recently made a run of 25 miles in a little over an hour, and the papers are full of jubilant articles about the achievement.

Tutor—Under what name do you designate the science of legislation as carried on, say, in Congress? Student (promptly)—Pneumatics.

Communications.

A Ventilated Passenger Car.

Editor National Car and Locomotive Builder:

Your correspondent "G. W. C." in May issue calls attention to the obstacles met with in the path of progress in car ventilation. He also brings up O'Connell's famous advice to "agitate," as the only way out of the woods which now presents itself. In connection with this matter, I wish to call attention to a car which is making regular daily trips between Binghamton and Oswego, on the Oswego and Syracuse division of the D., L. & W. R. R. This car is fitted with ventilating windows (the De Kalb system) so arranged that the rear edge of each sash swings outward about an inch and a half, forming an ejector which draws out of the car the vitiated air which comes from the lungs of each passenger.

I rode twice over the line in the ventilated car, and used thermometers and lighted candles freely for testing temperature and drafts. The temperature did not vary one degree between inside and outside the car, and between the ends or top and floor thereof. There was also a noticeable absence of dust, and the bad odor usually found in a crowded car on a warm day (thermometer at 77 degrees Fahr.). The candle tests showed a steady outward draft at each window, which was so gentle that it was not objectionable to any passenger, and at the same time each window was under the individual control of the occupant of the adjacent seat.

There was a difference of several degrees in favor of the ventilated car, between it and the rear coach which had the ordinary form of window, and many of them were open. There was also a good deal of the foul odor peculiar to crowded passenger cars.

I think the apparatus as applied to the car in question is a very desirable addition to passenger equipment, and its action is in the direct line of scientific (and practical) ventilation. Students of car ventilation should all see this car and ride in it 100 or 200 miles before they decide upon the best method of ventilating a car. J. F. H.

Faulty Boiler Settings.

Editor National Car and Locomotive Builder:

The literature upon the combustion of bituminous soft coals is voluminous, and commenced at a comparatively early period after the introduction of the steam engine as a mechanical factor. Some of the early writers, through practice and experiment, were able to closely formulate the principles involved in economical coal burning, which were found to be comparatively simple and easy of comprehension. It is interesting, however, though sometimes not very encouraging, to note how few coal users seem to have a proper understanding or appreciation of these principles. The consequence is, insufficient work from boiler plants and a needless expenditure of money. It may be well to note some of the ways in which errors are yet allowed in the setting of the ordinary cylindrical boiler, which materially increase the amount of coal needed for doing a certain amount of work.

One fact which was developed in the early history of coal burning was that the long flaming coals required a considerable distance of a "flameway" in which to complete the combustion of the gases. In the old flue boiler, the flues in connection with the flame bed under the boiler usually give enough distance for this purpose. When we come to the tubular boiler, however, the combustion has to be completed before the tubes are reached. Experiment has shown that these gases will continue in a burning condition only about two feet, in a four-inch tube with natural draft. Ordinary Western coals need a flameway of fully 20 feet for a grate 5 feet long, yet we often see boilers only 12 or 14 feet long used. This short length not only prevents the combustion of the gases, but allows them to escape from the boiler before all the heat possible has been extracted. We have seen the gases escaping into the stack at a temperature of some 700 to 800 degrees, which shows a material loss of heat.

Next, we often see a tendency toward using a larger grate surface than is necessary. The argument seems to be used, that if a certain grate surface gives good results, a larger one will give better. There is a certain area of grate surface which will give the best performance with each boiler plant, depending somewhat upon the fuel used, and also the amount of draft. If a larger grate is supplied, more fuel has to be burned and the product disposed of through the tubes, the absolute heat given out to the water not being any greater. When the draft is at all slow, the smaller grate we can use the better, as the small grate openings will allow a higher rate of speed of the currents of air through the coals, and a better combustion is obtained than in the case of the larger area.

The boilers are often set too near the grates, thus preventing space in which to commence properly the combustion of the gases arising from the coal. One of the first principles noted by the early experimenters was, that at least two feet should be allowed, and with long grates more distance, between the boiler and the grate. If the boilers are set too low the bridge wall is low also, and not only affords a poorer factor in mixing the coal gases and air, but often allows a material waste by small pieces of coal being thrown over into the ash-pit. Dropping the grate at the front end will materially improve these conditions when it is not possible to make other improvements for the time being.

Another common, and in fact almost universal, fault is the want of an adequate air supply over the grates for soft coal burning. When proper methods are employed to promote the mixture of the hydrocarbon gases and atmospheric air let in over the fire, the amount of air that can be advantageously admitted would astonish many coal burners. In heavy firing with natural draft, we have used openings over the fire to an extent equal to one-twentieth of the grate surface, with very good results, both in fuel economy and smoke prevention, even when using inferior coals. On the matter of dirty or badly constructed boilers, both features telling against good performance, I will not touch here. It is hoped that a consideration of the faults already referred to may help some persons towards more economical practices.

C. M. HIGGINSON.

Safety Car Heating.

Editor National Car and Locomotive Builder:

We have been asked whether the recent litigation in which was involved the patent of Elmore D. Cody for a system of car heating, in any way affected this company. We therefore deem it advisable to state that this litigation in no way involves any of the systems of car heating sold by us, either by hot water or direct steam. Every system used by us is covered by letters patent owned by us.

The Safety Car Heating and Lighting Company,
ROBERT ANDREWS, Vice-President.

NEW YORK, May 21.

A Typical Suburban Station on the Pennsylvania Railroad.

Supplementing our remarks in the May issue on "The Influence of Cleanliness and Ornament," we present herewith an engraving showing a railroad station beautified by greensward, flower beds and trailing vines This is a station on the main line of the Pennsylvania Railroad, about eight miles from Philadelphia. It was mentioned in our previous remarks, and is an example of tasteful and artistic decoration.

No railroad line in America has devoted as much attention to the beautifying of its stations as the Pennsylvania.

ARDMORE STATION, PENNSYLVANIA RAILROAD.

The suburban traffic of this line out of Philadelphia is very large, which may be partly accounted for by the beauty and picturesqueness of the country surrounding the "Quaker City." Fifty thousand people, principally "commuters," pass through the Broad Street station at Philadelphia every day, and they take and leave the trains at these attractive stations which punctuate the line of the road for many miles.

The station buildings are generally constructed of stone or brick, and their architecture is designed to form a harmonious foreground to their picturesque environment. At several points on each division greenhouses are maintained which supply the flowers and shrubs for ornamenting the station grounds.

A nugget was recently hoisted out of the "Smuggler" mine, near Aspen, Col., that for size surpasses anything on record and for richness is remarkable. The workmen encountered a huge body of ore, and in digging around it ascertained that it was a monster nugget. After considerable work they succeeded in hoisting it to the surface. The chunk weighed 3,300 pounds, and contained silver to the value of $25,000. It is the largest silver nugget ever mined, and is almost pure.

Efficiency of Air and Foundation Brakes.

Mr. Waldo H. Marshall, editor of *Railway Engineering and Mechanics*, read a paper on the above named subject at the April meeting of the Western Railway Club. It was pointed out in the paper that the location of brake cylinders of cars is often such as to make the removal of the cylinder head or piston, if necessary, a very difficult operation; and that triple valves are made difficult to remove or replace by the same cause—too close proximity to members of the underframing. This also makes it difficult to turn the airbrake piston a half turn, as is usual when oiling the cylinder in order to facilitate lubrication. To facilitate the inspection and renewal of screens in drain cups Mr. Marshall suggested that a cap should be provided for this purpose on the side of the cup opposite the branch pipe opening. He had recently examined the brake gear of some furniture cars on a prominent road, in which the drain cup could not be removed without beginning at the triple valve and dissecting the branch pipe until six joints in all were broken to get at the screen.

According to the paper, there is a good deal of carelessness displayed in arranging the levers of foundation brakes, this frequently resulting in badly slid wheels. The lengths of connections are of importance, for the distortion of the gear by improper lengths may cause cramping of parts or striking of levers against obstructions. In reference to the matter of the loss of brake efficiency, the paper expatiated on the causes of this under the subheadings of: Insufficient train pipe and reservoir pressure; Excessive piston travel; The friction of piston packing; Piston release spring resistance; Tension of brakebeam release springs; and Friction in foundation brakes. Of these sources of loss, that of brakebeam release springs was named as the least excusable. If brakes are properly hung the shoes will fall away from the wheels by gravity; no one dreams of using release springs on freight trucks, and there is no more call for them in the one class of service than in the other. Standing tests of the loss of efficiency due to the friction of pins, guides, levers, etc., showed that this frequently amounted to over 28 per cent.

The New York Central follows some nice practices that might well be adopted on other roads. One of these is the distribution on all its important trains of a small folder to each passenger, giving a condensed timetable of all the principal passenger trains on the road running in the same direction, and a somewhat more complete timetable of the particular train on which the folder is distributed. The folder contains a good deal of information of interest to passengers. One paragraph treats of the dining-car and dining-room service, another of the baggage transfer service at different points, and another invites criticism of the service and of the deportment of employes. Little things like this add to the comfort of passengers and to the popularity of a road.

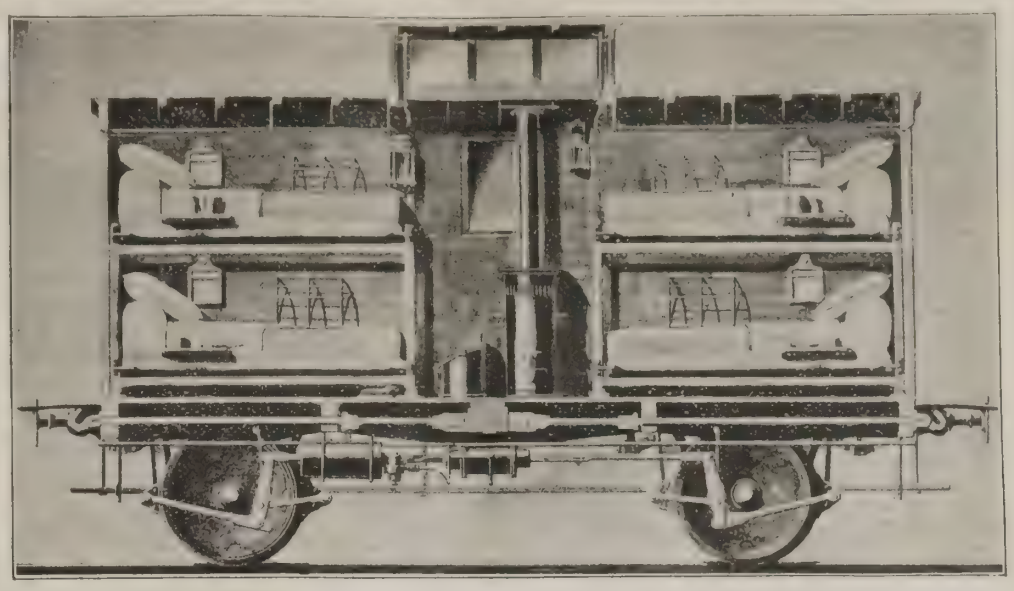
According to the latest statistics, there are in European Russia 82,241 manufactories, which afford employment for 1,206,289 persons. In the Caucasus and the portion of Russia which lies in Asia, there are 2,502 manufactories, employing 27,454 hands. In addition to these there are supposed to be in Russia about 8,000,000 "home industries," but there are no exhaustive particulars available with reference to these. The greatest number of manufactories, viz., 4,236 factories, with 242,847 hands, are in the Moscow district, and in the St. Petersburg district there are 2,256 factories. In the Warsaw district, which comprises five governments, there is an aggregate of 1,368 factories, but some are on a larger scale than in most other parts of Russia. The Government with the smallest number of manufactories is the Olonez Government, in the north of Russia, which boasts only 32 manufactories.—*Engineering.*

Government Hospital Train of the French Western Railway.

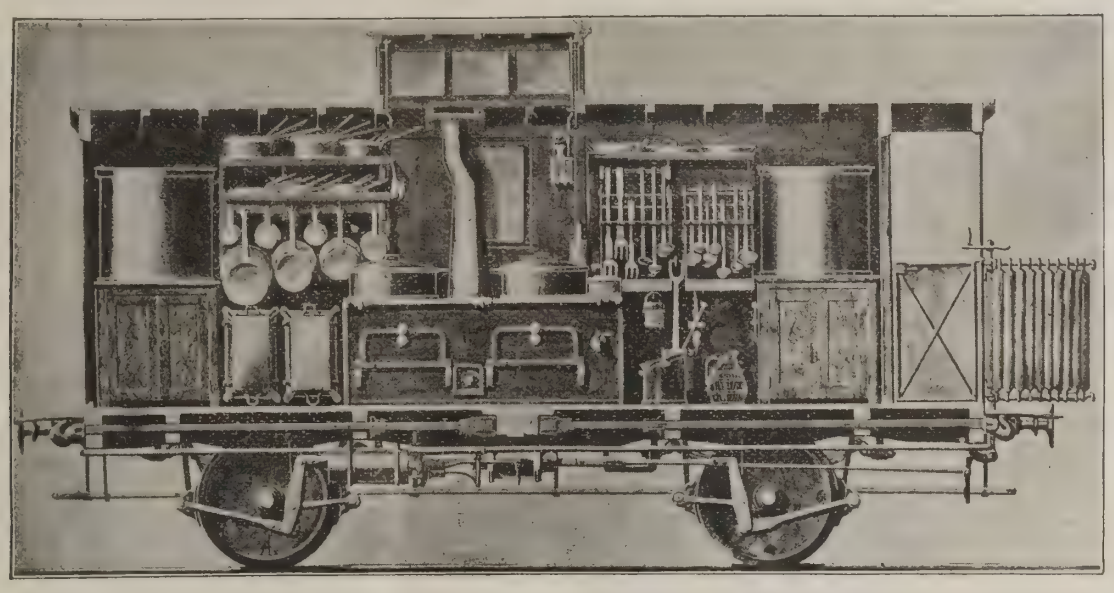
The accompanying engravings are taken from photographs, and exhibit the style of the vehicles of the "Sanitary" train of the French Western Railway, which may be considered as a veritable rolling hospital doing its work by means of its own appliances, and capable of performing during the whole course of a campaign a regular service between the field hospitals and those of the interior of the country.

This train is the outcome of the combined study of the sanitary service department of the French War Office and that of the rolling stock department of the Western Railway, and is made up of the following 22 cars, viz.: Sixteen cars for the wounded, one car for the nurses, one for surgery, medical stores and linen room, one for the kitchen, one for the kitchen tender, one for provisions, and one for soiled linen and fuel.

The cars for the wounded each contain eight cots, arranged by twos in each corner, as shown. Special attention has been given to the way of balancing or setting the cars on springs with a view to rendering their running along the lines as smooth as possible, which is an indispensable requisite in the case of wounded men. The cars



CAR FOR THE SICK OR WOUNDED.



KITCHEN CAR.

are fitted with springs of the same degree of elasticity as those of first-class passenger cars, and the stretchers, in which a bed is placed, rest upon velvet piles placed on the floor. Each car is fitted with a central skyligh to insure both light and ventilation, together with venetian blinds fixed in the end doors and windows.

In each car there is a stove constructed according to the most desirable hygienic principles. The top of it is made in such a way as to allow of pans being placed on it for warming anything desired. For the sake of cleanliness the floor is covered with linoleum, and has a trap in it for the removal of dust sweepings or other undesirable matter.

The medical staff car contains three iron bedsteads, with beds and curtains, toilet table, clothes box, writing table and water closet.

The surgical, pharmaceutical and linen cars contain the surgical instruments, drugs, etc., the pans and flasks being placed in specially constructed drawers.

The kitchen car is simply a large kitchen containing a range, etc.,as shown, and all the requisite utensils to prepare eatables and drinkables, also large water tanks at each of the four corners. The kitchen tender contains tables and their requisite kitchen articles for the preparation of the portions, preservation of the day's provisions, etc., and a charcoal filter. Wine in the wood and in bottles is also placed in it. These cars are suspended, lighted and ventilated in the same way as the cars for the wounded.

The provision car is equipped with special cupboards wherein to preserve fruit, groceries, meat and bread, etc. In the fuel and soiled linen car, the bags containing the fuel are placed in boxes resembling dog kennels; and the soiled linen is carried in caskets completely lined inside with zinc.

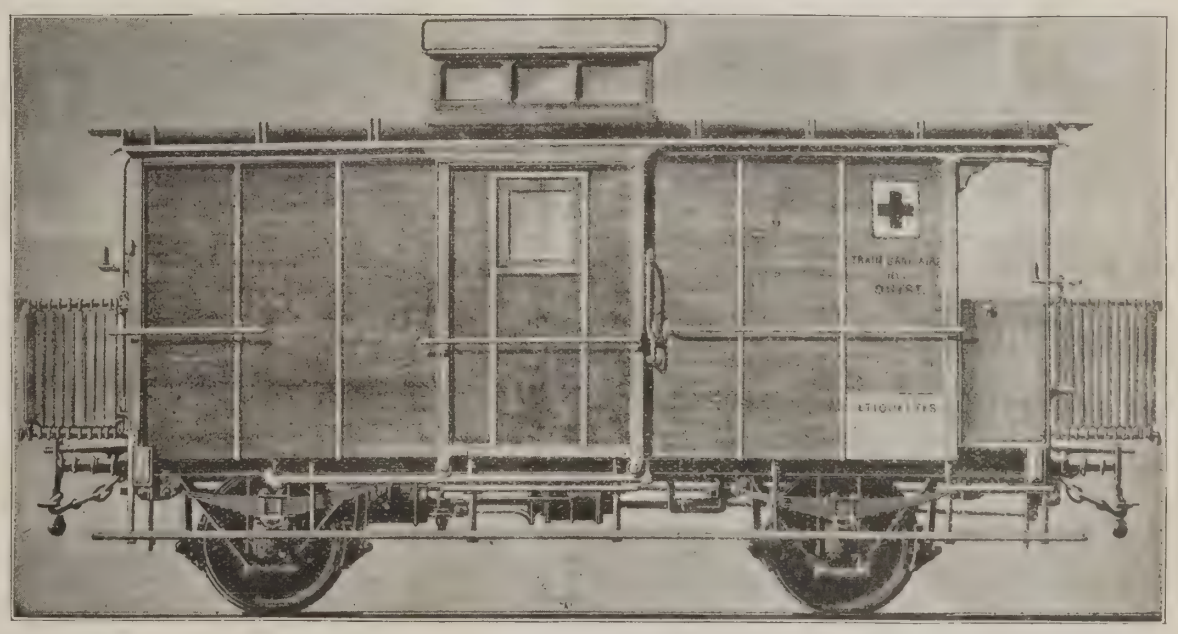
The provision car is placed in front of all the others, and that for the soiled linen is at the tail end of the train. The 20 intermediate cars each have end doors, with gangways and handrails, allowing the medical attendants and nurses to pass from one car to the other. The car for provisions and that for soiled linen are designedly outside of this range of communication.

The five vehicles, i. e., those of the medical staff, attendants, medical stores, kitchen and kitchen-tender are each fitted at the end with a platform and steps to allow of direct access from the outside without having to pass through the cars of the wounded.

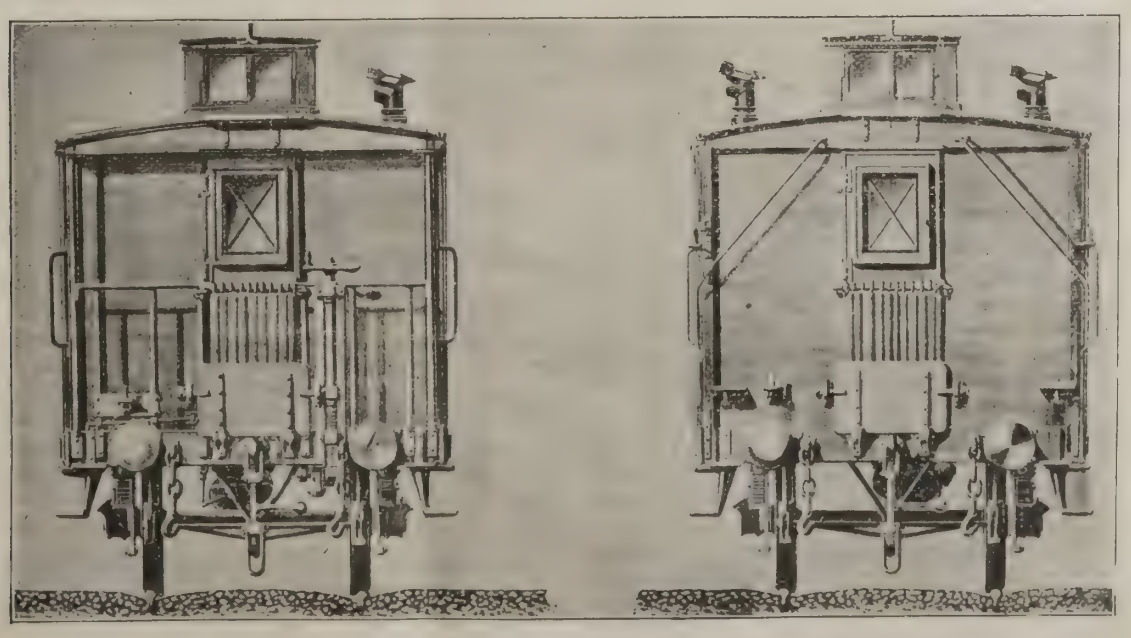
The above details, together with the photo-engravings of this permanent sanitary train, are taken from official documents of the French Western Railway.

Sad, But Appropriate News.

Weeping Water, Neb., May 18.—Colonel Robert A. Ricker, formerly General Superintendent of the Iron Mountain & Southern and Denver & Rio Grande roads, died last night in this city, of heart trouble.



HOSPITAL TRAIN MEDICAL-STAFF CAR.



END VIEW OF HOSPITAL-TRAIN CARS SHOWING MEANS OF INTERCOMMUNICATION.

The *Railway World* reports that a man wishing to patronize a Connecticut hotel hitched his ox team, with a load of lumber, to a freight car standing upon a side track near the railway station. A freight train passing by suffixed the waiting freight car with habitual dexterity and promptitude, and continued on its course. Never was lumber more lightly handled, never did it scatter more speedily, and never were oxen known to pace as fast. A brakeman luckily discovered the unpremeditated trailer before the oxen were utterly dismembered, and it is to be presumed that the startled teamster will hereafter look for a more permanent hitching post.

The question of the coal reserves in Europe is discussed by M. Nasse, a Mine Commissioner for the government, in a recent number of *Le Journal de la Société de Statistique de Paris*. He states that Germany possesses actually 107,000,000,000 of tons of coal, without counting the lignite, which corresponds to about 2,900,000,000 tons of bituminous coal. There are yet, in the other European countries, 244,000,000,000 tons to be extracted, 195,000,000,000 of which are to be found in Great Britain and 17,600,000,000 in France. M. Nasse thinks that, at the actual rate of consumption, coal will be exhausted within 500 years in Belgium, France and Austro-Hungary, and within 800 or 1,000 years in Great Britain and Germany.

Briquette Fuel.

Various attempts to utilize slack coal by pressing it into bricks, or briquettes, have been tried on some American roads, but generally with rather indifferent success, commercially considered. This is probably due to the abundance and consequent cheapness of coal in most sections of the United States. Roads on the Pacific Coast, and other sections where coal has to be supplied from a distance, will always be more or less interested in this matter, because their fuel is dear and much of it reaches them in such a powdered condition as to be almost useless for locomotives. An interesting paper was read on this subject by Mr. Alfred Giles at the meeting of the English Institution of Civil Engineers, May 1. The following synopsis of this paper is taken from *Engineering:*

The paper contained a description of the various English and Continental methods of agglomerating slack coal, which had now become an important and increasing industry, and opened up an outlet for large quantities of small coal hitherto lost on the pit bank or in the workings. Various agglomerating agents were detailed and their local advantages discussed; the characteristics of good pitch derived from coal-tar rendered that agent, however, in every way the most suitable. By the use of from eight to nine per cent. of pitch, slack coal might be agglomerated into a form eminently suitable for storage purposes, waterproof, incapable of deterioration on exposure, of cohesion greater than the large coal from which it was derived, and, finally, having calorific qualities nearly equal to large coal. In support of the latter contention the author cited the results of three experiments with English briquettes, which gave 8.41 pounds, 8.77 pounds, 8.99 pounds respectively, as the weight of water evaporated from and at 212 degrees Fahr. per pound of fuel. The average evaporative power of several of the best Welsh steam coals was 9.33 pounds. Careful experiments made by Mr. Marie on the Paris, Lyons and Mediterranean Railway gave as corresponding figures for three descriptions of French briquettes, 8.88 pounds, 9.15 pounds and 8.68 pounds respectively.

The mechanical preparation of the coal used in briquette manufacture received more attention on the Continent than in England, particularly in regard to the washing and subsequent drying of the slack. These operations were necessary in order to render the poorer coals serviceable for the manufacture. The coal and pitch were intimately intermixed by two methods, known respectively as the melted and dry pitch process; the pitch by the former being melted (sometimes with additions of common tar) prior to its addition to the coal, and by the latter being ground up with the coal in a dry state. In both instances the mixture of coal and pitch was subjected to the action of heat until each particle of coal was covered with a film of melted pitch, and so rendered fit for compression into blocks. In this state the mixture or paste contained from 3 to 5 per cent. of water in order to facilitate the sliding of the particles of coal one on the other during compression. The machines for compressing the paste were roughly divided into three classes, irrespective of the nature of the power employed. These classes were—first, single-compression machines; secondly, machines compressing on both sides of the briquettes; thirdly, machines acting by the tangential pressure of rolls, and those of the sausage machine type.

Briquettes hot from the press had an inconsiderable cohesion, and had to be treated with care in stacking and loading, and arrangements made to keep down the cost of labor. Costs were given of making briquettes in works in England, in the north of France, and in Belgium, the cost of labor, fuel, supplies and maintenance, not inclusive of of the cost of materials not agglomerated, being 2s. 1½d., 1s. 9d., and 2s. 6d. per ton respectively.

Steel Versus Iron for Rivets.

A correspondent in the last issue of the *Iron Age*, in discussing this subject, says: The use of steel for rivets for boiler and structural purpose, because of its diminished cost, is pushing it to a position it should not under any existing circumstances be permitted to occupy. It is well known by every metallurgist that all steel, by whatever process manufactured, becomes, in proportion to the carbon, phosphorus, sulphur and manganese it contains, difficult to weld, and more especially to itself. In proportion to the rapidity with which it is cooled does it become crystallized or granular, hence brittle and very unreliable where cohesiveness is a principal element of success. Bridges are in perpetual oscillation from atmospheric influences and the more violent vibrations of passing vehicles or cars. Boilers are subject to the successive strains of expansion and of contraction, both of which exert a most powerful and dangerous action upon the rivets. A steel rivet, to begin with, is more dense in its molecular structure than an iron rivet, and is made much more so by the process of riveting. A steel rivet becomes so crystallized underthe head and cone that very frequently the heads drop off from the mere vibrations necessary to complete the work.

This, however, is not the least of a number of evils inseparably connected with steel rivets. Presuming the boiler or structural material to be of steel, and hence of similar nature in density to the rivets to be used, we note that the holes are so punched as to allow easy admission through the two or more folds desired to be riveted together, but they are not large enough to allow for the expansion of the stem of the rivet by upsetting or riveting, and so relieve the neck from severe tension. On the contrary, the object sought is a perfectly tight combination of the parts. Hence the assembling must, from the very nature of the steel rivet and its manipulation, become more dangerous as this is continued, because it becomes more liable to crystallize by the operation, and consequently more defective in proportion to its continuation. It is true that such work may hold together till put in position, but before long expansion and contraction or the continual crystallizing action of vibration assert themselves, and we read the startling announcement of a bridge disaster more or less destructive of life and property, or of a boiler explosion with all its horrifying accompaniments. Investigations are made by learned theorists, and reports given to the press by manipulators of good, plain English; but a good, practical mechanic would tell us that the plates and rivets being of the same dense and unyielding material, expanded or contracted, as the case might be, and the weakest spot let loose the entire structure. But had first-class iron been used for rivets there would have existed some yielding.

Traditions of the Camden & Amboy Railroad.

The following interesting reminiscences of the early history of passenger and freight transportation between New York and Philadelphia are gleaned from a recent article in the Philadelphia *Public Ledger:*

It was natural that in the earliest Colonial times facilities should have been provided for travel between the settlements on the Hudson and the Delaware. Rough horse tracks were opened through the forests, and the first route across New Jersey was between Burlington and Amboy. This was originally an Indian trail, and when George Fox came to Burlington, he and his companion, George Whitefield, crossed the Delaware from Burlington to Bristol in a small canoe, swimming their horses after them. The transporters across Jersey early learned the advantages of "monopoly," and in 1707, Lord Cornbury, the Governor, granted the exclusive right of this transportation to certain favored persons. In that year a "waggion" ran every two weeks between Burlington and Amboy with a fixed rate of fare.

For nearly 45 years this "waggion" moving "once a fortnight" conducted the traveling public between Philadelphia and New York. Then our friend, Joseph Borden, appeared upon the scene. He had graduated as a Bordentown ferryman, and developing into a through-line transporter, in 1751 became the originator of a new line as the proprietor of a "stage-boat," moved by tide and wind power, upon the Delaware River, between Philadelphia and Bordentown. Borden loaded his boat with freight at the "Crooked Billet Wharf," in Philadelphia, every Tuesday, sailed on Wednesday to Bordentown Landing, and then on Thursday a "stage-wagon with a good awning" took the passengers across New Jersey to Perth Amboy, whence another "stage-boat" on Friday proceeded to New York, through the Kill Von Kull. This method of transit, when put in operation, was zealously described as "thirty or forty hours the fastest way yet made use of." It is curious to note that at this time the subsequent railway gage was set, for a law was passed that required all wagon wheels used on the highways to be 4 feet 8½ inches apart, "turnpike width." The usual rate of fare was threepence (6 cents) per mile. Travel grew by this route (interrupted during the Revolution), until in 1790 it was estimated about 2000 persons passed each way in the year between the two cities. In 1804 the first bridge was built across the Delaware River, at Trenton, and then a line of stages was established, going three times a week across this bridge, and leaving Philadelphia at 4 o'clock in the morning, arriving in New York at 8 in the evening. This stage route passed through Bristol, Trenton, Princeton, Kingston (half way), New Brunswick and Elizabethport, where boat was taken for New York. Withington's, in Kingston, was the famous halting place for dinner on this route, and it is related that the stage business grew to such proportions that "forty-nine stages loaded with passengers have been known to halt here at the same time, when more than 400 harnessed horses were seen standing in front of Withington's Inn at once."

Most of these early transportation methods were ultimately merged into the "Union Line," which for many years controlled the carriage of freight and passengers between the two cities. Their through route was 101 miles long. It consisted of a steamboat ride of 36 miles on the Delaware, from Philadelphia to South Trenton; 25 miles of staging, between Trenton and New Brunswick, over the turnpike chartered when the Delaware bridge was opened, in 1804; and another steamboat ride of 40 miles, from New Brunswick to New York. Steamboating was popular with travelers then, and was availed of whenever possible. This route carried the trade for a long period, and in 1825 was estimated as transporting about 2,800 passengers each way. John Stevens, the father of New Jersey transportation, was the active spirit in this line, having made steamboat navigation a success on the Delaware River as early as 1812. He was born in New York of English lineage, in 1749, and resided at Hoboken, being the father of Robert and Edwin Stevens. From 1792 he had been experimenting in steamboat propulsion, his "Phœnix" having steamed around from Sandy Hook to Cape May in 1808. He established the first steam ferry in the world, between New York and Hoboken, with his "Juliana," in 1811.

John Stevens first schemed out the idea of a railroad across New Jersey, and has been described as "the thinker ahead of his age," for he obtained the first railway charter granted in America, in 1817, for a railroad over the route of the "Union Line" stages between Trenton and New Brunswick. No result followed, for his plan was then regarded as visionary. It remained for his son, Robert, to carry out his ideas, though he lived until 1838 to see them fully realized. The first organized movement for building the railroad was at a public meeting in Mount Holly, the county seat of Burlington, in January, 1828, which passed resolutions advocating the construction of a road between Camden and South Amboy. The next three years saw the matter actively agitated at numerous meetings and by petitions to the Legislature. At that time the Erie Canal was so successful that a canal across New Jersey had strong advocates, and the Legislature was also petitioned for a canal between the Delaware and Raritan rivers. The canal projectors said they would build a railroad on the canal bank, and this made sharp rivalry. Then began the peculiar tactics in the New Jersey Legislature, for which that body has long been noted.

Active lobbies appeared at Trenton in 1829-30, one advocating the railroad and the other the canal, and so hot was the controversy that the parties actually carried arms through the streets. Robert L. Stevens was the railroad chieftain, and Commodore Robert F. Stockton championed the canal. It is curious to note that the bitter controversy was terminated in a most surprising manner. Between the acts of a play at the old Park Theatre in New York, Stevens and Stockton accidentally met in the vestibule in January, 1830, and after a few minutes' conversation compromised their dispute by joining forces. Both railroad and canal were chartered on the same day, Feb. 4, 1830, under the titles of the "Camden & Amboy Railroad and Transportation Company" and the "Delaware & Raritan Canal Company," each with $1,000,000 capital, with privilege of increase to $1,500,000. Each was to have a monopoly, for which transit dues were to be paid the State of 10 cents per passenger and 15 cents per ton of freight carried, and the State was authorized to purchase the works at a valuation at the end of 30 years.

When the Camden & Amboy Railroad was organized Robert L. Stevens was made President and Chief Engineer, Edwin A. Stevens, Treasurer, and they, with Abraham Brown, of Mount Holly; William McKnight, of Bordentown; William I. Watson, of Philadelphia, and Benjamin Fish, of Trenton, were the first Board of Directors. The surveys for the line were made by Major John Wilson, the direct charge of the surveying parties being given to William Cook and John Edgar Thomson (afterward President of the Pennsylvania Railroad). Cook laid out the route from Amboy to Crosswick's Creek, near Bordentown, and Thomson thence to Camden. It is very curious now to read that these surveys were made so that "as large a proportion of the distance as possible between New York and Philadelphia would be a water route, it being the belief in those days that traveling by steamboat would always be more popular and more economical than traveling overland, and that railroads would only be subsidiary to the water routes." Robert L. Stevens drew his first year's salary as President of the new railroad in November, 1831, $6,000, thus early setting the fashion for high salaries among railroad officials. He designed the American rail and spike, going to England to get them manufactured, and on the voyage over he whittled out of wood his models. The first rails, 18 feet long and weighing 36 pounds to the yard, came out in the ship *Charlemagne* to Philadelphia in May, 1831. Afterward the lengths were made 16 feet and the weight 40 to 42 pounds. They were laid upon stone blocks, two feet square, quarried and dressed by the convicts at Sing Sing, New York, but this was afterward changed to wooden ties. Stevens on this visit to England also ordered the "John Bull," built by George Stephenson, at Newcastle-on-Tyne, and arriving at Bordentown in August. No tender came with the locomotive, so one was improvised by putting a large whisky cask on a four-wheeled flat car, so as to supply water for the boiler.

All being in readiness, on Nov. 12, 1831, in presence of the New Jersey Legislature and State officials, the "John Bull" hauled the two old passenger cars (then new and handsome) over about 3,500 feet of track at Bordentown, back and forth many times, to demonstrate that this first movement of trains over the Camden & Amboy Railroad was a success. All rode in the cars and were satisfied, among them being Madame Murat, then residing at Bordentown. It is *naïvely* related that "In the evening a grand entertainment was given to the Legislature by the railroad company at Arnell's Hotel, Bordentown, and it has been whispered that the festivities kept up until a late hour in the night. Whether that be true or not, it is generally conceded that from that time to this the Legislature of New Jersey has always been more or less interested in the affairs of the Camden & Amboy Railroad and its successors." In 1832 the road was completed between Bordentown and South Amboy, and on Dec. 17 the first passengers went through: Mr. Benjamin Fish says, "fifty or sixty people went; it was a rainy day." The cars were drawn by horses, for they could not trust the locomotive out in the rain. The first freight car was moved in January, 1833, drawn by one horse, driven by Mr. Fish. Regular traffic began in 1838, the passengers coming from Philadelphia by steamboat and landing at the White Hill wharf. Galloping horses took the cars over to South Amboy in about three hours, there being three relays. Then, as the railroad developed, the "Union Line's" gayly painted stage coach, with prancing steeds and dashing drivers, soon became a past vision. The "John Bull," late in the year, took one train each way, and during the first year of service the through passengers numbered about 32,000, which had grown in 1840 to 153,112, or about 17 carloads per day. The railroad then owned 15 passenger cars, and two trains each way of four of our present cars could easily have done the whole service. When the war began in 1861 the passengers numbered 500,000 annually. The road was a single track of 61 miles between Camden and Amboy, but gradually the track along the canal bank was availed of between Trenton and New Brunswick, which, with the Philadelphia & Trenton Railroad, and extensions through Newark to Jersey City, made an all-rail route between the cities. In 1871 all the properties were absorbed by lease to the Pennsylvania Railroad, paying 10 per cent. annual dividends. The great corporation, so long managed by Robert L. and Edwin A. Stevens and Commodore Stockton and his sons, then passed under control of the greatest railway in the world, giving it the through outlet to New York, which has contributed so much to its prosperity and expansion. Such is the interesting story of Camden and Amboy.

Cost of Cars, 1836—1894.

We learn from an old exchange that the cost of passenger cars on the Baltimore & Ohio Railroad in 1836 was $658.55, and of freight cars, $159.92. It is probable that this was during the time the Baltimore & Ohio Railroad was running its trains with horses from Baltimore to Ellicot city, and that these cars were very small, about the size of a modern street car. Mr. E. W. Grieves, Superintendent Car Department Baltimore & Ohio Railroad, informs us that "Box cars cost now from $590 to $600 with air-brakesand automatic couplers, and gondolas cost us about $450. The first class passenger cars we are using, having every convenience, cost about $5,400."

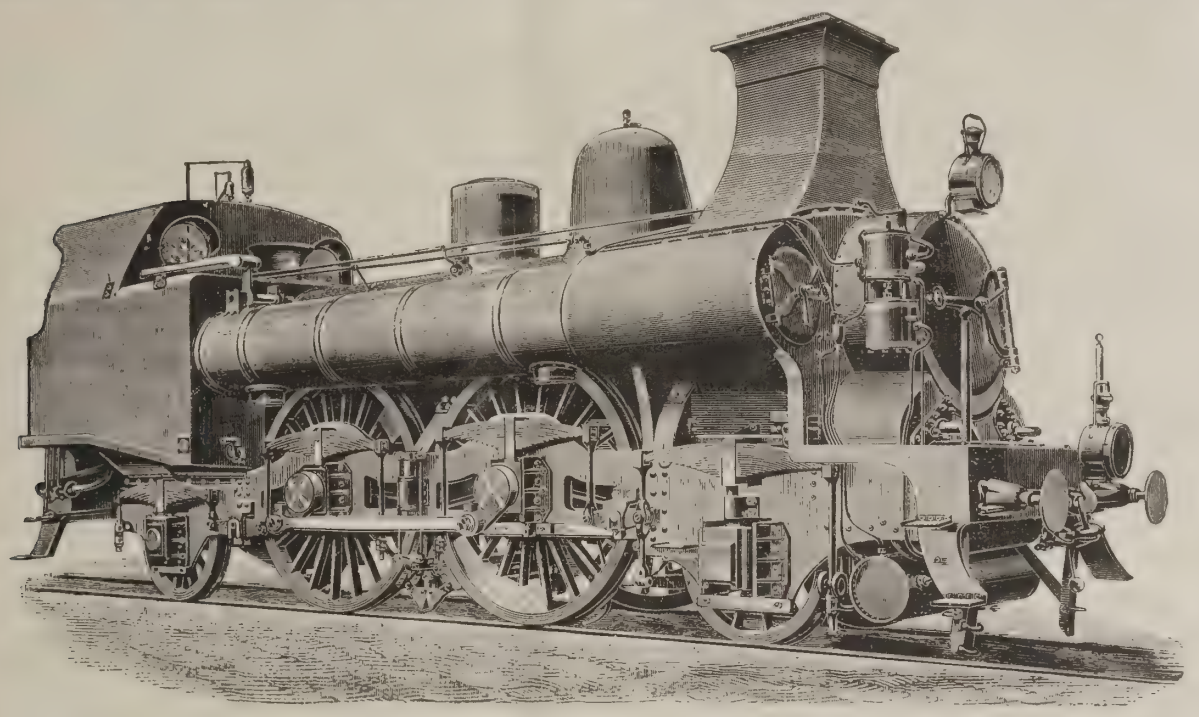
The Manchester Ship Canal was formally opened by Queen Victoria, May 21, and the event was provocative of the most unrestrained enthusiasm. It is estimated that 2,000,000 people took part in the celebration.

Triple-Boiler Locomotive for the Belgian State Railway.

The curious-looking locomotive which we illustrate on this page was built in 1888 by the Société St. Leonard, of Liège, Belgium, to compete with another engine designed by the Cockerill Company, of Seraing, and exhibited by them at the Paris Exhibition of 1889. This latter was less powerful than the triple-boiler engine, but was finally adopted by the Chemin de Fer de l'Etat as their standard express engine, of which over sixty have since been built by the various well known Belgian firms. The engraving of the triple-boiler engine is reproduced from our English contemporary *Engineering*.

In calling for competitive designs of new engines, the authorities required that the competing locomotives should be able to haul a gross load of 150 tons up a grade of 1 in 200 at 56 miles per hour, without diminution of steam pressure or of the level of the water in the boiler, for a distance of three miles at least. Both engines referred to above proved very satisfactory, and attained speeds of 59 miles per hour under the conditions named. Indeed, the triple-boiler engine ran up the grade stated at 61 miles per hour, and took trains of 150 tons gross (including engines) up hills of 1 in 62 at 40 miles per hour, and, on other occasions, loads of 182 tons up the same grade at 31 miles per hour. From these results, obtained under similar conditions, the powers developed by the two engines were found to be 1,235 horse-power for the triple boiler locomotive, and 1,189 horse-power by the "Type 12." At 59.4 miles per hour, with 150 tons, on a grade of 1 in 200, the power of the triple-boiler engine exerted 1,339 horse-power.

The two engines in question differed mainly in their boilers, as they had the same cylinder capacities. As will



BELGIAN TRIPLE-BOILER LOCOMOTIVE.

be seen from our engraving, the engine illustrated has a boiler with three barrels, which have the same tube sheet and the same extension smokebox in common. The smoke-stack is square, spreading out at its base to embrace the side divisions of the smokebox. The smoke and steam are said to be thrown with this square stack less clear away from the engine than with the round forms. The grate area is double that of any French express engines and superior to that of "Type 12," and the heating surface is 50 per cent. more than in the "Type 12" and 107 square feet above that obtained in Flaman's double-boiler locomotive.

The coal consumption is given as 3,167 pounds per hour, which, taking the speed as 44 miles per hour, corresponds to 72 pounds per mile; 1 pound of coal is said to evaporate 5.6 pounds of water upon the average, or 6.6 pounds as a maximum, results no better than obtained with American locomotives, but the coal burned by these Belgian locomotives is of the poorest "slack," unmixed with briquettes, as commonly practiced in France. As regards economy, the results given by the engine are said to be excellent. There are, it is true, certain details of construction that could be improved, even in the existing engine, as, for example, the square chimney, and the absence of running-boards permitting the engine to be got at when under way. There is also, sometimes, an unequal expansion of the tube-sheet due to a superior draft in the central series of tubes. A trouble also with engines of abnormally large grate area is the difficulty of obtaining a sufficient draft in the smokebox. The locomotive in question is one of the most unconventional developments of locomotive practice since the time of Stephenson. It was designed with a view of obtaining great steaming power without mounting the boiler dangerously high. Continental and American trains make greater demands on the steam producing capacity of the boilers than is the case in England; hence these multiple boilers of Flaman, the St. Leonard's Company and others have been produced.

The principal dimensions of the engine are as follows:

Firebox, width inside	9 ft. 3 in.
" " outside	9 " 10 "
" length inside	5 " 10 "
" " outside	6 " 43 "
" height, front	3 " 7 "
" " back	2 " 9 "
Grate area	56 sq. ft.
Boiler, central	4 ft. 3 in. diam.
Boilers, side	2 " 3 "
Tubes, central	180
" side series (48 each)	96
Total	276
Tubes, length	15 ft
Working pressure	130 lb. per sq. in.
Heating surface, firebox	121.6 sq. ft.
" " boilers	1,931.0 "
Total	2,052.6 sq. ft.
Clyinders, diameter	19.6 in.
Stroke	23.5 in.
Drivers	6 ft. 10½ in diam.
Weight, engine	56.8 tons
" tender	29.5 "
Total	86.3 tons

Transmission of Flame Heat in Steam Boilers.

Prof. Vivian B. Lewes read a paper before the Institution of Naval Architects, recently, entitled "Leaves from a Laboratory Notebook," from which the following is taken:

The calculated evaporative value of the fuel used in the furnaces of steam boilers, and also the value obtained by calorimetric tests, is invariably far higher than the evaporative power as found in actual working, the difference in many cases amounting to over 40 per cent.; this result being due to a large number of different causes. Among these are loss of heat by radiation from the exposed surfaces of the boiler, improper regulation of the air supply, and incrustation in the boiler reducing the conducting power of the plates; but I think there is yet another cause which has been overlooked.

As early as 1876 Heumann, in his researches upon the causes of luminosity in flame, found that no flame was in contact with a cool surface exposed to its action, and that a bar of cold metal plunged into a flame extinguished the flame gases in its immediate vicinity, leaving an area in which no combustion takes place, but which grew less and less as the metal became heated, until the rod had acquired nearly the same temperature as the flame itself, when contact between the two was completed. Before I knew that this work had been done I had noticed the same phenomenon, and had made experiments which led me to the same conclusion.

In all analyses of flue gases a certain proportion of unburnt combustible constituents will be found to still exist, and there is no doubt that the chief cause of this is to be found in the fact that the flame which plays along the upper part of a boiler furnace, and which heats the furnace crowns, combustion chambers, and tubes of the boiler, is cooled by contact with the boiler plates to such an extent that it is extinguished, leaving a thin layer of unburnt gas mixed with the products of combustion between the source of heat and the plate; and inasmuch as the plates on their exterior surface will only rise in temperature a degree or two above the temperature of the water within the boiler, you will never have, under normal conditions, boiler plates heated to a temperature higher than 200 degrees C., while flame has a temperature of over 1,000 degrees C.; the result being that a layer of non-conducting gas is always present, and checks the transmission from the burning fuel to the water within the boiler, while the unburnt gas creeping along the plates will, to a great extent, escape combustion, and by this dual action leads to a very considerable diminution in the evaporative value to be obtained from the fuel.

Unconsidered Uses of Wood.

There are countless ways in which wood is being consumed, besides the larger uses for fuel, building purposes, and the like; and in the aggregate these unconsidered uses amount to a serious drain upon the forests, while little or nothing is done to insure a supply for future demands. The enumeration of the special uses of wood in the arts forms a very interesting chapter. One of the principal uses of the wood of the holly, dyed black, is to be substituted for ebony in the handles of metal teapots, etc., and the strong straight shoals, deprived of their bark, are made into whip handles and walking sticks. The limetree forms the best planks for shoemakers and glovers upon which to cut their leather, and is extensively used in the manufacture of toys and Tunbridge ware, and by the turner for pillboxes, etc.; and the inner bark is made into ropes and matting. The sycamore furnishes wood for cheese and cider presses, mangles, etc., and when the wooden dishes and spoons were in common use they were mostly made of this wood. It is now used also in printing and bleaching works for beetling beams and in cast iron foundries for making patterns. The yew is used by the turner and made into vases, snuffboxes and musical instruments, and it is a common saying among the inhabitants of New Forest that a post of yew will outlast a post of iron. Where it is found in sufficient quantities to be employed for works underground, such as water-pipes, pumps, etc., the yew will last longer than any other wood. Gate-posts and stakes of yew are admirable to wear, and in France the wood makes the strongest of all wooden axletrees. Of the beech are made planes, screws, wooden shovels, and common fowling-pieces and muskets are also stocked with it, and beech staves for herring-barrels are not unknown. The sweet or Spanish chestnut furnishes gate and other posts, railing, and barrel staves, hop poles and other such matters, such as strong and good charcoal, though scarcely equal to that of oak for domestic purposes, but considered superior to that of any other for forges.

Hornbeam is the best wood that can be used for cogs of wheels, excelling either the crab or the yew; but its application in this manner is about at an end. As a fuel it stands in the highest rank, emitting much heat, burning long, and with a bright, clear flame. In charcoal it is highly prized not only for culinary purposes and the forge, but also for the manufacture of gunpowder, into which, on the Continent, it enters in large proportion.

In Russia many of the roads are formed of the trunks of the Scotch pine, trees from six inches to one foot in diameter at the larger end being selected for the purpose. These are laid down side by side across the intended road, the thick of one alternately with the narrow end of the other, and the branches being left at the end to form a sort of hedge on each side of the road. When thus laid the hollows are filled up with earth, and the road is finished, being analogous to the corduroy roads of North America. In Germany casks are made of larch, which is almost indestructible, and they allow of no evaporation of the spirituous particles of the wine contained in them. In Switzerland larch poles are much used for vine crops, they are never taken up, and see crop after crop of vines spring up, bear their fruit, and perish at their feet without showing symptoms of decay. The uninjured state in which larch remains when buried in the earth or immersed in water renders it an excellent material for water-pipes, to which purpose it is largely applied in many parts of France. The butternut is esteemed for the posts and rails of rural fences in America, for troughs for the use of cattle, for corn shovels and wooden dishes.

Shell-bark hickory provides baskets, whip handles and the backbows of Windsor chairs. The pignut hickory is preferred to any other for axletrees and ax handles. The sugar maple is used by wheelwrights for axletrees and spokes, and for lining the runners of common sleds. Dogwood is used for the handles of light tools such as mallets, small vises, etc. In the country it furnishes harrow teeth to the American farmer, and supplies the harness of horses' collars, etc.; also lining for the runners of sledges. The mountain laurel is selected for the handles of light tools, for small screws, boxes, etc. It most resembles boxwood, and is most proper to supply its place. Bowls and trays are made of red birch, and when saplings of hickory or white oak are not to be found, hoops, particularly those of rice casks, are made of the young stocks and of branches not exceeding one inch in diameter. Its twigs are exclusively chosen for the brooms with which the streets and courtyards are swept. The twigs of the other species of both, being less supple and more brittle, are not proper for this use. Shoe lasts are made from birch, but they are less esteemed than those of beech.

Immense quantities of wooden shoes are made in France from the wood of the European alder, which are seasoned by fire before they are sold. The wood of the locust is substituted for box by the turners in many species of light work, such as salt cellars, sugar-bowls, candlesticks, spoons, and forks for salads, boxes, and many other trifling objects, which are carefully wrought into pleasant shapes and sold at low prices. The olive is used to form light ornamental articles, such as dressing cases, tobacco-boxes, etc. The wood of the roots, which is more agreeably marbled, is preferred, and for inlaying it is invaluable. Of persimmon turners make large screws and tinmen mallets. Also shoemakers' lasts are made of it equal to beech, and for the shafts of chaises it has been found preferable to ash, and to every species of wood except lancewood. The common European elm is used for the carriages of cannon and for the gunwale, the blocks, etc., of ships. It is everywhere preferred by wheelwrights for the naves and felloes of wheels, and for other objects. White cedar serves many subsidiary purposes. From it are fabricated pails, wash-tubs, and churns of different forms. The ware is cheap, light, and neatly made, and instead of becoming dull, like that of other wood, it grows whiter and smoother by use. The hoops are made of young cedars stripped of the bark and split into two parts. The wood also supplies good charcoal. The red cedar furnishes staves, cigar boxes, stopcocks, stakes, and is also used for coffins.

A few special applications of wood in this country are mentioned, separated into trades—namely, sieves, usually of black or water ash for the bottom and oak or hickory for the circle; whipstocks, white oak; baskets, willow, white oak and shellbark hickory; picture frames, white pine and sweet gum; saddle-trees, red maple and sugar maple; screws of bookbinders' presses, hickory or dogwood; hatters blocks, sour gum; corn shovels, butternut; shoe lasts, beech and black or yellow birch.—*Illustrated Carpenter and Builder.*

All of the inhabitants of five villages in Venezuela perished during the earthquake of April 29.

A large iron railroad tunnel has just been completed on the North British Railroad near Glasgow. It is known as the Mound North Tunnel, and is a tube of cast iron 17 feet 6 inches in diameter, composed of segments 4 feet long and 18 inches in breadth, bolted together through flanges 7 inches deep and 1¾ inches thick.

New York Railroad Club.

Roller Bearings.

Mr. Charles D. Meneely read a paper on "The Substitution of Rolling Movement for Sliding Friction in Journal Boxes" before the last meeting for the season of the New York Railroad Club, which was held on the evening of May 17. In his introduction to the subject Mr. Meneely said:

Some threescore years ago it became evident that however useful and even indispenable might be the operation of friction in many ways, it was certainly out of place upon the journals of steam railway cars. The sliding, grinding friction which had been a source of trouble from time immemorial upon the axles of vehicles drawn by animal strength was still more difficult to control in this new field of rapid transit, where greater weight and higher speed gave rise to conditions before unknown. Inventors were naturally attracted to the solution of the problem, and ever since have sought, with endless ingenuity, to effect successfully a rolling relation between the moving journal and the fixed portion of the car or truck, which would be analogous to the movement of the wheel upon the rail.

The paper described and illustrated a variety of different forms of roller bearings which had failed through faulty design, due to the lack of knowledge by their inventors of the essential requisites of such bearings. These requisities were outlined as follows:

First. That rubbing friction must be entirely avoided, and that the bearing must operate wholly by rolling movement.

Second. That a perfect alignment must be maintained with the journal, for if the exteriors of two cylindrical bodies contact in a line they must be exactly parallel, from which position the least deviation reduces their contact to a point.

Third. That to preserve unimpaired the fit and adjustment of the device, the lines of rolling separation must be co-extensive with the bearing length of the rollers of the journal.

Fourth. That the bearing lines taking the weight must be closely grouped to prevent journal wedging, and to form a continuous bearing which will operate without shock.

Fifth. That the device must carry no dead weight, in order that sliding friction may be obviated by an instant response to journal movement at all times.

Sixth. That the device shall be simple, and the form and material of its parts such that safe operation, with reasonable care, is assured.

In the Meneely tubular bearing which has now been in operation under steam cars for three years and a half, these conditions appear to be fulfilled. It is said that these bearings were placed under a Delaware & Hudson coach weighing 50,000 pounds, Dec. 9, 1890, and have ever since been in regular service, with a record to date of 136,000 miles. Continuing, the paper said:

At the end of two years the bearings were temporarily removed, carefully measured and returned to service. It was found that the bearings calipered to exact original size, no wear having occurred save the polish of the exteriors of the rollers. On their interiors and on the separators the tool-marks were distinctly visible. The journals were smoothly polished by rolling: one only, the metal of which was porous, had been compressed to the extent of $\frac{1}{64}$ of an inch. The same company has also a train of four passenger coaches, weight 204,000 pounds, which has been in daily service for nearly two years on a run where brake applications are made in 117 regular daily stops, and neither bearings nor journals exhibit any rate of wear whatever. The electric railways of Albany and Troy have used tubular bearings for more than two years, and have together about 90 cars (nearly their whole equipment) now operating upon them. Both systems have adopted the appliance as their standard. The results gained on these cars have been eminently satisfactory. The four-car train, referred to above, has repeatedly been moved by a man of ordinary strength in both directions on a level track; and the ease with which both steam and street cars are handled is a constant surprise to those accustomed to the heavy pull of brasses.

It was stated that among the results of the use of these bearings was a saving in initial moving force of over ninety (90) per cent., and a large reduction in journal resistance at all speeds. Also a saving of 25 per cent. in fuel and 80 per cent. in lubricants, absolute avoidance of hot boxes and no increase of journal resistance in cold weather. In the discussion of the paper, Mr. M. N. Forney said that the resistance due to journal friction constituted but a small per cent. of the total draft of a train upon the engine; that the roller bearing would not diminish the power required to lift a train over grades, and that it did not reduce the friction of the locomotive or effect the atmospheric resistance, and that it was very doubtful if it decreased the resistance of curvature. When these were all taken into consideration it left comparatively little for the roller bearing to save. He would be surprised if, in usual practice, it amounted to 25 per cent. of the total fuel burned. The saving claimed as being effected in lubricants he did not doubt. Mr. F. D. Adams, Master Car Builder of the Boston & Albany Rail road, gave briefly the results of his experience with roller bearings upon his road, and expressed the belief that they were entirely successful.

Auto-Pneumatic Switches and Signals.

Mr. H. B. La Rue, who is very well and favorably known in railroad circles, has become General Manager of the Auto-Pneumatic Railway Signal Company, of Rochester, N. Y. This company is introducing a pneumatic block system, pneumatic switch and signal interlocking appliances and a pneumatic brake-setting device. Speaking of a switch and signal plant installed by this company at Buffalo last October, Mr. La Rue says:

It has passed through a severe winter, and has accomplished about 80,000 consecutive movements without a single failure or requiring one dollar in repairs. It is very simple in its construction but absolute and accurate in its action. Eight signals and six derailing points are moved by one short lever in the hands of a young cripple. Referring to a recent discussion in the railway press as to the capability of a girl operating an interlocking plant, here is one that she could. Gales and electric storms, snow and ice, have no effect whatever upon it; it works equally well in all kinds of weather, the pipes laying under ground and the moving parts being boxed in.

The Gould Coupler Company has moved its offices to the Manhattan Life Building, 66 Broadway, New York City.

The Central Railroad and Banking Company of Georgia is reported to have ordered 800 freight cars of Pullman's Palace Car Company. The Pullman company has also received the order for 1,000 freight cars for the Baltimore & Ohio Southwestern.

Steel Plates for Car Steps, Running Boards, Etc., Etc.

Cast iron plates are extensively used for running boards on locomotives and on car steps, and on the stairs and floors of buildings wherever a roughened surface is desired. Steel plates are now being introduced for these purposes, and are proving much superior in several ways. They are lighter, cheaper and more durable. They are much easier to fit and place in position, and can easily be straightened if bent, whereas cast iron plates will not bend, and are useless if broken.

The Linden Steel Company, Limited, of Pittsburgh, Pa., is making a specialty of the manufacture of roughened steel plates for the purposes indicated. The company has three patterns, each of which is a neat design. One is the ribbed pattern, the projections running the length of the plate. The checkered pattern has the projections in squares. The diamond pattern has, as the name applies, the surface broken by diamond-shaped projections. The extreme sizes of the plates of different patterns are as follows: The ribbed pattern up to 40 inches by 96 inches; the checkered pattern up to 42 inches square; the diamond pattern up to 30 inches by 96 inches. The thickness is 3-16 inch and heavier.

The weight of the plates is as follows: Plates 3-16 inch thick, 10 pounds per square foot; plates ¼ inch thick, 12½ pounds per square foot; plates 5-16 inch thick, 14½ pounds per square foot; plates ⅜ inch thick, 17 pounds per square foot; plates ½ inch thick, 22½ pounds per square foot.

Goldsdorf Compound Locomotive.

"Compound Locomotives Without Starting Mechanism" is the title of a book recently given out by the Nathan Manufacturing Company, of 92 and 94 Liberty street, New York. It describes the operation of a compound locomotive on the Austrian state railways, designed by K. Goldsdorf, in which steam is admitted automatically into the low pressure cylinder at starting, thus rendering a starting mechanism unnecessary. It is said that in Europe the Golsdorf locomotive is looked upon as having safely passed the experimental stage and is rapidly growing into use. Although it is but a short while since its introduction, there are at this time 21 of these engines in service on the Austrian state railways, while 41 are now building for Russian railroads, and 16 for other European countries. These are all engines intended for passenger traffic, while 30 freight engines are also being constructed on the Golsdorf system for the Austrian state railways.

But it is not only in the construction of new power that the Golsdorf system has found a place. Any existing locomotive, of either the simple cylinder or the compound type, may be rebuilt in accordance with the Golsdorf invention, involving but slight structural changes of the cylinders and a very moderate amount of expense.

Those who desire full information respecting this type of engine should address the Nathan Manufacturing Company, as we understand it has undertaken the introduction of these locomotives in this country.

Queen & Company's New York Establishment.

The many friends of Mr. G. S. Woolman, for many years engaged in the scientific instrument business at 116 Fulton St., New York, will be interested to learn of an important change in his affairs. The firm of Queen & Company, of Philadelphia, with whom he was connected earlier in life, having found it necessary owing to the great volume of their business in the vicinity of New York to establish a branch there, have purchased Mr. Woolman's entire business and have secured his services as their New York manager.

The extent of Queen & Company's business may be gaged if we consider that they have eight different departments—

Department 1, Ophthalmological and Optical Instruments.
" 2, Engineering, Mathematical and Drafting Instruments.
" 3, Microscopes and Bacteriological Apparatus.
" 5, Projection Apparatus.
" 6, Thermometers, Barometers and Meteorological Instruments.
" 7, Photographic Apparatus and Materials.
" 8, Chemical Apparatus and Chemicals.

The business of these various departments will be adequately represented at New York by Mr. Woolman. From the Philadelphia staff of the electrical department, Mr. O. T. Lewis, formerly in charge of resistance standardization in Queen & Company's laboratory at Ardmore, has been detached and stationed at the New York office. The establishment of this NewYork branch will be a great convenience to the many customers of Queen & Company in New York and will undoubtedly result in largely increasing their already extensive business in that vicinity.

Those who have been engaged in the recent disputes and litigation relating to the Leach and Collin patents on locomotive track sanding apparatus announce that this matter is now settled, and that the business is under the sole charge of Mr. Henry L. Leach, whose office is at No. 70 Kilby street, Boston, Mass.

We are glad to herald the news that business is good with the Bushnell Manufacturing Company, of Easton, Pa. We are so tired of hearing of poor business, etc., that it is positively refreshing to hear of somebody that is busy and hard at work. This company has recently received orders to equip with its rattan spring seats and backs 100 cars that are being built by the Pullman company for the Chicago Metropolitan West Side Elevated; also to furnish with its No. 91 plush seats 10 new coaches being built for the Delaware Lackawanna & Western. The serviceable and well-known seats of the company are also specified for some new coaches which the Chicago, Union City & Cincinnati Railway is asking bids for, also for the Cooperstown & Charlotte Valley Railroad. This will give about two months' work, and the company is in hopes that the fall business will be up to standard.

Substantial Drills.

One of the patrons of the Cleveland Twist Drill Company writes as follows concerning the work of some drills he purchased of it:

"The drills which you have furnished us are the best I know of. I have drilled two holes in a 66-pound steel rail with two men in exactly four minutes. They very often have drilled 100 holes without being sharpened, and I have one instance of 120 holes by accurate count without sharpening the drill." The manufacturers say, in connection with the remarks as to the two men drilling the rail, that these drills were used in one of the well-known makes of track drills which are run by hand power.

The Fox Solid Pressed Steel Company has removed its New York office to Room 908, Havemeyer Building, corner Church and Cortlandt streets.

Mr. John B. Hicks, who has long been known in the varnish trade, has identified himself with The American Wearing Varnish Company of 111 Broadway, New York City.

Mr. Edward F. Luce has been appointed General Agent of the Detroit Lubricator Company with headquarters at Chicago, and the Chicago office of this company has been removed from the Western Union Building to No. 941 The Rookery.

Mr. J. T. Connelly, of Milton, Pa., has sent us a set of his radial drill devices for inspection. These devices are specially adapted for drilling holes at long distances, accurately and in perfect alignment; also for drilling out or removing old and broken staybolts from fireboxes, and rethreading the old holes without removing the drivers, frames or other parts. These drilling devices are well known and largely used in the principal locomotive repair shops of the country. One railroad alone has purchased 100 sets of these drills.

The Buffalo Woodworking Machine Company, of Buffalo N. Y., has furnished to the Buffalo Street Railway Company a full outfit of machinery for building and repairing street cars. Every machine in the plant is driven by electricity, the power being produced by a 15 horse-power dynamo, making 2,000 revolutions per minute. This is the only woodworking plant in the city employing electricity as a motive power, and the results are being watched with great interest.

Messrs. A. S. Males & Company, of Cincinnati, O., dealers in railway equipment, have sent us a copy of their latest catalogue of the equipment they have for sale. This shows that they have a large variety of all kinds and makes of standard-gage locomotives and electric motors, and passenger, baggage, mail, express, private, official add excursion cars; also box, stock, gondola, flat, refrigerator, oil-tank, coal and other freight cars. Steam-shovels, turn-tables and hoisting engines, and a long array of three-foot-gage locomotives complete the list. Evidently this company is able to furnish any kind of rolling equipment for any railroad.

A coparnership between Mr. T. W. Ridsdale and T. A. Lewis has just been formed under the firm name of Ridsdale & Lewis, with offices at 39 and 41 Cortlandt street, New York. Mr. Ridsdale is well known to the export trade of New York, as Secretary of the Worthington Pumping Engine Company; and Mr. Lewis has been connected with Henry R. Worthington some years as Engineer and Traveling Representative, and will be remembered by many of his friends in the engineering and railroad business as having charge of the extensive Worthington domestic exhibit at the World's Columbian Exposition.

Our Directory

OF OFFICIAL CHANGES IN MAY.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Baltimore & Ohio.—The title of E. W. Grieves, Master Car Builder, is made Superintendent of Car Department.

Cape Fear & Yadkin Valley.—John Gill is appointed Receiver. Office, Baltimore, Md.

Chesapeake & Ohio Southwestern.—G. J. Granner is appointed Assistant General Manager, vice Epes Randolph, resigned.

Chicago Great Western.—C. E. Slayton is appointed Master Mechanic at Oelwein, Ia.

Chicago & South Side Rapid Transit Elevated.—W. T. Barnard, President, died May 9th.

Cleveland, Akron & Columbus.—Nicholas Monsarrat, Vice-President and General Manager, has resigned.

Des Moines, Northern & Western.—L. M. Martin, General Manager, has resigned.

Evansville & Terre Haute.—John Torrence, Master Mechanic, is appointed Superintendent Motive Power and Rolling Stock. J. F. Scott, Master Car Builder, has resigned, and the office is abolished.

Findlay, Fort Wayne & Western.—C. G. Patterson is appointed General Manager, with office at Findlay, O.

Florida Southern.—William H. Young is appointed Master Mechanic, with office at Palatka, Fla., vice J. Rutherford, resigned.

Hutchinson & Southern.—The office of Superintendent is abolished. Correspondence should be addressed to Byron Roberts, Receiver.

Jacksonville, Tampa & Key West.—W. B. Coffin is appointed General Superintendent.

Lehigh Valley.—Theodore Voorhees, General Manager, has resigned.

Pecos Valley.—J. N. Miller is appointed General Manager.

Pontiac, Oxford & Northern.—James Houston, General Superintendent, has resigned, and is succeeded by Wm. C. Sanford. Office, Pontiac, Mich.

Seaboard Air Line.—J. H. Winder is appointed General manager, with office at Atlanta, Ga.

Employment.

WANTED.—Situation—By experienced railroad clerk. Rapid, accurate and thorough in all work pertaining to car, machinery and store departments. Ten years experience. A1 references. Address W. T. C., 475 W. Main street, Peru, Ind.

NATIONAL CAR AND LOCOMOTIVE BUILDER

JULY, 1894.

CONTENTS.

A Wabash freight train was blown from the track, June 9, near West Grove, Ia., by a tornado.

The Juniata shops of the Pennsylvania Railroad at Altoona, Pa., have resumed working on full time.

The Lehigh Valley has recently ordered three heavy locomotives from the Schenectady Locomotive Works.

The New York, Lake Erie & Western has shortened its running time betwen New York and Chicago one hour.

The Omaha, Eastern Nebraska & Gulf Railroad Company will build a line from Sioux City through eastern Nebraska.

The Youngstown Car Works are building 150 platform and 30 tank cars for use on the sugar plantation railroads in Cuba.

The Cincinnati, Lebanon & Northern has recently ordered several standard gage locomotives from the Baldwin Locomotive Works.

The Railway Specialty Company, of Chicago, has been organized with C. S. Burton, Joseph Schneeder and E. T. Wray as incorporators.

The Lake Shore & Michigan Southern proposes to build new general shops at Toledo, O. It is said that the new shops will employ about 1,000 men.

The wages of the employees of the Wheeling & Lake Erie have been increased 33⅓ per cent., the company having cut salaries 33⅓ per cent. on April 27.

Twenty-five Chicago carrier pigeons were released at Milan, Mo., June 21. They arrived safely in Chicago three hours later, having traversed a distance of 310 miles.

The Lehigh Valley Railroad Company has ordered 2,000 coal cars—1,000 from the Buffalo Manufacturing Company and 1,000 from the Lebanon Manufacturing Company.

After ten months of reduced time and reduced force, the Lehigh Valley Railroad shops at Hazleton have started up full handed and double time. Five hundred men are employed.

The Youngstown Car Manufacturing Company has secured several large orders for cars, and has resumed operations. Among the orders is one from a Cuban railroad.

The earnings of the Chicago, Milwaukee & St. Paul Railroad for the second week in June were $540,007. For the same week last year they were $708,249, a decrease of $168,242.

It is said that the shops of the Madison Car Company will be opened in July, under an agreement with the creditors, who have accepted the settlement proposed by the company's officers.

The Carlisle Manufacturing Company has a contract for 95 new cars of different kinds, and the shops will resume as soon as the necessary material arrives. A portion of the cars must be completed by Aug. 1.

The California Railway Equipment Company has been incorporated in California by John W. Bourdette, S. C. Denson, James T. Hall, N. A. Acker and W. R. Craig, with a paid up capital stock of $12,500.

William A. Simsrott, late treasurer and secretary of the Switchmen's Mutual Aid Association, and whose accounts have been declared short about $25,000 by an investigating committee of the association, has disappeared.

The Wharton Railroad Switch Company, of Philadelphia, which controls the Wootten patents, has brought suit against the Rogers Locomotive Company for infringement, and an injunction and accounting are asked for.

A fire broke out June 3 at the Laconia Car Works, at Laconia, N. H., and destroyed over $100,000 worth of property. The fire started in the paint shop. There were indications of incendiarism. The works will be rebuilt at once.

The Union Car Works, at Depew, N. Y., are rebuilding 50 cars for the Merchants' Despatch Transportation Company, and as soon as this work is finished the works will begin rebuilding 50 cars for the Arms Palace Horse Car Company.

A train on the Baltimore & Ohio, June 17, made the remarkable run of 691 miles, from Philadelphia to Cincinnati, in 15 hours and 26 minutes. The last 200 miles over the Baltimore & Ohio Southwestern was made in less than four hours.

It is said that glacial action has in places on the Union Pacific road moved the mountains down on the narrow right of way along the Columbian River, where the cliff rises often 400 feet above the track, leaving now hardly a footing for the track.

The Erie Railroad announces a Fourth of July excursion to Niagara Falls at half fare, tickets good going on regular trains July 3, and returning until July 5, inclusive. The Erie will also run Fourth of July excursions to Shohola and Greenwood Lake glens.

The General Electric Company has been awarded the contract for the electrical equipment of the Metropolitan Elevated Road of Chicago. This is the first elevated road toadopt the Intra-Mural Railway system, so successfully exhibited and used at the World's Fair.

The Rogers Locomotive Works are building 12 engines for the United Railroads of Havana and two for the Cardenas & Jucaro Railroad in Cuba. These works have also just received orders to build five locomotives for the New York, Susquehanna & Western Railroad.

The Baldwin Locomotive Works have received an order from the Missouri, Kansas & Texas for five consolidation freight locomotives. Orders for five more engines of the same class will probably be given by the M., K. & T. before long, as bids were asked for 10 engines.

A trestle on the Bellaire, Zanesville & Cincinnati road gave way near Woodfield, O., June 18th, precipitating the engine and tender of a freight train to the bottom of the ravine. The fireman was instantly killed, and the engineer and front brakeman were seriously injured.

Four men were badly injured and nine horses killed outright in a wreck on the Wisconsin Central Railroad at Stillman Valley, June 18. The wreck was caused by a drawbar pulling out and falling on the track. Three cars were overturned. A lamp in one of the cars soon set fire to the wreck.

By the decision of arbitrators the eight per cent. cut in wages on the Mobile & Ohio, as announced in our last issue, has been changed to a four per cent. cut. While the decision properly applied to only a few classes of employés, the management has generously extended its application to all in its employ.

The rails for a new electric railroad are being laid on Third street from Market to the Southern Pacific depot, in San Francisco. The horse-car line which will thus be supplanted was the pioneer street railroad in San Francisco, and the road has been operated from North Beach to the railroad depot since 1862.

Work on the new shops of the Boston & Albany, at West Springfield, Mass., will be begun in August. Four buildings are to be erected, all of brick. It is said that the company intends to put in new machinery almost entirely, and will transfer few of the tools in the present Springfield shops to West Springfield.

Over 4,000 freight cars are now being contracted for in New York City. Among these are 500 for the New York, Ontario & Western, 600 for the New York, Susquehanna & Western, and 1,000 for Cox Brothers or the Lehigh Valley Railroad. These do not include the 2,000 the Lehigh Valley has recently contracted for.

The Wagner Palace Car Company is building a number of compartment cars for the Cleveland, Cincinnati, Chicago & St. Louis, to run between Cincinnati and Chicago and St. Louis. They will be similar to those used between New York and Chicago on the New York Central and the Lake Shore & Michigan Southern roads.

The Harvey Steel Car Works have received an order to repair over 300 refrigerator cars for the Chicago Refrigerator Car Line. The firm has also secured, through Messrs. Thebaud Brothers, of 87 Broad street, New York City, a small order for narrow gage steel flat and box cars, to be shipped to T. de C. Cucuta, Maricaibo, S. A.

A fatal accident occurred to a Canadian Pacific passenger train near Fort William, Mont., June 10. A burning bridge gave way under the train and four cars were precipitated into the Mattawa River. The cars took fire from the bridge and were consumed with all mail and express matter. Four persons were drowned and three injured.

The receipts from the Brooklyn Bridge car traffic for May were $105,293.03, and the expenditures for the month $76,940.29. There were 3,537,534 passengers carried during the month. After July 1 two bridge car tickets will be sold for five cents. The price of single tickets has previously been three cents, ten tickets being sold for 25 cents.

On June 26, the largest shipment of freight ever made over the Fitchburg Railroad in one train, and in all probability the largest shipment of one commodity ever made at one time, arrived at Boston. The train consisted of 57 carloads of Worcester salt loaded in special airbrake cars. The weight of salt carried by it was about 3,000,000 pounds.

Judge E. L. Ross, in the United States Circuit Court at Los Angles, June 25, delivered an opinion in the case of the United States against the Southern Pacific Railroad Company, involving about 700,000 acres of land in Ventura and Los Angeles counties. He finds for the Government, and throws all of this vast tract of land open to settlement.

The Missouri, Kansas & Texas Railway Company has agreed to locate its general offices in the State of Texas, at Parsons, and the citizens of that town have subscribed a bonus of $25,000 toward providing quarters. This disposes amicably of the State's suit against the company to forfeit its charter for failure to comply with this charter requirement.

The interest which the public takes in the achievements of the New York Central's Empire State Express has resulted in the publication of the "Empire State Express March," by William A. Pond & Co., the music publishers On the title page is a picture of the New York Central's engine No. 999, which holds the world's record for fast running.

Galeton, Pa., has finally been selected as the site of the proposed new shops of the Buffalo and Susquehanna road. The dimensions of the buildings are: Paint shop, 50 by 150 feet; round-house, 70 by 180 feet, containing 17 stalls, of which six will be at once built; machine shops, 100 by 150 feet; car shops, 75 by 135 feet; planing mill, 50 by 80 feet; office, 40 by 70 feet; a 60-foot turn-table will be put in.

One hundred and seventy "Industrials" were sentenced to four months in jail by Judge Ross, of the United States Circuit Court at Los Angeles, Cal., June 14, for stealing an Atlantic & Pacific train recently. Fifty-nine of the same breed, who stole a Northern Pacific train were let off with 90 days in jail by Judge Knowles, of the United States District Court at Helena, Mont., June 9. All had to sign a pledge not to steal trains in the future.

A dispatch from Buenos Ayres, dated June 1, says: The directors of the Government Central Railroad announce today that they have contracted with an American firm for the purchase of sixty freight locomotives, to be used on their line. American locomotives are preferred in Brazil to those built in any other country. Many tenders of English locomotives were made to the railroad, but the government decided to patronize the United States makers.

The Portland, Vancouver & Yakima Railroad Company has been incorporated to build a line from Portland to North Yakima. The distance is 150 miles, shortening the present route 158 miles. From Yakima the road will be continued to Spokane and will shorten the distance via either Northern Pacific or Union Pacific by 300 miles. Twelve miles of the road are already built from Vancouver and the construction will be continued this summer.

A Vandalia passenger train was ditched while rounding a sharp curve 40 miles east of St. Louis, June 9. The train was running at the rate of 40 miles per hour. The engine, two mail cars and a combination baggage and passenger car were badly wrecked and the ladies' coach was turned over on its side. The fireman was buried beneath the tender and killed, and the engineer, conductor and six postal clerks and four passengers were more or less seriously injured.

A broken wheel is reported to have caused a wreck which occurred on the Lehigh Valley road, June 27, near Ithaca, N. Y. A freight train of 16 cars was ditched. Parallel with the Lehigh Valley tracks at this point run the tracks of the Delaware, Lackawanna & Western. A train on this road conveying a gang of bridge laborers passed the wreck. One of the men stood up to look at the wreck. His head came in contact with a bridge the next moment and he was instantly killed.

President Cleveland has approved an act of Congress authorizing the Pennsylvania and New Jersey railroad companies, or either of them, to construct a bridge over the Delaware River at Philadelphia. It provides that the structure shall clear high water by 40 feet, the channel span shall be 500 feet long, and the draw span shall give an opening 125 feet wide. Plans are to be submitted to the Secretary of War within two years, and the bridge must be completed within seven years.

A washerwoman started to leave a Boston trolley car by the front platform. Her bundle was rather large and decidedly awkward to handle, and when she reached the street it slipped from her grasp and fell upon one of the tracks. She started quickly to recover it, but a sudden apprehension seized her and she stopped. Looking at the motorman, she said, doubtfully: "If Oi put me fut on the track, will Oi hov a shock?" "No, madam," replied the motorman, gravely, "not unless you put your other foot on the trolley wire."

The restoration of the Purdue Laboratory at La Fayette, Ind., recently destroyed by fire, is being pushed forward rapidly. The locomotive "Schenectady" has been returned to the university from the Panhandle shops at Indianapolis, where it was put in thorough repair. The engine was backed in over the new track into the annex laboratory, and directly upon the carrying wheels of the testing apparatus, all under its own steam. This indicates the ease with which the new annex laboratory may receive any locomotive for testing.

Particulars reach this country early in June showing that the 200 soldiers reported to have been killed in one of the recent battles at Santa Ana, Salvador, really lost their lives in a railroad accident. On May 3 1,500 men were placed on a special train which started for Santa Ana, then threatened by insurgents. The insurgents learning of the approach of the government troops, removed the rails from the track on a steep grade several leagues from Santa Ana. Eight cars were telescoped. Two hundred men were killed and 122 injured.

The C. & C. V. R. R. Co. has ordered from the Wason Manufacturing Company, of Springfield, Mass., some new passenger coaches, to be about 60 feet long. The general interior finish will be mahogany with oak ceiling. The seats will be the Bushnell Manufacturing Company's of Easton, Pa., high back tilting, covered with crimson mohair plush. The trimmings are to be of the best quality of bronze. Artificial light will be supplied from four of Howard's double burner Victoria lamps. The cars will also contain two saloons. Westinghouse automatic brakes will be used, and the cars will be painted a Tuscan red, handsomely striped and lettered.

It is reported that a consolidation of railroad interests in the South is contemplated. The new company, it is stated, will comprise the Richmond & Danville, the East Tennessee, Virginia & Georgia and the Cincinnati Southern systems. The Central Railroad of Georgia is said to be already practically under the control of the newly organized Richmond & Danville system; and the Georgia & Atlanta and West Point roads, while seemingly under independent management, are really controlled through the Georgia Central and Louisville & Nashville roads. This will leave but three roads of the ten entering Atlanta outside of the Southern Railway Company. The time fixed for the connection is shortly before Oct. 1.

The Master Car Builders' Convention.

The 28th annual convention of the Master Car Builders' Association was held at Saratoga June 12 to 15 inclusive. Mr. Caleb W. Mitchell, President of the village of Saratoga, made an address of welcome, in which he said that the people of Saratoga felt a direct and friendly interest in the association, and that they appreciated the compliment paid the town by its frequent choice as a place of meeting.

President E. W. Grieves delivered an interesting address, in which he said that the depressed condition of business during the past year had rendered the position of many members embarrassing and their duties arduous in following the general policy of retrenchment adopted in order to prevent operating expenses exceeding the receipts. One effect of this was to make the members more than ever appreciative of the sociability and general good will that characterize the conventions. He spoke of the educational influence of the Columbian Exposition, and of the exhibits seen there of most interest to railroad men, and of the unparalleled exhibit of the Baltimore & Ohio Railroad. The progress made during the past year in the application of automatic brakes and couplers was spoken of, and the fact was mentioned that this movement had been greatly retarded by the unfavorable condition of business. Referring to carbuilding and the height of drawbars, he said:

Effort has also been made to adjust the freight car couplers to the standard height which has been adopted in accordance with the act of Congress. The construction of cars during the year has been very limited, owing to the general falling off in traffic, so that any extensive outlay in this direction was not warranted. We hope very soon to see an improvement in business which will alter these conditions.

Reference was made to the Fox pressed steel truck, and to its adoption as standard on several roads, and careful attention was invited to it in view of the ultimate adoption of a standard truck. Continuing on the subject of trucks, it was said that "in the mean time it is very desirable that we should arrive at standard forms and dimensions for arch bars and other important parts of the ordinary freight truck, in order that we may be in a position to more thoroughly care for cars when off the home road."

The address recommended that the recommendations of the M. C. B. Association be submitted for approval to the American Railway Association, it being believed that such indorsement would result in more general observance of M. C. B. standards. Reference was made to the necessity of exercising care in the selection of men for responsible positions in the car department, as on these will eventually devolve the responsibilities now borne by the members of the association. Referring to the members of the association who had died during the past year, President Grieves said:

Each year brings its changes to us; the stream of life carries our frail bark rapidly onward—to what the future only can reveal. It hardly seems that a year has passed since we met at Lakewood, and yet in that time six of our associates have passed from life into the great beyond: David H. Baker, E. Richardson, Robert Walker, C. M. Leonard, W. G. Van Buskirk and E. B. Wall. Mention of the venerable David H. Baker recalls the resolution passed at our convention last year, making him a life member of the association, an action which he highly appreciated. He was one of the few remaining members who were identified with the earliest history of the association.

The following members answered the rollcall:

Anderson, Geo. T., Indianapolis Car and F. Co.
Agnew, J. H., South Carolina.
Aldcorn, Thos., West Shore.
Ames, LaMott, Beech Creek.
Anderson, Thos., Pitts. & Western.
Ashley, W. E.
Barr, J. N., C., M. & S. P.
Barber, J. C., Nor. Pac.
Bowen, H. A.
Brazier, F. W.
Bush, S. P., P., C., C. & St. L.
Bushnell, R. W., Bur., Ced. Raps. & N.
Butler, C. J., Fall Brook Coal Co.
Billingham, Jos., Gulf, Col. & S. F.
Bissell, T. A., Wagner Palace Car Co.
Blackall, R. C., Del. & H. Canal Co.
Bray, F. O., Lake Shore & Mich. Southern.
Bronner, E. D., Michigan Central.
Buchanan, Wm., N. Y. C. & Hud. R.
Baker, Jos., Hicks Stock Car Co.
Clark, Beman I., N. Y., L. E. & W. Ry., Susquehanna, Pa.
Chamberlain, J. T., Boston & Maine.
Charpiot, S. A., Cent. R. R. & B. Co. of Ga.
Clifford, C. J., Illinois Steel Co.
Cook, Jno. S., Georgia & G. J. S.
Cormack, Wm., Wisconsin Central.
Cory, Chas. H., Cin., Ham. & Dayton.
Coulter, H., Philadelphia, Wilmington & Baltimore.
Casey, J. J., Illinois Central.
Cromwell, A. J., Baltimore & Ohio.
Crone, S. A., New York Central.
Demarest, G. W., Northern Central.
Devine, John F., Wilmington & Weldon.
Dow, George N., Lake Shore & Michigan Southern.
Downing, T., Elgin, Joliet & Eastern.
Davis, Jno. H., Wilmington & Weldon.
Dorsey, J. B.
Dunborow, R. N., Pa. R. R., West Philadelphia, Pa.
Duncan, T. G.
English, Rich., Atlantic & Pacific.
Fildes, Thomas, Lake Shore & Michigan Southern.
Garland, R. T., Pennsylvania Railroad.
Garstang, Wm., C., C., C. & St. Louis.
Gibbs, Geo., Chicago, Milwaukee & St. Paul.
Grieves, E. W., Baltimore & Ohio.
Hatswell, T. J., Flint & Pere Marquette.
Hawksworth, D., Burlington & Missouri River.
Hennessey, J. J., Chicago, Milwaukee & St. Paul.
Hodge, John.
Holt, J. M., Richmond & Danville.
Hackett, Geo., Philadelphia & Reading.
Hannaford, P. W., Maine Cent. R. R., Waterville, Me.
Harris, George D., G. S. F. and M. & B. Ry's, Macon, Ga.
Harris, Wells, N. Y., L. E. & W. Ry., Susquehanna, Pa.
Harrison, W. H., Baltimore & Ohio.
Haskell, B.
Hitt, S. B., Nelson Morris & Co.
Hoffecker, W. L., Cent. Ry. of N. J.
Holtz, David.
Irvin, Samuel, Missouri, Kansas & Texas.
Irvin, T. B., Cent. Ry. of Ga., Savannah, Ga.
Kearney, Alex., P., W. & B. R. R., Philadelphia, Pa.
Keeler, Sanford.
Kirby, John, Lake Shore & Michigan Southern.
Keiber, Geo.
Leeds, Palaski, Louisville & Nashville.
Lentz, John S., Lehigh Valley.
Lewis, W. H., Chicago, Burlington & Northern.
Lindsay, Thomas, Baltimore & Ohio.
Lungren, W. H., Philadelphia, Wilmington & Baltimore.
McCarthy, H. C., Phil. & Erie.
Martin, M. M., Wabash.
Mileham, C. M., Street's Stable Car Line.
McGee, F. H., Central R. R. & B. Co. of Georgia.
McGee, James, Houston & Texas Central.
McKenna, Robert, Delaware, Lackawanna & Western.
McWood, Wm., Grand Trunk.
Mackenzie, Jno., New York, Chic. & St. L.
Maglenn, Jas., Carolina Central.
Marden, J. W., Fitchburg Railroad.
Marshall, R. E., Phil., Wilm. & Balto.
Mill, Stott, Lehigh & Hudson.
Mitchell, A. E., New York, L. E. & Western.
Monkhouse, H., C., R. I. & P. Ry., Horton, Kan.
Mooney, P. T., Texas Central.
Morris, W. S., Chesapeake & Ohio.
Nelson, E. D., Penna. R. R.
Packard, L., New York Central.
Peck, P. H., Chic. & West. Indiana.
Porcher, Sam'l, Penna. R. R.
Potter, G. L., Penna. R. R.
Paxson, L. B., Phil. & Read.
Rankin, Jno. H., Phil. & Reading.
Rhodes, G. W., Chic., Burl. & Quincy.
Robertson, W. J., Central Vermont.
Roberts, E. M., So. Carolina.
Rutherford, Wm., Plant System, Savannah, Ga.
Scarborough, S. D., Chester & Lenoir R. R., Chester, S. C.
Schroyer, C. A., Chic. & Northwestern.
Silvins, E. T., Jack, S. A. & Indian River.
Simons, J. E., Pittsburg & Lake Erie.
Skinner, J. R., Del. & Hud. Canal Co.
Small, H. J., Southern Pacific.
Small, W. T., Buf., Roch. & Pittsburg.
Soule, R. H., Norfolk & Western.
Steinbrenner, A. G., Am. Refrig. Transit Co.
Stinard, F. A.
Sutherland, T., Chic. & Grand Trunk.
Sollers, G. B.
Stark, F. H., Cleve., Lor. & Wheeling.
Stark, W. H., Wheel. & L. Erie.
Thomson, B. E., Williamsport, Pa.
Tonge, John, Minn. & St. L. R. R., Minneapolis, Minn.
Tyrrell, Thos., Stat. Id. Rapid.
Vose, Wm., Barney & Smith Car Co.
Wade, R. D., Rich. & Danville.
White, David, Intercol. of Canada.
Waughop, Chas.
Waitt, A. M., Lake Shore & Mich. Southern.
Walker, C. W., Seaboard & Roanoke.
Wallis, J. M., Penn. R. R.
West, Geo. W., New York, Ont. & Western.
Wilson, Geo. F., Chic., Rock Island & Pacific.
Wood, I. E., Balt. & Ohio.

Number of members attending, 125.

Following the rollcall the Secretary, Mr. John W. Cloud, read his report showing that the association had 192 active members, 137 representative and 5 associate members, a total of 334. Recent returns show that there are now represented in the association 1,145,125 cars, an increase of 30,259 cars over last year, which increase is more than made up from cars owned by new representation, there being a slight decrease in the number of cars owned by railroads formerly represented. The report showed that $7,997.54 was collected during the year, and that disbursement amounted to $8,018.84, a deficit of $21.30. The arrears of unpaid dues amounted to about $1,000.

Section 2 of Article IX. of the Constitution was amended by substituting "thirty" days in place of "sixty" days, as the limit of time when ballots should be counted by the secretary, and the result announced as prescribed by the executive committee.

The executive committee submitted a report calling attention to the fact that the actions of the association have only a recommendatory character, and are not binding on any of its members, or the companies represented in it. The suggestions made in the President's address that steps should be taken to secure the indorsement of the American Railway Association was recommended. In reference to the standards of the association the report said:

That standards of car construction are economical on any large railroad system will hardly be questioned, and it therefore needs no argument, when the facts of interchange are considered, to show that parts of freight cars which are mechanically operative in actual transportation ought to be of one universal standard for cars that are offered in interchange traffic,—such as wheels and axles and allied parts, as well as draft appliances and connections in particular, which might be advantageously extended to other parts of trucks and connections between cars as well as to brake constructions and whatever else is subject to actual mechanical service in actual transportation. These are the particular items which have received the principal attention by the Master Car Builders' Association and for many of which standards of construction have been adopted without any means provided for their general use; these important standards are so largely ignored or so loosely followed that there is small inducement to further progress. We wonder how the past generation managed to get along without any standard screw thread for bolts and nuts; our successors will look upon us with equally wondering admiration at our fertility of resource in devising variations in car construction where uniformity would have been so much easier and so fruitful of economy. We cannot begin to build for the future until we view the subject broadly and learn that the interest of one is the interest of all, and that it is a short-sighted home policy which differs very slightly from the standards of the association without any improvement, for it may be shown that such slight variations sometimes produce serious consequences entirely out of proportion to any good results that might have been reasonably anticipated from such variations.

With a view, therefore, of taking a forward step in the matter of the standards of the association, this subject is called to the attention of the members at this time with the suggestion that they authorize the executive committee to take it up with the American Railway Association in such a manner as the latter might prefer, and to act in behalf of the association with the American Railway Association in an effort to evolve some plan of action which will cause the standards of the associatian to be generally followed.

The executive committee was authorized to act on its suggestion and to communicate with the officers of the American Railway Association.

Messrs. John Kirby, F. D. Adams, C. A. Smith, George Hackett, Robert McKenna and I. W. Van Houton were elected to life membership in the association. Messrs. Adams, Kirby, McKenna and Smith, who were present, made appropriate remarks expressing their appreciation of the honor conferred.

The report of the Committee on Indelible Pencils was then read by the Secretary.

Indelible Pencils.

The report stated that many pencil manufacturers had been communicated with and informed of the conditions that pencils used for writing interchange cards should possess. They should be black, and their writing should be difficult to erase. They should not harden or deteriorate with age, and should be easily sharpened, and yet not easily broken. The writing must not smudge or run if wet, or fade by exposure to light.

The committee tested a number of makes of indelible pencils by subjecting their writing to exposure and such treatment as they would receive in practice. In testing for erasure, rubbing was continued until the surface of the paper commenced to rise.

Referring to the qualities of the pencils the report says:

Pencil No. 6 writes freely, the lead is strong and easily sharpened, but requires too heavy a pressure to make a good black mark. Pencil No. 7 has a fairly strong lead, but is sticky when writing, and requires a very heavy pressure to get a good black mark. Pencil No. 8 is still more sticky than No. 7, and is too brittle for use of ordinary car inspectors. Pencil No. 10 trims very nicely, but does not write smoothly. Holds back a little and requires quite an effort to write with it as compared with some of the others. The point is also easily broken. Pencil No. 11; if the paper is too wet when this pencil is used, the writing smudges and the lead seems to melt and run. Pencil No. 12 writes more smoothly than either No. 7 or 8, and is far preferable in this respect to No. 10. It requires heavy pressure, however, to get a good black writing unless it is kept quite sharp. It, however, is sharpened quite readily. Pencils Nos. 13 and 14 seem to have the same lead filling and write freely and smoothly, and are, generally speaking, preferable in this respect to any of the other black pencils submitted, readily making a good black mark and not requiring too heavy a pressure, nor is the lead too easily broken. Pencil No. 15; the lead is too crumbly and cannot be very readily brought to a fine point, and does not stand heavy pressure when writing. No. 16 is a black crayon, not put up in a wood case, and is not altogether suitable for use in writing cards. No. 17; this pencil has hard spots in it which tear the paper when wet, cannot be used unless the paper is wet, smudges easily, and is very difficult to write with. Pencil No. 18 seems to be very similar to No. 15. If there is any difference at all, it has a trifle better lead than No. 15. Pencil No. 19 is apparently identical with No. 13, except that the lead is not quite as firm as No. 13, particles of the lead detaching themselves when the pencil is being used. Pencil No. 20; the lead in this is too hard, chips easily when pointed fine, seems to be quite like No. 6, but is not as difficult to write with. As the result of their experience with these pencils, your committee feel that they can specially recommend pencils 13 and 14. American Carbon Pencil No. 113, American Editor Pencil No. 185; while Pencil No. 12, Eagle No. 4.82, Pencil No. 15, Dixon's Leather and Cloth Marker No. 789, Pencil No. 18, Dixon's Marking Pencil No. 784, and Pencil No. 19, Faber's No. 1, Unverwischlich, can all be considered as good pencils, filling the requirements fairly well.

Samples submitted as follows: 3 A. W. Faber's graphite pencil H. H. H.; 4 Eagle drafting pencil No. 314; 5 Faber blue pencil; 6 Faber special pencil; 7 Eagle pencil No. 3.8 5; 8 Eagle pencil No. T-w; 9 Eagle copying indelible pencil No. 865; 10 Eagle "Anograph" No. 889-W; 11 Eagle "Anograph" No. 889-N, dampened; 12 Eagle pencil No. 4.82; 13 American "Carbon" pencil No. 113; 14 American "Editor" pencil No. 185; 15 Dixon's leather and cloth marker No. 789; 16 Dixon's black crayon; 17 Clark indelible pencil dampened; 18 Dixon's marking pencil No. 784; 19 Faber's No. 1, Unverwischlich; 20 Faber's ineffaceable pencil.

R. P. C. SANDERSON, Chairman; A. E. MITCHELL, F. D. ADAMS, Committee.

Mr. G. W. Rhodes, chairman of the committee on "Standard Sizes for Catalogues, Specifications, Etc.," then read the report of the committee.

This report was published in full in the February issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER (see pages 30 and 31). It contains a neat design of a filing case arranged for the standard sizes recommended by the committee. At the conclusion of the reading of the report, the chairman stated that another rule had been adopted by the committee, namely, that in the upper right hand corner of papers the dimensions should be given, with the word "standard" underneath. By this means the parties receiving the paper will know at a glance that they are standard, and of what size.

The report of the committee on "Steel-Tired Wheels" was then read by the chairman, Mr. R. E. Marshall, as follows:

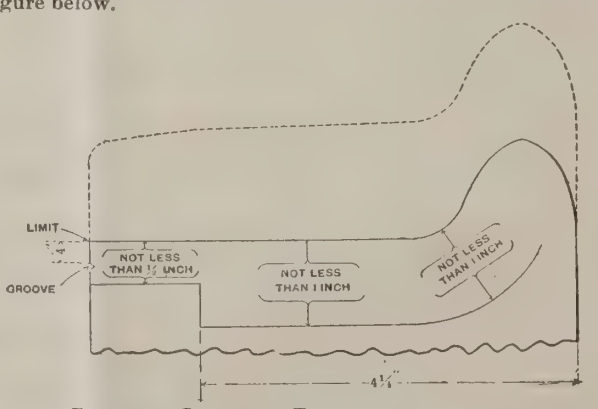
Steel-Tired Wheels.

Your committee has received replies to its circular of inquiry from 62 members, representing 17,562 cars, or about 57 per cent. of the passenger car equipment in the country. The members report 145,820 wheels under passenger equipment cars and that 51,862, or about 36 per cent. of them, are steel-tired wheels.

LIMIT OF THICKNESS FOR TIRES.

It seems to be the consensus of opinion that one inch is the proper limit of thickness of tires. On account, however, of the variety of sections of tires used, it is important that this limit be clearly defined, and your committee, therefore, offers the following recommendations:

1. That the limit for thickness of tires of all steel-tired wheels shall be one inch, measured normally to the tread and radially to the curved portions of the flange, through the thinnest part within 4¼ inches from the back of the flange—the thickness from the latter point to outer edge of tread to be not less than one-half inch at thinnest part. See figure below.



PROPOSED LIMITS OF THICKNESS OF TIRES.

2. That, in order to facilitate inspection, a small groove shall be cut on outer edge of all tires at a radius ¼ inch less than that of the tread of tire when worn to the prescribed limit.

3. That the above recommendations shall be submitted to letter ballot for adoption as "Recommended Practice" of the Association.

R. E. MARSHALL, J. O. PATTEE, C. H. CORY, A. E. MITCHELL, H. BARTLETT, T. A. BISSELL, Committee.

The following information has also been tabulated by the committee:

NUMBER OF STEEL-TIRED WHEELS IN USE OF EACH TYPE AND MAKE.

Engine Truck and Tender Wheels Included.

Type.	Make.	Number.	Totals.
Bolted plate	Allen	13,943	
	Paige	7,369	
	Boies	1,898	
	Thurber	144	
	Munton	50	
	Chicago Spring & Tire Co.	50	
	Indefinite	9,095	32,549
Spoke	Arbel	3,200	
	Krupp	236	
	Paige	715	
	Boies	698	
	Brunswick	1,287	
	Vauclain	704	
	Owen & Dyson	8	
	Wednesbury	32	
	Cast Spoke (C. & A. R. R.)	412	
	Cast Spoke (B. & M. R. in Neb.)	62	
	Plain Spoke (O. & W. R. R.)	100	
	Indefinite	1,330	8,784
Disk or Solid Plate	Allen	1,435	
	Arbel	18	
	Boies	244	
	Krupp	5,795	
	Washburn	1,681	
	Snow, Boltless	3,515	
	McKee, Fuller & Co.	208	
	Fowler	259	
	Taylor Iron & Steel Co.	100	
	Indefinite	418	17,673
Indefinite			8,600
	Grand total		67,600

DEFECTS DEVELOPED IN EACH TYPE OF WHEEL.

Numbers under each Item Indicate the Number of Members Reporting such Defects.

Defects.	Bolted plate.	Spoke.	Disk or solid plate.
Loose tire	22	10	11
Loose hub	13	2	0
Loose bolts	37	1	1
Loose plates	22	0	0
Broken bolts	30	1	0
Burst tire	14	8	3
Burst or cracked hub	0	13	1
Broken or cracked plates	5	0	3
Bolt holes worn oblong	23	0	0
Burst or cracked solid disk centers	0	0	4
Broken or cracked brackets on solid disk centers	0	0	1
Broken or cracked spokes	0	10	0
Broken or cracked rims on spoke centers	0	2	0
Rims of spoke centers flattened between spokes	0	0	0
Broken or cracked internal flange on tire	3	0	0
Retaining ring broken or defective	2	3	5
Total	171	50	29

TYPE OF WHEEL FOUND TO GIVE MOST SATISFACTORY SERVICE.

Type.	Members reporting. Number.	How many steel-tired wheels in use.
Bolted plate	16	25,335
Spoke	4	3,196
Disk or solid plate	15	15,363
Not given	27	23,706
Total	62	67,600

Drawings, accompanied by notes containing information as to number of parts, weights of principal parts and methods of manufacture and re-tiring, were submitted with the report, and include all makes and styles of steel-tired wheels now in the market for which the committee succeeded in obtaining such information.

Mr. Waitt: It seems to me to be somewhat unfortunate to have the recommendation of the committee to submit a letter ballot in just the form it is. I notice that there are some types of wheels that would manifestly be dealt with unfairly if the recommendation of the committee should be finally adopted. There are some types of wheels—two types shown—Washburn and McKee, Fuller & Co.—where the tire and center are practically in one piece, or, in other words, where the tire is supported solidly, so that it cannot be affected by expansion or contraction, to take one part from the other; they would be done an injustice, according to these recommendations. There are thousands of such wheels that have been used with perfect safety, without any accident or failure, running the tires down to a half inch thick, and we have never found a single case of burst or cracked tire, from running the rim down to that thickness. It seems to me it would work against these wheels. We do not use them, but I wish we did, to have an opportunity of gaining some experience with them. In any standard we adopt for the association, we ought to make it so that it will be just to all. We do not want to throw out the tire of a wheel that is perfectly safe to run for a great many hundreds of thousands of miles, simply because it has the misfortune not to have the tires separate from the center. I hope if this is going to be submitted to letter ballot, that the ballot will provide for two classes, one where the tire is solid with the center and the other where the tire is separate and held by retaining rings or bolts.

Mr. Lentz: I have not the data with me to give the association the benefit of our experience with the McKee, Fuller & Co. wheel, but my recollection is that the present practice is that we wear them down to five-eighths of an inch.

Mr. Adams inquired the object of the limit groove as shown in the drawing.

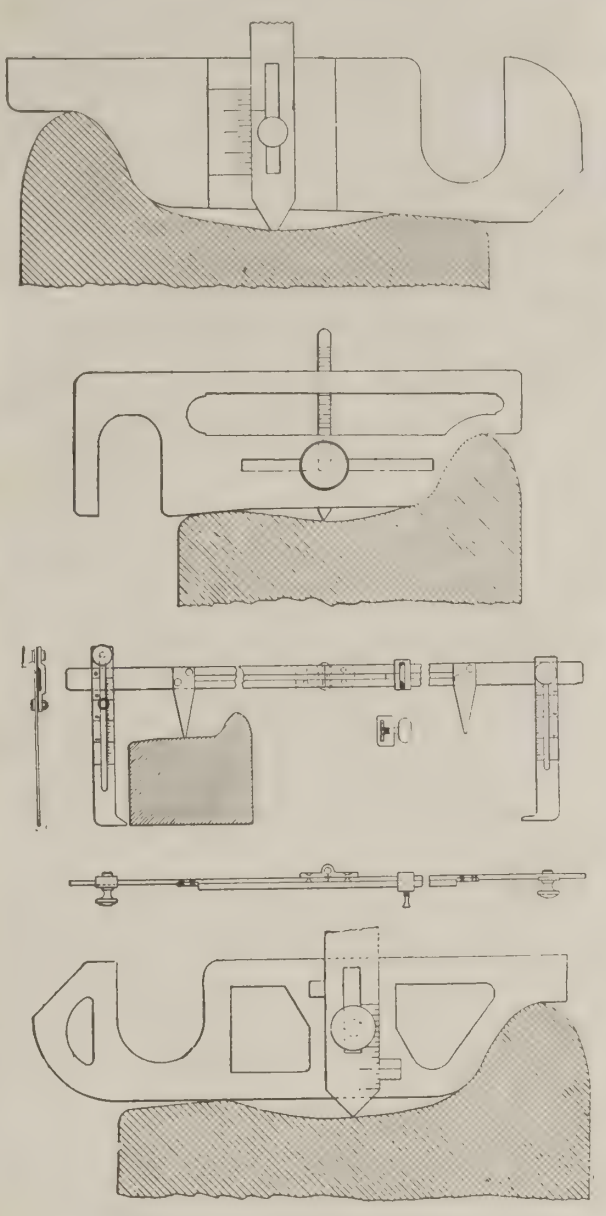
Mr. Marshall: The only point at which the inspectors can judge of the thickness of the tire is the edge. The groove is set there for the purpose of indicating that point.

Mr. Gibbs: I would like to ask if the committee has any information showing the distinction between the limits of tire thickness on the integral center and bolted center of wheels?

Mr. Marshall: There is a very marked difference between the integral locked and the other kind. It is governed by the amount of metal cutting away under the flange, also by the amount of metal shown on the outer edge as compared with the amount in the body of the tire.

Mr. Casanave: I move the report be recommitted to the committee, to report upon later, and that they fix the limits for the thickness of tires of the different kinds of wheels, and report later during the session.

Mr. Wallis: I hope the motion will not be voted down. We are all in need of a limit for the built up steel-tired



GAGES FOR MEASURING THE WEAR OF TREADS AND FLANGES.

wheel. The amendment of Mr. Waitt provides that the wheels that are fused to the tire shall be fixed in another point. That seems to be satisfactory to the users of the wheels. It will give them the limit, and it will give the members using the built-up wheel the limit they want. It will put us in a position to have something to act on.

The motion was put and lost.

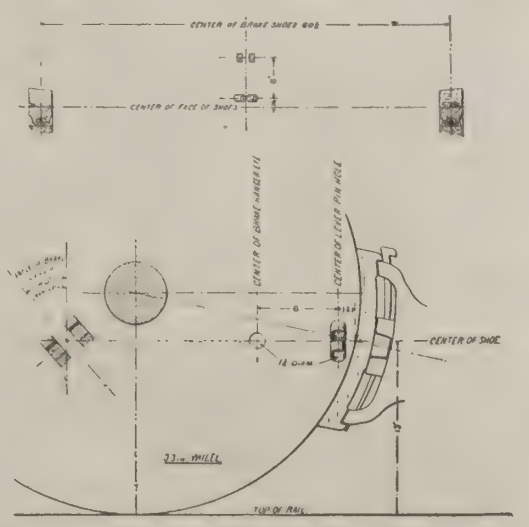
Mr. Casanave: I move that the committee be instructed to change the recommendations in accordance with the desires of the members, and that they report at to-morrow's session, or after that.

Carried.

Mr. Wilson, the chairman of the Committee on Brakebeams, read the report of the committee, as follows:

Brakebeams.

The instructions given your committee were to consider the recommendation of the committee reporting to the convention of 1893 on the subject of the standard height of drawbars and standard iron brakebeam relating to the adoption of a standard location for brake lever pin hole and brake hanger eye in a metal brakebeam, and the location



PROPOSED STANDARD DETAILS FOR BRAKEBEAM LOCATION.

for the center of beam for outside hung brakes and inside hung brakes measured vertically from the top of the rail.

As the committee referred to had received instructions to consider the recommendations made by the Committee on Standards of the Association and reporting to the convention of 1892, it is only proper in this connection, and in order to make the work of your committee entirely clear, to refer to the suggestions of the latter. This was that a drawing should be made, showing the center lines of a triangular brake beam without showing any specific construction of brake-beam, but distinctly showing the Christie brake head and shoe in position; the distance from center to center of brake heads; the location of brakebeam strut; the angle of the lever which passes through the strut, etc.

After considering the forms of metal brakebeams which are now commonly used, it was found to be impossible to give the location desired with reference to the center line of the metal beam. The reason for this is that many of the metal beams now used have no geometrical center. It was therefore thought best to take as a starting point one which was absolutely fixed, and which had no reference whatever to a particular construction of beam. A line drawn horizontally and parallel to the truck, and passing through the points of contact of the center of the Standard Christie brakeshoe with the tread of the wheel, was found to fulfill these requirements, and this has been used as the reference line for other necessary dimensions.

The committee has not shown on the drawing attached to this report the Christie brake head as adopted by the association, for the reason that this head is intended for wooden beams or for a specific construction of metal beam, and the details showing the form of head where it is attached to the beam proper are therefore admitted. The Christie shoe and the parts of the head necessary to fit to the shoe are shown. There has also been omitted from the drawing anything indicating a strut. This was for the purpose of allowing other metal beams than those constructed with the strut to conform to the location of holes of such standard as the association might decide to adopt. The two holes for the brake lever pin and the hole for the brake hanger eye are arranged on a horizontal line drawn through the center of the brake-shoe at its point of contact with the wheel. The endeavor has been to decide on the points necessary so that they will, as far as possible, conform to present practices.

Inquiry among the members of the association was made for the purpose of ascertaining the dimensions and locations now in use. Those replying to the circular of your committee represent 816,747 cars, those members of the association who have the iron brakebeam in use represent 546,619 cars, of which there are now equipped with a metal brake-beam hung on the outside of wheels 72,684 cars, and with a metal brakebeam hung inside of wheels 56,883 cars. It was also learned incidentally that the standard distance of 60¼ inches between centers of brakeshoes has been adopted by a very large proportion of the roads using the metal beam. This is also true of the adoption of the Master Car Builders' standard lateral angle of 40 degrees for the brake lever. The size of holes shown on the drawing is for the beam carrying a load of 7,500 pounds.

Your committee thinks one standard height for both inside and outside beams should be adopted, and recommend 13 inches, measured from the top of rail to center of brake-shoe, as shown on Fig 1. On account of the construction of trucks it is more difficult to adopt a standard height for inside hung beams than for outside hung beams. The location chosen is considered as fair as possible to those who now have inside hung metal beams, in connection with good practice. If the Association thinks there should be one height for inside hung beams and one for outside, your committee recommends 13 inches for inside hung beams, and 14½ inches for outside hung beams, but believes it would be better to adopt the one of 13 inches for both. The location for lever pin hole and brake hanger eye is shown on Fig. 1.

E. D. NELSON, J. H. RANKIN, J. BEAN, Committee.

Mr. Gibbs: There are one or two matters in connection with the drawing. The committee has located the center of the brake hanger eye 7¼ inches inside the face of the shoe. Is that intended to be the brake hanger eye or the third support? The brake hanger eye is back of the shoe as the beams are usually made.

Mr. Nelson: That is the third point of support—I think that is the term which is used in the Master Car Builders' Dictionary for that point.

Mr. Rhodes: Many roads that have the inside hung brake have met with a great deal of trouble on account of their connections being too low, and quite a number of roads prefer having the outside hung brake. With that arrangement they are able to do with connections very much higher from the track than with inside connections. If these two questions are submitted to letter ballot, I hope the members will bear in mind that if they vote for the first question they make it a uniform height of 13 inches, and if they carry out that they make the outside hung beam just as low as the inside hung beam. As to the outside hung beam, the advocates of that ought to get all there is in it, and one of the great advantages is the height you can get above the rail. I think it looks better to see a brakeshoe that has its center the height of the center of the axle. That gets your connections free from the track and from any obstacles in winter time at crossovers and difficulties of that kind.

Mr. West: I desire to say a word in favor of the outside hung brakebeam. It has an advantage in the case of an automatic coupling falling down. It will strike the inside brakes of 13 inches; but the outside brakes will pass over them without any trouble.

Mr. Barr: I understand this drawing is to show the center of the brake hanger eye. It has the point of third support level with the center of the lever pin hole. This produces a strain on the brakeshoes. It seems to me the support should be parallel with the pressure. On some beams, especially the National Hollow, a departure of the strain from this line of the truss will sometimes produce trouble. The line of strain should be on the line with the plane of the truss.

Mr. Hennessey: The center of the lever pin hole is one and one-quarter inches inside the face of the shield. I think that in cases where the third support is not used—and I think that is the case in the majority of railroads—it will have a tendency to carry the lever in so far that it will tip the shoe and make the top part rub on the wheel, when the cars are in service.

Mr. Waitt: The motion is not intended to include anything but the matter of height. It is a question whether it will be wise to adopt these dimensions given as a standard, other than those referring to the height. It is necessary in a brakebeam to have the location of the center of the lever pin hole and brake hanger eye so adjusted as to balance the beam as nearly as possible after the connections are on. To lay down an imperative rule would make certain beams give poor results on account of the dragging of the shoe, and other beams would give better results. This matter must be adapted to the construction of the beam, and cannot wisely be set down as an inflexible rule. The higher the brakes are the less sagging is produced in the load when the car settles.

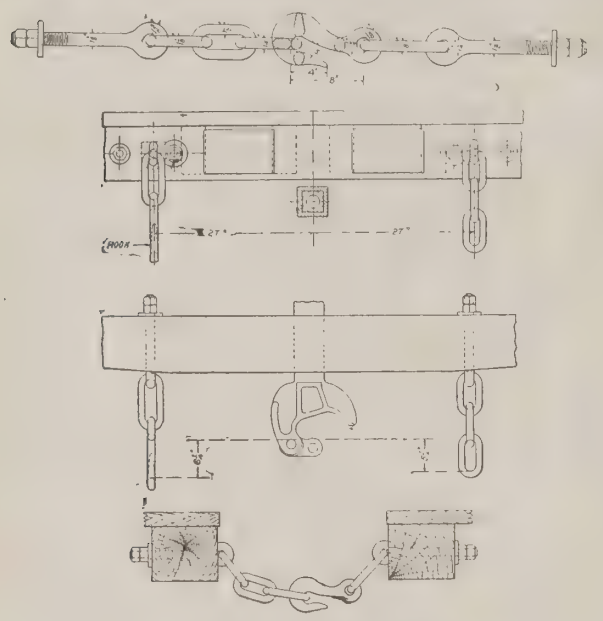
The recommendations of the committee were ordered to be submitted to letter ballot.

Safety Chains for Freight Cars.

In answer to a circular of inquiry addressed to the members of the Master Car Builders' Association, replies have been received from 45 roads, representing 569,261 freight equipment cars, and it is to be regretted that a majority of the members, in replying, have gone no further into the subject than a simple statement of fact as to whether or not safety chains were used on freight equipment cars on their lines, thus depriving the committee of the benefit of their views relative to the location, manner of attaching to cars, etc. From such information as has been submitted, however, the deduction of your committee is that the consensus of opinion is adverse to the use of safety chains on freight equipment cars generally, and in support of this opinion a variety of reasons are given, some of which are as follows:

Chains would not be used, and, therefore, would be an unprofitable investment. Expensive in first cost and maintenance. Impracticable; trainmen would not use them. Couplers render them unnecessary. Not reliable on account of slack.

An opinion favorable to the use of safety chains on twin and triple flat cars and low side gondolas, when carrying ing long timbers or structural material loaded on two or more cars, is given on the ground that they are an element of safety and reduce the chances of damage and delay, together with the attendant expense resulting from the parting of trains. Of the total replies received to the committee's circular, 12 roads, representing 226,351 freight equipment cars, favor the use of safety chains; whereas 33 roads, representing 342,910 cars, are either unfavorable to their use or regard the subject as not material. Of the latter, 16 roads (201,672 cars) do not consider them necessary on freight cars of any description, and 17 roads (141,238 cars) express no opinion. While 12 roads report favorably as regards safety



PROPOSED SAFETY CHAINS.

chains, their actual use, at present, is confined to five roads, and on the latter they are applied only to such cars as may be used in the transportation of structural iron, long timber, piling, etc. One line had 500 cars equipped with chains, but removed them on account of the expense of maintenance.

The committee has had but little to work on in the way of suggestions from members—past experience having been cited in but one instance—and its conclusions have necessarily been arrived at as much by assumption as by logical deduction. It is its opinion that safety chains are necessary only on flat and low side gondola cars which are frequently used as twins and triplets, to carry lading extending over two or three cars. The committee does not recommend the general use of safety chains on any classes of cars; but with a view to securing interchangeability of such chains as may be applied, recommends those which are shown in Fig. 1 for adoption as standard of the association.

H. COULTER, JAMES E. SIMONS, E. E. CARVER, W. H. DAY, J. J. CASEY, Committee.

Mr. Barr: I believe we are going to vote to recommend a practice which none of us believes in, in submitting this question to letter ballot. I am inclined to think that the proper course to pursue in this case is to express the sense of the association that the use of chains is not to be generally recommended; that if there are any special loads, logs to be hauled, etc., some special provision can be made for them. We do not want to recommend something for practice that we do not believe in.

Mr. Rhodes: I had Mr. Barr's views originally, but in reading the report of the committee it is evident that for certain kinds of cars and certain loads this method of chaining would be very desirable, if it was uniform. I agree with Mr. Barr that for general uses the safety chain for ordinary cars is useless, and becomes more so every day than it has been in the past, for the reason that our cars are gradually becoming equipped with the M. C. B. coupler and automatic brake. With the automatic brake there is no necessity for any safety chains between cars, and many roads do not use them. It would seem that the general tendency of the device is to become less and less useful every day, but whether it would be a good thing to have on our file a device to meet the few emergencies which may come up, is another question.

Mr. Lewis: I think it would be a wise thing to define some standard or uniform method of linking cars in that way. It cannot do any harm. In fact it would be a good thing.

Mr. Marshall: As for the necessity growing less, I think it will grow greater with the introduction of four-track system, where, in the event of trouble, the stoppage becomes so much more serious. The committee says that it does not recommend the general use of safety chains on any class of cars. It wishes to provide for those special cases where the use of chains would be appropriate on certain classes of cars and as circumstances may decide.

Mr. Barr: Is there any one here who knows of any cars equipped in this way?

Mr. Marshall: Our road has nearly seven hundred.

Mr. Waitt: I think it is the general practice, where long structural iron or telegraph poles are being transported, to use two cars and to chain the two cars together. We do not always feel confidence enough in the ordinary coupling holding, and we take the additional precaution against the breaking in two of the train and the terrible wreck that would follow with that class of material. We would make no mistake in submitting this question for recommended practice. I do not feel, however, that the dimensions given by the committee are just as they should be. It seems to me that the location of the chains are too far from the center of the car. On our passenger equipment we adopted 14½ inches on each side of the center as recommended practice. They would be better there than if spread 27 inches each side of the center. With chains that are not very long, in rounding curves that might cause trouble and pull out the sills, if the chains didn't break. It would be better to substitute the dimensions that are given for passenger equipment—just divide the 27 inches almost in half. I move that this be recommitted to the committee, to report later in the session as to the advisability of changing that. Carried.

Heating Passenger Equipment.

The report on this subject embraced 29 questions and answers thereto by about 30 members. These questions and answers showed that 26 members answering use pressure reducing valves on the steam pipe at the locomotive, and that three do not. Respecting the desirable pressure at this valve, two recommended 5 pounds, three 10, three 15, one 20, two 40 and one 60; and others recommended all degrees of pressure between these extremes, showing a wide diversity of practice. No members answering used pressure reducing valves on cars. Nineteen had adopted the standard size and location for end of train pipe, and eight had not. Eighteen recommend iron for hose nipples, and nine brass. The average time of service of steam hose on cars is reported as about 10 months, varying on different roads, answering from two months to two years. Of the members answering, 13 use the Sewall steam coupling on 2,572 cars; five use the Gold coupling on 1,376 cars, and others use the Gibbs on 161 cars, Martin, 111; P. R. R., 147; Gibbs & Sewall, 40; Gibbs & Johnson, 145; McElroy, 802; J. D. Searl, 3; Martin & Sewall, 374, and Sewall & Gold on 138 cars. In the use of train pipe cocks there is wide diversity of practice, the three-way cock being the apparent favorite, while some use globe valves and plug cocks, and others use numerous special cocks. The heating surface used varies from 34 to 300 square feet. Seven had good results with automatic temperature regulators, and two had not. The Consolidated car heating regulator being the only one named.

Twenty-one members, representing 2,454 cars, have stoves in them for use in case of emergency; 9 members, representing 3,415 cars, do not. A majority favor keeping steam heated cars warm at terminals.

From 30 answers received from roads representing 30,011 miles, the committee finds 5,869 cars equipped with steam heating apparatus or other improved methods, and 6,432 cars not equipped. It also finds answers from 13 roads, representing 16,947 miles and 2,414 cars, which have not adopted steam heat, making a grand total of 5,869 cars equipped and 8,846 cars not equipped.

Messrs. W. L. Hoffecker, George F. Wilson, John Hodge, James Macbeth and A. J. Cromwell were the committee on this subject.

Mr. Waitt moved that the report of the committee be received and the committee discharged. Carried.

A report on the lighting of passenger equipment, prepared by the Secretary, was read.

Lighting Passenger Equipment.

When it became evident that no report would be presented to this convention by the committee appointed to consider what improvements had been made in the lighting of passenger equipment cars, the President of the Association directed the Secretary to make some inquiries of the principal railroad companies, and to present the substance of the replies received to this inquiry to the convention in lieu of a report of the committee.

Pursuing these instructions the Secretary addressed a letter of inquiry to most of the principal railroads represented in the Association and received replies, principally statistical, to many of these letters.

Many of the railroad companies report that in using oil for lighting cars they have recently introduced improved lamps, and the Adams & Westlake "Acme" lamp is mentioned in several cases as being introduced in lieu of the older lamps, with marked improvement in the light.

Of the roads using the Pintsch light, the following information is given:

The Philadelphia & Reading Railroad Company is changing gradually to Pintsch light for their system.

Maine Central R. R. Co. Pintsch gas is very satisfactory.

Union Pacific System. Pintsch light adopted and equipping six or seven cars per month.

Central Railroad of New Jersey. Patrons well pleased with Pintsch light and is considered the best.

Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. Have adopted Pintsch light and equipping 15 cars per month.

Denver & Rio Grande R. R. Co. Pintsch light is used on all cars that can be charged at existing gas plants.

Boston & Albany R. R. Co. Pintsch light is liked and is being extended.

Chicago, Rock Island & Pacific Ry. Co. Changing to Pintsch light as fast as convenient.

Michigan Central R. R. Co. Recently adopted Pintsch light, but have only commenced equipping cars.

Wagner Palace Car Company. Changing to Pintsch light as rapidly as possible, as it gives a very satisfactory light with a minimum of expense.

Pullman Palace Car Co. Applying Pintsch light largely at request of railroad companies using the cars. Find its use is a great saving in the matter of carpets and upholstery, as oil lamps will leak more or less and injure them.

Of the roads reporting the use of the Frost light, the—

New York, Ontario & Western Ry. Co. says cars generally repaired are being equipped with this light.

The other roads do not mention at what rate it is being extended.

Several roads report that they have had more or less experience with electric lighting by means of secondary batteries.

The Grand Trunk Ry. did not find the use of such a light satisfactory on account of the expense, and it has been removed from all cars excepting one.

The Boston & Maine, Boston & Albany and Louisville, New Albany & Chicago roads all report the use of secondary batteries too expensive and removed from experimental service.

The Chesapeake & Ohio Ry. Co. says its experience with secondary batteries has been very satisfactory; that it produces an average of 148.8 C. P. per car at 94.9 cents per day of 14 hours light, and that the cars run from Cincinnati to Jersey City and return with one charging.

The Pennsylvania company, Northwest System, reports that its experience with electric light is confined to that had with the Pullman cars on its Limited Express. The system has been in use about five years, and while it is somewhat expensive, it is very satisfactory in giving good light, and is capable of being distributed to the points at which most benefit is derived; also, that the liability of danger from fire is reduced to a minimum. The current is produced by a dynamo located in the baggage car, and the steam for the engine running the dynamo is furnished from the locomotive boiler. The cars are also provided with storage batteries through which the current passes, and these batteries are charged to some extent at terminals from stationary plants.

In 1889 the Chicago, Milwaukee & St. Paul company began experiments with the system the same as reported above for the Pennsylvania company, and some modifications were introduced tending to produce a more regular light, but after some two years' experiments the plan was abandoned. As the trains which it desired to light were heavy trains for long distance runs, it was considered feasible to use a direct current lighting system, doing away entirely with the secondary batteries. From this idea their present system was introduced and has been in successful use up to date. For some trains they use a light and heat tender in which is located a boiler as well as an engine and dynamo for the production of the current. In summer time when steam is not required for heating, the light and heat tenders are laid off and the lighting outfit is placed in the forward end of the baggage car using steam from the locomotive boiler. The system of wiring the cars for this light, as developed by Mr. Gibbs, of the C., M. & St. P. Ry., embodies some new features, especially in regard to the placing of lights in the berths and at other points close to the object to be illuminated. The details of this system of lighting have been thoroughly worked out and the cars are well and uniformly lighted. The cost of running the light is estimated at 88 cents per car per day when figured on a 7 car train, but if a longer train were taken the cost per car per day would be somewhat less, as the allowance for attendance would be the same.

JNO. W. CLOUD, Secretary.

Mr. Waitt moved that the report be received. Carried.

Mr. Waitt, chairman of the committee on lubrication of cars, read the report.

Lubrication of Cars.

Among the elements which go to make up the successful operation of railway trains, the items of journal lubrication and hot box prevention play a very important part. Although for years careful attention has been paid to reducing the cost of oiling per mile for locomotives, and every facility has been furnished and every effort bent to make a record of economy in this direction, without interfering with freedom from heating, yet the same feature in connection with car operation has been very generally neglected. When it is considered that for every locomotive in service there are more than 100 cars, and where the locomotive is making 200 miles per day perhaps the corresponding cars are making over 2,000 miles, we may begin to see the importance of the study of economy in car lubrication. In the construction of the locomotive, exceeding care is taken to provide large bearing surfaces, with the boxes made of the finest quality of bronze, carefully fitted, all the parts, such as boxes, jaws, slides, etc., being made perfectly square and true, all being finished machine work. Daily inspection, cleaning and oiling are given to these parts of the locomotive, and invariably the better grades of oil are used. Even with this care trouble frequently occurs. It is thought altogether necessary to give the greatest care to the bearings that carry our splendid motive power, but with the more extensive car equipment such is far from the general practice. Possibly familiarity breeds contempt, and from the great number of such cars there is a natural feeling that they are of little consequence, and most anything will do for them.

On our car equipment, which has to make equally good speed with the locomotives, there are no nicely fitted parts, but instead only rough castings, sometimes loosely and sometimes tightly fitting, are thrown together with oftentimes little or no attention to the fact of the parts being square or in line. Bearings, sometimes bored, but more often rough, but sometimes having the roughness kindly softened by a charitable covering of lead, are often crowded into boxes which they but indifferently fit, with a key or wedge on the top which many times binds them so that there is little or no play. Such a combination put together by unskilled workmen, and lubricated from a limited amount of waste, half saturated with the cheapest of crude earth oils, is put into competition with the nicely adjusted and well-cared-for locomotive, and is expected to give good results and be free from annoying detentions due to hot boxes and cut journals. The absurdity of the requirements under such altogether too prevalent conditions is evident at once. Replies have been received from only 46 roads, representing about 576,000 cars. It is evident that oil rather than grease is the preference as a means of lubrication, as no road replying used grease exclusively, although six were using some grease in connection with oil, but all preferred oil for general use. The grades of oil in use vary from a very cheap crude oil at 5 cents to the best refined Galena oil at 35 cents per gallon. Twenty-one of the roads replying are using Galena oil, while seventeen roads use common West Virginia or black oil, and eight roads use either special oils or else part Galena and part comman black oil. From the replies received we find that the cost of oiling cars per 1,000 miles varies from 6 cents to 41.6 cents on passenger equipment, and from 6 cents to 26.3 on freight cars.

We find that 21 out of 45 roads use special cooling compounds to prevent or reduce hot boxes, in addition to the regular oil lubricant. A singular but significant fact is noticed, that with but four exceptions the use of special cooling compounds is confined to the roads using the cheap grade of oils. It seems that of the 25 roads who find no need for a special cooling mixture, 21 of them are those who use only the high grade Galena oil. This would seem to indicate clearly that the high grade of oils are better lubricators and need no expensive assistants in the shape of cooling mixtures. This suggests to your committee that in figuring on the comparative economy of different grades of oils, the feature of there being no necessity for a special cooler for use of trainmen and inspectors should be fully recognized.

From the 21 roads using special cooling mixtures, 2 roads report poor results, 7 fair results, 11 good and 1 very good. It can safely be said in this connection that there are undoubtedly many cases of hot boxes occurring to-day that can be partially or wholly remedied by these special coolers judiciously used, but your committee firmly believe that many, if not most, of these cars could be equally well cared for by the use by trainmen or inspectors of a proper quantity of freshly soaked waste and oil, carefully applied, the poor and dirty waste in the box being first removed. We further believe that, by proper care being taken, in connection with various important points, which will be referred to later, few if any hot boxes need occur. The replies to inquiries state that 21 roads out of 46 keep a record of hot boxes and four roads keep record on passenger trains only. From the fact that only 12 roads are able to give definite figures as to number of hot boxes on passenger equipment, and only 10 roads on freight, the committee can only infer that on the balance of the roads the records kept are not complete, definite or reliable. Four roads report no hot obxes, or too few to keep record of.

The record of hot boxes per 1,000 miles on passenger equipment, as reported, shows quite a variation, running from .001 to .19, the average being .0516; or, in other words, the best record was one hot box in 1,000,000 miles run, while the

poorest had one in about every 5,360 miles run, the average being one in about every 20,000 miles. A curious fact is shown by the reports, namely, that the three roads showing the best records and the three showing the poorest, all are using the highest grades and, consequently, the highest-priced oils. This fact shows quite clearly that, though the best results can only be obtained by the use of the best grades of oil, poor results may be had with the same oil where insufficient attention is paid to other important features. Or, in other words, the quality of lubricant is only one of the many details that must be looked after in the successful lubrication and cool running of car journals.

Another very curious development is the large variation in the number of gallons of oil used to the 1,000 miles run. This runs, on passenger equipment, as high as 4½ gallons and as low as $\frac{6}{10}$ of a gallon, the latter figure being on a short road with but few trains, which runs through a territory free from sand. Most roads, in oiling passenger equipment, use from 1 to 2 gallons per car per 1,000 miles run. The great variation will account readily for the well-oiled ties on some lines and the wheels so often found thickly coated with grease and dirt. There is undoubtedly room for greater economy and much improvement by more careful supervision of car oiling. In the oiling of freight equipment a similarly large variation in practice is noticed from the replies received. The minimum amount of oil used is slightly less than one-half of a gallon per 1,000 miles, while the maximum is 2¼ gallons.

As to the kind of packing which is best, there seems to be no great unanimity of opinion. Seventeen roads use and favor all wool waste; nine roads are in favor of cotton waste wholly; 16 roads are in favor of wool for passenger equipment, and cotton for freight, while three roads are using successfully elastic wool, a composite material of wool and some elastic vegetable fiber. It is generally conceded that high speed passenger trains require greater care and better material than freight trains. The practice of 33 roads out of 45 indicates that wool is generally considered the best material for a reliable packing. Its elasticity and durability, as well as the fact that a pound of good quality wool waste will go further in filling a box than even best cotton, all are in its favor for passenger cars, even though its cost per pound is considerably more than cotton. Your committee feel warranted in recommending a good grade of all wool waste, which is free from dirt, and is composed of good long fiber, as the best material for packing that can be obtained. The data at hand do not warrant giving any reliable conclusions as to the comparative efficiency and economy of cotton waste and elastic wool.

The opinions of roads with regard to the comparative freedom from heating of iron and steel axles, seem to be about equally divided, and about all that can be said is that probably steel axles are freer from flaws and seams in journals than iron, and for that reason heat less from those causes. But, on the other hand, the grain of steel axles being much closer than in iron, there is less oportunity for the oil to be held in the minute spaces between the molecules of metal, and, as a consequence, it is somewhat more difficult to lubricate steel journals, if they are loaded to anywhere near their full capacity.

The subject of proper mixtures and metals for journal bearings, and the kind and quality of metal for linings, is one which the replies to inquiries show to be in a very undecided state. There seems to be no uniformity of opinion on any kind of metal or any proportions of mixtures. On a few points as to journal bearings there is almost entire unanimity. All but two out of 46 roads favor a solid lead lined journal bearing. Some of those so deciding are to a slight extent using filled shell bearings. All roads agree that the journal bearings should be ground or bored, and lined, on a radius larger at least by $\frac{1}{32}$ inch than the journal they are to run on. Some roads wish this to be as much as $\frac{3}{16}$ inch larger. It is astonishing to find a few roads who neither bore nor grind their journal bearings, but simply clean the surface of the bearing and coat them with $\frac{1}{16}$ to $\frac{3}{16}$ inch of lead or babbitt, and then are surprised when the lining is worn through that the hard, sand lined surface of the bearing should begin to cause heating and cutting of the journal. No worse or more dangerous practice has come to the notice of your committee than allowing practically a rough unfinished casting to be used on a nicely polished journal to carry the weight of a heavy passenger coach, or sleeper, moving at from 40 to 60 miles an hour, with its freight of human lives who might be instantly killed or maimed by the excessive heating and consequent breaking off of a journal.

The information received by the committee indicates the almost universal use of lead, or lead with a very small percentage of antimony, as the best metal for lining bearings.

From the general tenor of replies received to our circular, and from our individual experience, it seems clear to us that there are a number of important features to be carefully looked after, in order to get good results in the line of economical lubrication and as nearly absolute freedom as possible from hot boxes. Among other features the most important are:

1, Oil; 2, waste; 3, journal bearings; 4, axles; 5, general construction and maintenance of trucks; 6, instructions to shop foremen and inspectors as to care, repairs and reports in connection with oiling of cars and attention to hot boxes.

A neglect of either of the above enumerated items is liable to cause much trouble and annoyance by increasing the heating and cutting of journals; but careful attention paid to all is sure to give a record free, or practically so, from such annoyances on our home cars, and will do much toward reducing the troubles on foreign equipment on our lines.

Oil.—It is a safe general rule that articles which are high-priced, because of their superior quality, give the best results, and this is true with regard to car lubricating oils. It would be very desirable if this question could be more definitely settled in an official and reliable way, and we would recommend that the subject of lubricating oils for cars be made the special subject of committee work for the next year, with the object of obtaining samples from the ordinary shipments made by various leading oil supply firms, and submitting them to careful shop tests and, if feasible, to such service tests as may be arranged for.

Waste.—It is clear that in order to obtain good results the grade of waste must be such that it is free from sweepings and dirt, or fine stuff, and it should not contain pieces of twine, rope, rags, or other useless and harmful materials often found in cheap waste, both wool and cotton. The best results, in the committee's opinion, will be had with good elastic wool waste without the introduction of any cheapening fiber, introduced nominally to give it great elasticity, but really so that it will sell cheaper. Wool or cotton will feed up the oil, but fiber will not. Cotton waste, though somewhat elastic when fresh, soon loses this quality entirely and becomes matted and packed, settling away from the bottom of the journals and thereby cutting off the supply of oil. It should be a univeral rule, which ought to stand in writing in every railroad shop, that all waste must be soaked in oil, being well covered, for at least 24 hours before being used; if possible, it should have 48 hours for the oil to act on it. In order that waste so saturated may not be used with more oil than it will properly hold, before using, it should be drained from any surplus by being placed on a screen placed so the drainingswill drip on to the still soaking waste beneath.

Journal Bearings.—Wonderful claims are made for the saving effected by using any one of the legion of special mixtures for journal bearings, with which every railroad mechanical department is besieged. There may be good grounds in the various claims, but unfortunately there has never been any opportunity of officially knowing the comparative merit of the different styles of bearings. The need for accurate information, based on experiments conducted under similar conditions on different roads, is very evident, and it seems to your committee that the M. C. B. Association can do a great service to railroads by taking up and completing such a series of tests, both in the shop and on the road, as will develop facts and figures of a reliable character as to the merits of the materials most commonly used in railway service. Hence, we would recommend that for the coming year, if possible, a committee take up the subject of "*The Economics of Journal Bearings*," as determined by shop and service tests. Experience has shown to us the fact that some of the most serious difficulties due to journal bearings have not been due to varying proportions of the different constituent metals, but rather to mechanical defects. Railroads are oftentimes very careful to specify minutely that a bearing must contain certain proportions of various metals, but fail to specify or note as to the accuracy of the dimensions, the manner of preparing or applying the linings, or the size of the bore or of the arbor on which the lining is poured. A few roads have, by careful experiments covering from six months to two or three years, clearly proven that fifty per cent. of their hot boxes have come from not knowing that their bearings and keys were properly constructed in their relations to each other and to the oil boxes.

It is surprising in the replies we have received to see that only seven out of forty-five roads test their journal bearings and wedges to see that they are proper in dimensions and relation to parts they are supposed to fit. Is it any wonder that boxes run hot when so little attention is paid to this important part of our cars? With a locomotive we take the greatest care to fit to $\frac{1}{64}$ of an inch or less, but the prevalent idea with the cars would appear to be that it matters little so long as we can drive the parts together with a hammer. From an examination of bearings removed from some two hundred or more cases of hot boxes, it was found that over seventy-five per cent. of them showed that either they did not fit the key properly, or else there was no provision made for the bearing to adjust itself to the irregularities of the truck. In most cases where the journal bearing and key were both straight on the back, allowing no automatic adjustment, the bearing would invariably show a heavy amount of wear on the outer end, showing that truck was out of square or bearing of equalizer on top of journal box, or the spring on the equalizer was bearing stronger on the outside. Trucks will get out of square, pedestals also out of plumb. Equalizers will get a twist in them or not set fairly on the rough top of the oil-boxes, the equalizer springs will often be so placed that more weight is thrown on one side than on the other. The results of all the common errors is felt in the disback side of flange to the side lug of bearing. All of these points are essential to smooth running bearings and freedom from heating, and it will be surprising to most members to find how many bearings commonly accepted do not fulfill the requirements of the above gages.

Axles.—Another prevalent cause of hot boxes is defective axles. In these days of the increasing use of steel it is getting to be very difficult to obtain good scrap iron axles, free from seams and flaws, and the necessity for strict specifications and rigid inspection in connection with new axles is very necessary. If steel axles are substituted for iron, in the opinion of many (perhaps one-half) of the railroad experts in the country, it is merely "jumping from the frying pan into the fire." One thing is certain if iron axles continue to grow poorer and the manufacturers protest against strict requirements, the railroads will be forced to the alternative of steel axles.

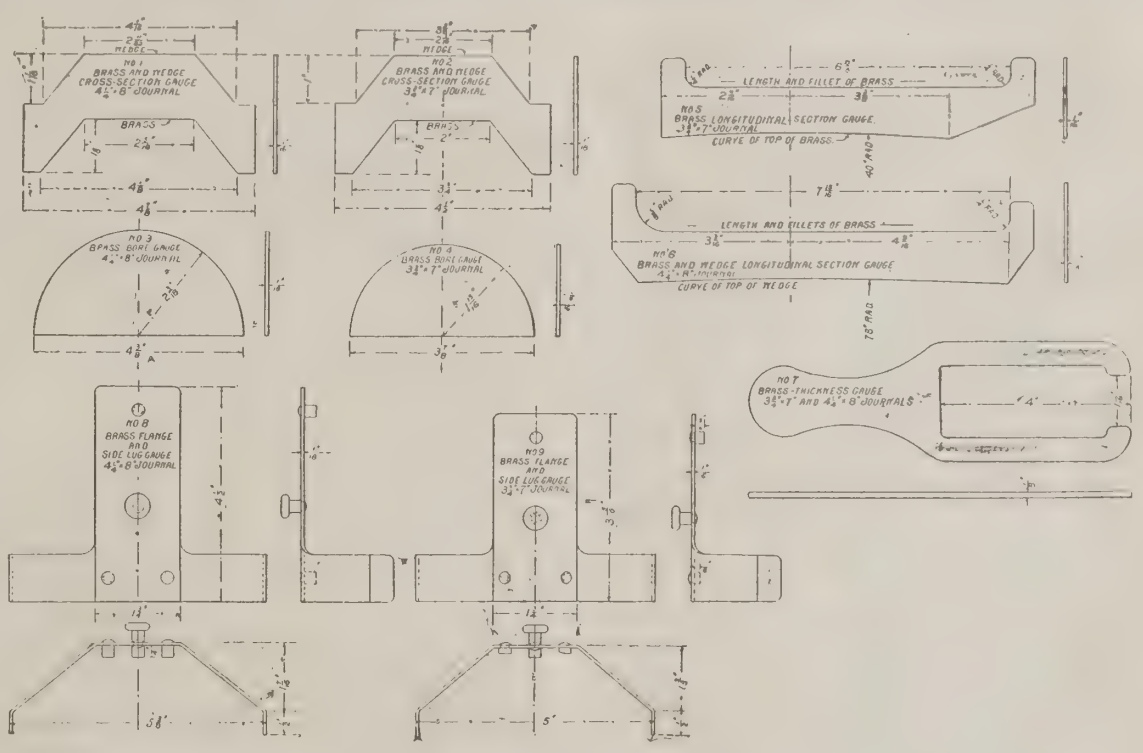
So long as the experience of different railroads varies to the extent shown in the replies received, it would be unwise of this committee to advocate any particular metal for axles as superior to any other; but as in the case of oil and journal bearing, we believe some official experiments would be very desirable.

Judging from the condition of the journals in many cars built by car manufacturing companies, it would seem that inspectors and manufacturers have no clearly defined instructions as to what will be accepted in the way of imperfect journals. A perfect journal on an axle is almost an impossibility. In steel axles a very close approach may be found, but in iron, the welding, or lack of it, will show in the way of dark seams, sometimes like a hairline, and sometimes showing a wide opening. For a safe limit which will be reasonably certain to insure cool running of a journal, the following may be safely incorporated in axle specifications:

"Axles must be well hammered and free from any clearly defined open seams. Axles must finish in the lathe with the journal free from flaws in the way of holes or pieces shelled out, or seams large enough so that with a knife blade scale or dirt can be removed from such seams, or open seams showing a clear opening of $\frac{1}{32}$ inch or over, and being one inch in length. Journals must be finished perfectly smooth, showing no clearly defined tool marks or roughness when tried by running the finger nail over the journal lengthwise."

To insure the necessary amount of hammering from a heavy hammer, if a limit from the standard dimensions is fixed upon, and a corresponding limit to variation in weight is specified, the necessary hammering will be assured.

General Construction and Maintenance of Trucks.—More hot boxes occur from failure to look after this important matter than from any other source. This is the



PROPOSED GAGES FOR JOURNAL BEARINGS AND KEYS.

tribution of the weight of the car on the journal. If the top of the bearing and the key is straight the contact is rigid, and as the weight is transmitted to the top of the oil-box, so it is transmitted to the journal, either bearing centrally or harder at one end than at the other. The M. C. B. Association committees in previous years wisely recognized this feature and provided for it, by rounding the top of the 3¾ by 7 bearing, and the top of the 4¼ by 8 key, thus allowing for an automatic adjustment to overcome any irregularities in the truck, and still keep the weight practically over the center of the journal, thus preventing an excessive pressure on either end. Many roads have overlooked the need of this adjustment and by making straight back, so-called M. C. B. bearings and keys, are having many unnecessary hot boxes, or are obliged to use an excessive amount of oil or special cooler to run their cars without any unusual amount of heating. It may be that the curved back of the 3¾ by 7 M. C. B. bearing has been abandoned by some from the fact that when worn thin the pressure is transmitted heavier in the center than at the ends, owing to slight spring of the thinner ends of the bearing, resulting in the axle being worn slightly hollow. It is an open question if it is not better to hold to the curved top bearing, with its few cases of hollow journals, than to make the bearing straight, thereby changing the standard and having more or less hot boxes in consequence. The committee deem it wise to recommend to the consideration of the Association the changing of the present standard 3¾ by 7 journal bearing and key to the form given to the 4¼ by 8 bearing and key, namely, make the top of the bearing straight and curve the top of key instead of the opposite, as it now is. This change could be made without interfering with interchangeability of parts, and in a few years all cars would be changed with the benefits accruing yearly to each car changed. We would also recommend that all M. C. B. journal bearings and keys made or purchased be required to pass the inspection and test of the gages shown in Fig. 2. These gages, Nos. 1 and 2, are made in accordance with the strict M. C. B. dimensions in section, which it is very essential should not be exceeded, if the bearings and keys are to fit properly.

Gages Nos. 3 and 4 are for use in testing the radius of the bore of bearing and radius of lining. Gage No. 5 is for testing the curve of top of 3¾ by 7 bearing and the proper radius of the fillet, and the limit in safe length for this bearing. Gage No. 6 is for testing proper curve of top of 4¼ by 8 wedge, and safe limit for length of 4¼ by 8 journal bearing.

The roads represented by two members of our committee can report most satisfactory results coming from the buying of bearings subject to part of these test gages. Another essential is the use of a solid caliper gage No. 7, which we would recommend for the thickness of the bearing, which may be made to allow an excess of $\frac{1}{16}$ inch over the standard; also length gages Nos. 8 and 9, which will not permit bearings to vary from the standard, in the distance from main point in which locomotive and car practice differ. For good results in running, a truck must be put together by a mechanic, not a common laborer. The various parts must be put up exactly to standard dimensions, which can best be assured by using fixed gages for testing. The pedestals on passenger trucks must be plumb and square, the frames of the trucks must be square and all parts kept tight. The equalizers must be square in the feet and have them parallel, and must have slight allowance made for the spring in the car under load. The equalizer springs must be so located that the thin end of the spring will equalize the weight on each side of the center line, otherwise the foot of the equalizer will bear unevenly on the top of the oil box. The oil box covers must fit reasonably well. Dust guards must be close fitting and made entirely of, or lined with, some durable material like rawhide or vulcanized fiber. In roads passing through very sandy soil the tight dust guard and oil box cover are very essential; on ordinary roads these are features of much less importance than is commonly thought. With the trucks once properly constructed, it should yearly be gone over in all points above mentioned and made right, if not found so.

Before concluding this report your committee have one rather radical recommendation to make, namely, that for the best results to be obtained in line of good lubrication of cars and freedom from hot boxes, oil cans and clear oil should be removed from shops, shop yards, and train crews. Clear oil to be used only to a limited extent in interchange inspection yards. The reason for our recommendation is that most cases of heating of journals come from the waste sagging away from the journal, and therefore no oil is fed to it. If oil is poured on in such a case it only lubricates for a few minutes, for the oil still cannot feed on to the journal; but if instead of oil the dope bucket is used, a small quantity of freshly soaked waste will furnish the necessary oil and will at the same time fill the box with waste up close around the journal, allowing the remaining oil in the balance of the waste to feed to the journal. If at shops all cars are freshly packed with saturated waste, or the box is properly filled with such, there is surely no necessity for the oil then. The use of waste in this manner will save much in the needless waste of oil, as well as put the oil boxes in the best condition for good service.

A. M. WAITT, W. H. THOMAS, I. E. WOOD, F. A. STINARD, W. K. CARR, Committee.

The report contained a lengthy set of instructions to "Shop Foremen and Inspectors," "All Employees Concerned" and to "Freight Conductors and Brakemen"; also a form of report for the use of car inspectors to report hot boxes and broken axles, and a form of general statement showing the number and causes of hot boxes on the several divisions of a large road. At the conclusion of the report

Mr. Waitt gave a brief description of the gages and dimensions employed and referred to in the report of the committee; having samples of journals and gages, by which he showed their practical application.

Mr. Barr: A point has been called to my attention by a couple of the most intelligent foremen of the car works that I have which disagrees with the position taken by the committee, and that is that the use of some good old waste which has been in a box for a long time is better than fresh soaked waste, even after it is soaked for three or four days or more. I do not wish to find fault with the report, but bring it up to make it part of the subject for investigation for any future committee. I have been told time and again by some of our foremen that where they have had trouble in passenger cars, with journals running hot, they have remedied the difficulty by adhering to the use of old waste.

Mr. Waitt: We do not recommend throwing away the old waste, except the dirty part, but before it is used again it should be resaturated with oil.

Mr. Barr: I understand the committee recommends its use for freight cars. I am not questioning the throwing away. I am simply raising the question whether a box will run better packed with old waste, in fair condition, that has been used a long time, or will run better with new waste, no matter how long it is soaked. I think that question ought to be investigated.

Mr. Marshall moved that the recommended change from 3¾ by 7 bearing and key be submitted to letter ballot for adoption; that the recommendation as to further investigation be referred to the committee on subjects; and the recommendations as to gages be submitted to letter ballot for adoption as recommended practice, and the committee discharged with thanks.

Mr. Leeds moved to amend the motion, that the committee be continued for another year. It was necessary to have a rising vote on the amendment, and 33 were in favor and 26 opposed, the amendment being adopted. Mr. Marshall's motion was put and carried.

Mr. West read the report of the Committee on Ventilation of Passenger Equipment.

Ventilation of Passenger Equipment.

Your committee on passenger car ventilation has, as it expected, found the problem of securing perfect ventilation in passenger cars of all kinds an exceedingiy difficult and complex one, owing to the varying conditions of climate and service, as well as the inconsiderate selfishness of the average passenger.

When the temperature of the outer air is such that for the comfort of people sitting still in an average condition of health, the car must be warmed, heating and ventilation are inseparable, and any system of ventilation which does not admit warm, fresh air at the proper temperature must be incomplete. Open windows and doors materially interfere with the effectiveness of any system of ventilation in winter time, and for the good of the majority of the passengers it becomes necessary to interfere somewhat with the personal liberties of the cranks and educate the trainmen to strike a fair average condition of temperature and freshness of the air; but in summer time the ventilating problem is very simple and narrows itself down to providing for the maximum draft and air, with the minimum quantity of dust and rain. No system of ventilation requiring permanently fastened windows would be permissible in summer time, when the fanning action of the wind blowing over the heated skin provides the cooling influence which makes life endurable. Instances have been mentioned where in such cases passengers have smashed the glass out of coach windows, and paid $1.50 for fresh air.

Without going too much into details, researches have shown that each normal human being requires at least four cubic feet of fresh pure air per minute, to replace the air vitiated by the lungs and skin, the vitiation consisting of carbonic acid and moisture, with smells and micro-organisms, the oxygen in the air being proportionately reduced. For those not familiar with what has been effected by modern systems of ventilation in hospitals, etc., it may be interesting to say that physicians attribute a very large portion of their modern successes in hospitals, as well as the improved health of school children and others in large public buildings, to the better systems of ventilation now in more general use.

As the law of diffusion of gases makes it impracticable to remove just the net amount of vitiated air from the body of a human being, and replace it with fresh air, a much larger portion of fresh air is therefore necessary to dilute the air surrounding a human being to keep it at such a degree of purity that it will not be unhealthy or objectionable. To mix the air in such a way that the carbonic acid will not exceed six or seven parts in ten thousand requires not less than 22 cubic feet of air per minute per person, the best practice allows 30 cubic feet per minute per head. The average amount of carbonic acid in fresh air is between three and four parts in ten thousand. When carbonic acid is in excess of ten or twelve parts in ten thousand, the air is bad and unhealthy. This means that in a 50-foot modern coach, seating 58 people, and having five powerful gas burners, the ventilating apparatus should have a capacity of 2,640 cubic feet of fresh air per minute. This, it will be noticed, is more than half the cubic capacity of the car, so that the air in the car ought to be changed a little oftener than once every two minutes. This must be done without draft or without inconvenience to the passengers. The car above mentioned would have 28 trailing sash ventilators of usual size for carrying off the foul air, and through these openings say 2,700 feet per minute of vitiated air should be exhausted; which means that the air must pass through these ventilators at a speed of about five and three-quarters miles per hour. Air moving at the rate of two or three miles per hour is hardly perceptible to the senses, but when the speed rises to five or six miles per hour it is considered a pleasant breeze. Of course, it must be borne in mind that no exhaust ventilator can work successfully unless fresh air is admitted as rapidly as the exhausters would extract the air from the car. Therefore, it is plain that no system of ventilation is complete unless it provides for both the admission of fresh air as well as for the abstraction of the foul air, or for the coach before mentioned we must furnish 2,700 cubic feet of fresh air per minute.

When air is admitted to an inclosure occupied by human beings at a speed of not over 3½ miles per hour, the difference between drafts and ventilation simply becomes a question of temperature, cold air coming in at this speed being felt as a draft. The heating apparatus, therefore, of a passenger car of a size as given above, should be so constructed that it can warm and deliver into the car 2,700 cubic feet of air at a temperature of 70 degrees Fahr. This part of the subject properly belongs to the domain of your Committee on the Heating of Passenger Cars, and should not be elaborated here.

Another very important point is the humidity of the air. The moisture in the air varies according to temperature and locality, and the human skin is peculiarly sensitive to the condition of the air as regards moisture. At 32 degrees Fahr.—freezing point—the air is almost dry. At 70 degrees Fahr. the air should have from four to five grains of water per cubic foot held in a state of vapor, and at 100 degrees Fahr. 10 grains per cubic foot would be a normal condition of humidity. Now, if winter air is simply warmed and served up in a practically dry state, it is exceedingly unpleasant, causing a dry, parched feeling to the skin.

As regards the proper location of the outlets and inlets, many mistakes have been made by inventors and others, they supposing that because the carbonic acid gas is heavier than air, the foul air would be at the bottom or floor of the room or car, and that the outlets for the foul air should be at or near the floor line. As the air emitted from the lungs is generally at more than 10 or 12 degrees Fahr. higher temperature than that surrounding us, it will be at least two per cent. lighter and the addition of two or three parts of carbonic acid in 10,000 parts of air will not begin to counteract the decrease of weight caused by the additional warmth. All the best modern authorities on ventilation are unanimous in stating that fresh warm air should be distributed low down through as many openings as can be arranged for, the foul air to be carried out as it ascends at the roof or ceiling.

Another law of nature which is often lost sight of is the law of diffusion of gases. If this law did not exist, then instead of the carbonic acid being uniformly distributed in the air, and varying very little, if any, between the plains and tops of the mountains, the earth would be blanketed around with a heavy cloud of carbonic acid. There could be no life in such an atmosphere, and instead of the clouds being generally up in the sky, they would be lying on the earth at all times as a permanent fog, the oxygen being above this, and the nitrogen being still further out next to space—a sort of atmospheric "pousse cafe." There are places such as in the bottoms of wells, the celebrated Valley of Death, the neighborhood of factories and furnaces, where the carbonic acid is formed faster than the diffusion can carry it off, but such cases are exceptional.

Another important consideration, which must not be lost sight of, is that the amount of air breathed by the passengers and necessary for good ventilation is entirely independent of the speed of the train, so that if the ventilating apparatus is so arranged that the air has to be forced in by the movement of the train and exhausted by the same source of power, the ventilation will be very unequal, and when the cars are standing, running slowly, or moving with the wind, there will be practicaliy no ventilation at all.

In all modern systems of ventilation, sanitary engineers endeavor to have a plenum instead of a vacuum, or, in other words, to have a slight excess pressure inside of the building instead of a slight vacuum. With a plenum there can never be any cold drafts or admission of smoke, dust or cinders, for the reason that the pressure would always be driving the air outward through every crack and opening. With a vacuum the reverse is the case, and dust, smoke and cold air will find their way in at every crack. It is very desirable that the windows of passenger cars be so arranged that they can be locked fast in winter time to prevent one obstinate passenger interfering with the comfort of the whole carload, but this can only be done when a sufficient supply of fresh air is constantly being furnished to the passengers, comfortably warmed. The opening of the doors at stations is also a great interference with a uniform system of ventilation. This cannot be avoided, but the evil effects of it can be largely overcome by building the cars with an inner swinging door. Most of the modern larger passenger cars having smoking rooms, double saloons and heating apartments, can be very easily fitted up with a swinging door at the end of the passage in between the compartments, which will act as a kind of air lock and prevent a good deal of discomfort otherwise unavoidable. A convenient way of arranging the windows so as to avoid the drafts and interference to the comfort of the passengers in winter time would be to have the outer sash arranged, as is commonly the case now, with inner sash arranged so that when lowered they will lock themselves tight and can only be released by a lever at the end of the car, attached to a locking bar running the full length of the car on either side. These windows could be kept raised in summer time, the outer sashes being so that the passengers can raise them or lower them as they please. In the winter time, when these inner sashes are lowered, no windows could be raised.

To summarize, the ideal conditions would be as follows:

1. The admission of 30 cubic feet per minute per passenger of fresh air and the carrying off of an equal amount of foul air summer and winter.

2. The fresh air so admitted must not be moving at a speed of more than three or four miles per hour in winter time.

3. Fresh air admitted must be at a temperature in winter time of about 70 degrees Fahr.

4. Fresh air so admitted in winter time must have added to it a proper degree of moisture for the temperature at which it is admitted, according to the average humidity of the atmosphere, when at 70 degrees in the climate in which the cars are running.

5. No system of winter ventilation can be successful unless means for the fresh air supply are provided independently of and separately from the windows and doors, as well as the ventilators for carrying off the foul air.

6. The fresh warm air should be distributed through as many openings and as low down as it can be conveniently arranged for, and the foul air should be carried off through as many small openings in the roof of the car as can conveniently be arranged for in winter.

7. The ventilation should be entirely independent of the speed of the train and act equally as well whether the car is standing or running.

8. The ventilation should be so arranged that there will be a plenum or slight excess of pressure inside the car, so that all drafts will be outward instead of inward, and smoke and dust thus excluded.

9. It is most desirable that double windows should be used, and so arranged that they can be locked fast in winter time, but readily opened in summer time.

10. It is most desirable that an inside swinging door be used, so as to form an air lock or inside vestibule, to prevent the admission of cold air and dust every time the doors to the platform are opened.

It may be argued that there is no use for any such system of ventilation as this, that the present arrangements for the ventilaton of passenger cars are good enough, and that nobody is any the worse for the present state of affairs. To show that this is an entirely wrong position to take, your committee had a number of tests made to show the degree of foulness of the air in sleeping cars, chair cars and day coaches, which tests have been under the supervision of Mr. William Forsyth, of the C., B. & Q., through the kindness of Mr. Rhodes. Pure air contains from three to four parts in 10,000 of carbonic acid, and at 70 degrees Fahr. an average condition of moisture would be from four to five grains of water per cubic foot. Dr. Angus Smith made a series of careful experiments in lead-lined air-tight rooms for the purpose of seeing how long healthy people could exist in an atmosphere having an excess of carbonic acid and moisture. As the result of his experience, it was shown that it was very unwholesome to breath an atmosphere having more than seven parts in 10,000 of carbonic acid, and that an atmosphere containing 10 parts in 10,000 could not be endured by delicate people for long without injury, and that as the presence of an excess of carbonic acid is a direct indication of the presence of micro-organisms, commonly called disease germs, the injurious effects are not merely limited to the poisonous influence of carbonic acid, but that the danger of taking organic diseases was very largely increased. It was further shown that the senses are a very unreliable guard in judging of the foulness of the atmosphere, and that people who remained in a room in which the atmosphere had become gradually fouled would hardly notice its foulness, whereas outsiders suddenly coming in would be almost suffocated. Micro-organisms, or disease germs, are not given off to any harmful extent in the exhalations of healthy human beings, but they are given off in large numbers in the breath and spittle and evaporation from the skin of unhealthy persons. Especially is this the case with people suffering from tuberculosis, whooping cough, fevers and so on, and the disease germs grow and multiply very rapidly in a foul, moist atmosphere. To quote a prominent Eastern railroad surgeon, "The road is short, straight and sure from vomica and mucous patch to the receptive nedus in another's body. Who that has ever had forced on him an aerial feast of cabbage, onions, garlic, alcohol, tobacco and gastric effluvia of an old debauch can doubt that aqueous vapor can transport microscopic germs by the same route?" Experiments made in Europe on animals which were inoculated with a preparation from the dust beaten out of the cushions of railroad cars in ordinary service, and which cars were not known to have carried sick people, showed that the most of these animals which were inoculated died of violent diseases. Few of them lived long enough to die of tuberculosis—none of them survived. As these micro-organisms are in the air and simply settle on the dust, all this goes to show how very necessary indeed it is to carry off the foul air, and that, to quote a southern physician, "The movement of vast masses of people annually from one section of this broad country in search of those climatic influences modifying the course and progress of disease has become, from a sanitarian standpoint, a great unsolved problem, namely, that of accomplishing the proper ventilation of cars by the introduction of pure air, free from dust, cinders, smoke, and so on, and at the same time the withdrawal of the impure air arising from the natural emanations of the body, as well as the more serious dangers accruing from chronic or contagious influences."

In explanation of the figures given below it may be mentioned that the air taken from shop yards at times contains more carbonic acid than the normal, for the reason that at certain stages of the wind the smoke from the engine-houses, furnaces, etc., is driven over the shop yard. It will be noticed that the air in the sleeping cars is bad, in all cases beyond the health limit of 10 parts in 10,000. The air in the chair cars is, generally speaking, much better. There were fewer occupants per cubic foot of volume, the travel was mostly local or suburban, and the passengers had done a good deal of kicking, so that the porters were attentive to their duties.

TESTS OF VARIOUS PATTERNS OF VENTILATORS FOR PASSENGER CAR ROOFS.

No.	Name.	Cu. ft. of air exhausted per min. with wind at 49½ miles per hour.	Back draft.	Remarks.
1....	Cone cap.....	29	None at any angle.....	Allows free natural draft.
2....	Cone and apron.....	12	None at any angle.....	Allows free natural draft.
3..	Canopy	4	Current constantly reversing, but very slight in either direction.....	Natural draft badly obstructed.
4....	Tornado canopy....	56½	Back draft set in when wind is at angles from 65° to 90°..	Natural draft much obstructed.
5....	Dished cap.....	63	Back draft set in when wind is at angles from 70° to 90°..	Allows free natural draft.
6....	Moore.....	49	None at any angle.....	Allows free natural draft.
7....	Duplex	54¼	None at any angle.....	Allows free natural draft.
8....	Roe	58	None at any angle.....	Natural draft only fair.
9....	Stasch.....	86	None at any angle.....	Natural draft very free.
10	Star.....	83	None at any angle.....	Natural draft very free.
11...	Globe—erect	71	None at any angle.....	Natural draft moderately free.
12 ..	Globe—horizontal....	80	None at any angle.....	Natural draft quite free.
13....	World.....	72	Back draft set in when wind is at angles from 40° to 50°..	Natural draft quite free.
14....	Torpedo.....	84	None at any angle.....	Natural draft very free.
15....	Deflector—cast.....	90	None at any angle	Natural draft moderately free.
16....	Deflector—sheet.....	88½	None at any angle.....	Natural draft moderately free.
17....	Creamer Eureka.....	34	None at any angle.....	Natural draft moderately free.
18....	Creamer Automatic..	34½	Back draft set in at 18 to 90°, when blade flaps back and forth.....	Natural draft fairly free.
19 ...	P. R. R. Induction...	43	None at any angle.....	Natural draft badly obstructed.
20....	Trailing sash.....	67	Back draft set in when wind is at angles from 65° to 90°.	Natural draft quite free.
21 ..	Drop sash.....	43½	Back drafts occur with wind at all angles from 5° to 90°..	Natural draft very free.

NOTES.—During the tests the Baker blower was carefully regulated so that the speed of the wind was as regular as possible, anemometer readings were taken between tests to check wind-velocity which at no time varied more than 120 feet per minute from the average. The speed of 49½ miles per hour given above was the average speed at the center of the blast, 3 feet 2 inches from the nozzle, which was 12 inches diameter. The blast spread to a diameter of about 28 inches, at 3 feet 2 inches from nozzle, where ventilators were tested. The angle of back draft is measured from the direction in which a car fitted with such ventilators on the sides of the clerestory would be running, this direction being 0 and a right angle cross wind would be at 90°.

SLEEPING CAR.

Date, 1894.	No. of Passengers.	No. of ventilators open.	Temp. of car.	Weather.	CO_2.*	Moisture.
1-31....	12	4	66° F.	Cold, Clear	.220	430
2-6.....	10	None	67° F.	" "	.220	.330
2-7.....	15	All	68° F.	" "	.182	.300
2-8.....	13	All partly	68° F.	" "	.157	.427
2-9.....	12	" "	70° F.	Rain	.113	.445
2-10	16	6	66° F.	Cold, Cloudy	.113	.339
2-14....	16	None	71° F.	Snow, Cloudy	.218	.397
2-15	6	"	70° F.	Clear, Cold	.217	.342

CHAIR CARS.

Date, 1894.	No. of passengers.	No. of open ventilators.	Weather.	CO_2.	Moist.
1-24....	9	None	Clear —10° F.	.090	.330
3-29...	10	2	Clear, cold	.070	.375
3-30....	12	3	Freezing	.155	.330
4-2.....	20	3	"	.105	.302
4-3.....	20	1	Clear, 50° F.	.067	.440
4-4..	20	4	" 40° F.	.141	.275
4-6.....	28	5	" 55° F.	.089	.332
4-7.....	18	2	" 50° F.	.141	.380

* CO_2 = Carbonic acid.

SUBURBAN COACHES.

Date, 1894.	No. of passengers.	No. of open ventilators.	Weather.	CO_2.	Moist.
2-20....	¾ full	None	Cold	.217	.245
2-21....	½ "	"	"	.163	.270
2-22....	¼ "	"	Moderate	.122	.212
2-23....	¾ "	4	"	.152	.203
2-27....	¾ "	7	Thawing	.102	.347
3-1.....	½ "	10	"	.069	.367

MISCELLANEOUS TESTS FOR COMPARISON.

Date.	Source of Sample.	CO_2.	Moisture.
2-15....	Office occupied by six persons, door open to hall, cold day.....	.085	.324
2-16....	Opera house, in rear of floor seats, house full.....	.113	.282
2-17....	Chemical laboratory, two persons, two lamps burning, 70° F.....	.040	.287

It would be entirely practicable to obtain a perfect system of ventilation where electric power is obtainable—that is, where electric lighting is used—or where compressed air power can be used for driving the air into the coaches by means of small fans in the ends of the cars about half way between the roof and the floor. This position being farthest removed from the smoke and the foul air on the roofs, and from the dust and snow under the floors. The air driven by these fans can be passed through heaters, or can be heated in wind boxes or wind trunks running along the sides of the cars on the floor or between the floors, and can be delivered to the car in perfectly regular quantities and at a perfectly even heat, through registers conveniently placed between the seats or at the end of the seats, or elsewhere as the design of the car may require. In this way a constant plenum or slight pressure can be maintained in the car, which will assist the ventilators in the deck, of whatever pattern they may be, in discharging the foul air which rises to the roof. The speed of the train would have comparatively little influence on such a system. It would, however, require intelligent handling by the trainmen, as every improved device or apparatus requires more intelligent care than the crude, simple, unsatifactory arrangement which preceded it. Such an apparatus could, however, be made almost automatic by the means of a temperature regulator, several kinds of which are made to-day for regulating the heat in buildings, which would not only control the heat, but also by the means of suitable attachments, could be made to control the speed of the fans.

It will not be worth while for your committee to criticise every device which has been submitted to them, but with the ten conditions given previously, any intelligent master carbuilder can judge of the efficiency or lack of efficiency of any apparatus under consideration. The most perfect of those to which the attention of your committee has been called was that elaborated by Colonel Mann and applied to the Mann Boudoir cars; it, however, was entirely dependent for its action on the speed of the train. In all other respects it is an admirable plan, but has been a general failure for the reason that the railroad companies and others operating the cars did not see that the men in charge were properly instructed, carried out their instructions, or kept their apparatus in good order.

Briefly described, the fresh air needed for ventilation is taken in through a wind scoop and forced downward into a filter chamber where it passes through a lot of loose excelsior, which excelsior is kept cool and moistened by melting ice placed above it. After being cleansed in this way, the air passes, in winter time, into a heating chamber and from thence into a wind trunk running along the corridor, the air being distributed into the corridor and boudoirs by means of registers. In summer time the air passed direct from the filter chamber to the wind trunk and could be delivered in the car at a temperature ten degrees Fahr. lower than the outer air.

There are a number of similar arrangments, not as complete as that above described, all of which take in the air through scoops or hoods on the roof or sides of car, passing it over heating surfaces—either stoves or steam pipes—and delivering the air into the coaches at a more or less comfortable temperature.

All these devices depend upon the speed of the train for their action, and where the air intakes surround the stovepipe, every time the car stops the ventilating process ceases and may be reversed; at slow speed it will be almost inoperative.

Great improvement could, however, be made in the condition of the air in our crowded passenger cars if the trainmen were compelled to pay proper attention to the ventilators; a regular set of instructions should be furnished them for their guidance, and division officers should be instructed to pass through the train at every opportunity and report cases where the ventilators have been neglected and the air overheated or foul, to the division superintendent for discipline. The men would then soon learn to attend to this part of their duty. Sleeping car companies should have a code of rules printed and posted in the cars, and their porters and conductors should be made to observe such rules. One specially important thing is not to open the ventilators on the windward side of the train, otherwise with drop sash or trailing sash ventilators down drafts and cross drafts are unavoidable.

It would, however, be quite practicable to use light varnished silk flapvalves made with wire frames so hinged and balanced that they would close the ventilator openings automatically on the windward side of the car, or whenever the current of air had a tendency to move in the wrong direction.

Some schemes have been extensively advertised, which provided for the heating of the air for ventilating the coaches in coils of pipe in the extension front of the locomotive, or in a special heat tender, the air afterward to be conveyed back and delivered to the cars by the means of a train pipe A few figures, which any one can make, will show that to supply air enough for two or three coaches in the quantities needed, the air would have to travel through any admissible size of train pipe at a speed of millions of feet per minute, to do which it would have to be forced at an enormous pressure, and the expansion afterward would refrigerate everything in the neighborhood. For very hot weather, or for cars running in very hot climates, a great deal of comfort could be obtained by the judicious use of some small fans driven by electric or other power, to keep the air in the car constantly in pleasant motion. The Central Railroad of Georgia has made some experiments in this line with more or less satisfactory results. When inquiring into the efficiency of the various styles of ventilators in use and recommended for use for exhausting foul air from the decks of passenger cars, your committee was unable to get any accurate information. Believing that some information of this kind would be of service to the master car builders in designing cars, some tests were made of the efficiency of the various patterns of ventilators, the results of which are given herewith, and which will enable the designer to tell how many ventilators of any particular pattern are needed to carry off the air vitiated by a given number of passengers under given conditions.

With the general information given in the first part of the report, with the ten general conditions, the attainment of which should be striven for in designing new cars, and which can be used as a guide in considering the efficiency of any system proposed, and as each passenger car running in its own set of conditions must be a problem in itself, and with the information given above as regards the efficiency of the various patterns of ventilators, your committee feels that it has done all that can be done in dealing with generalities, and would only urge in conclusion that better rules and discipline be enforced to obtain the best results with the apparatus now in the cars, and that the railroad companies and sleeping and chair car companies spend a little portion of the money now spent in flashy and extravagant interior decoration in providing a little better for the health and comfort of their patrons.

R P. C SANDERSON, WM. FORSYTH, A. C. ROBSON, G. W. WEST, J. M. HOLT, Committee.

On motion the convention then adjourned until Wednesday morning.

On Wednesday morning President Grieves announced that the consideration of the Rules of Interchange would be in order at 10 o'clock; meantime the Report on Wheel and Flange Gages would be considered. This report was read by the Secretary; an abstract follows:

Wheel and Flange Gages.

In taking up this matter your Committee found that the subject had been taken up and carefully considered by Mr. G. W. Rhodes and the result of his investigations presented to the Western Railway Club at the meeting of January, 1893. More recently a committee representing the Maintenance of Way and Motive Power departments of the Pennsylvania Railroad Company has made an elaborate and close investigation of the same subject. These two investigations present the entire subject so fully that your committee has decided that it cannot do better than to practically reproduce these two papers.

The two papers were here presented. Mr. Rhodes' paper was published in the NATIONAL CAR AND LOCOMOTIVE BUILDER for March, 1893. The report of the Pennsylvania Railroad committee has not previously been made public. It shows that the committee discovered that the wheel limits prescribed by the rules of interchange are defective in being applicable only to cases where both wheels of a mounted pair have flanges of equal thickness. New limits were finally chosen in order to make an accurate examination of the subject. It was the aim, in selecting these limits, to detect every possible combination of conditions that cause impingement on the frog point or blow on the guard rail and frog wing. These limits comprise an over-flange limit or wheel gage, designed to check the distance between those lines of any pair of wheels which run against the rail head; a limit measured from the back of a wheel with thin flange to the gage line of the other wheel of thicker flange, and a corresponding limit measured from the back of the wheel of thick flange to the gage line of the wheel of thin flange. These are considered the essential limits and are supplemented by a maximum flange limit and minimum over-all limit, measured from the gage line of each wheel to the outer edge of rim of opposite wheel.

This report expresses the conclusion that the ideal condition of immunity from impingement on the frog and blow on the guard rail is obtained when the wheels have flanges of equal thickness and are mounted to a limit of 4 feet 6⅝ inches from the back of one flange to the gage line of its mate, but to allow for present variations, and until the wheels actually in service have been adjusted to the stricter limit, an interchange limit of 4 feet 7 inches is suggested. The committee had constructed a number of gages to the 4 feet 7 inch limit, and had a large number of wheels examined on the four divisions of the Pennsylvania system. Thirteen thousand one hundred and forty-one pairs of wheels were measured under 3,461 cars. Of these only 13 per cent. were found to have their wheels properly mounted and proportioned to suit the requirements of equal and unequal throats. The P. R. R. committee recommends the adoption of a car inspector's gage made to the 4 feet 7 inch limit, to supersede the present interchange limits for maximum distances; as soon as sufficient progress has been made in remedying existing wheel defects this limit to be reduced 4 feet 6⅝ inches; that the variation in flange thickness on the same axle shall not exeed one-eighth of an inch; that 1⅝ inches be the maximum flange thickness.

The M. C. B. Committee, continuing its report, says:

The above presents the subject from every point of view and illustrates how necessary it is to take track, and especially frogs, into consideration in deciding on gages for wheels, gages for mounting wheels and gages for inspecting wheels at interchange points. It should also be borne in mind that any of the above described conditions which allow an interference between the inside of flange and of guard rail, allow a similar interference between inside of flange and the open rail of split switches. This interference is possibly a greater menace to the safety of trains than the difficulties encountered at frogs. In order to speak concisely and without ambiguity the following definitions of the terms employed are presented, with the recommendation that they be carefully considered with a view of adoption.

1. *Gage of Track.*—Gage of track is the shortest distance between heads of track rails, see Fig. 20, and equals 4 feet 8½ inches.
2. *Track Rails* are the two main rails forming the track.
3. *Base Line* for wheel gages for M. C. B. standard section is a line parallel to axis of wheel and drawn through point of intersection with tread, of a perpendicular line through center of throat curve (see Fig. 20).
4. *Inside Gage of Flanges* is the distance between the two flanges of a pair of mounted wheels measured on a line parallel to the base line and ¼ inch nearer the axis of the wheels (see Fig. 20).
5. *Gage of Wheels* is the distance between the outside of flanges of a pair of mounted wheels measured on a line parallel to the base line and $\frac{17}{64}$ inch further from the axis of the wheels (see Fig. 20).
6. *Thickness of flange* is the distance measured on the base line from the point of measurement of the inside gage of flanges to the point of measurement of gage of wheels; see line *c-d*, Fig. 20.
7. *Width of Tread* is the distance measured on the base line from the point of measurement of gage of wheels to outer edge of tread; see *e-f* Fig 20.
8. *Check Gage* is the distance measured on the base line from the point at which measurement of inside gage of flanges is taken on one wheel, to the point at which measurement of gage of wheels is taken on the mate wheel.

(Continued on page 107.)

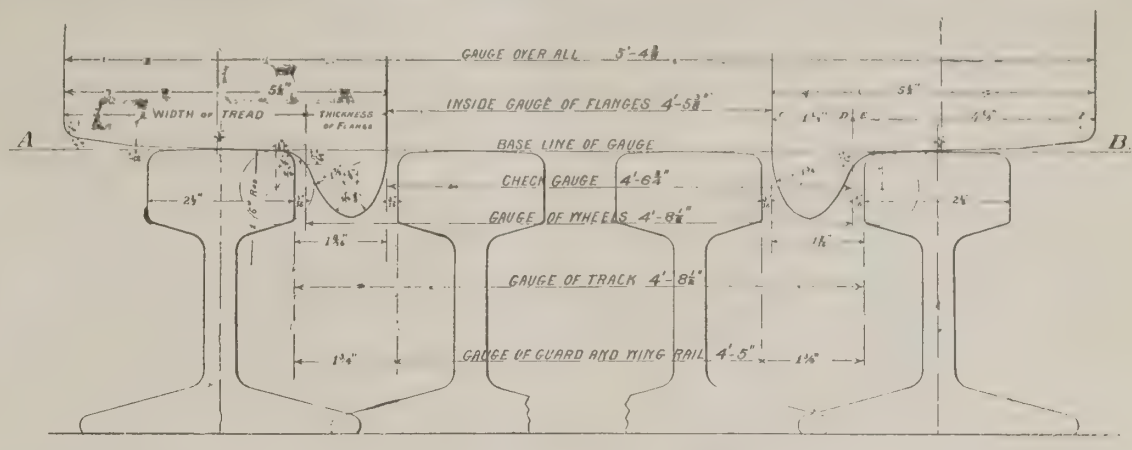


Fig. 20.—Proposed Location of Gaging Points.

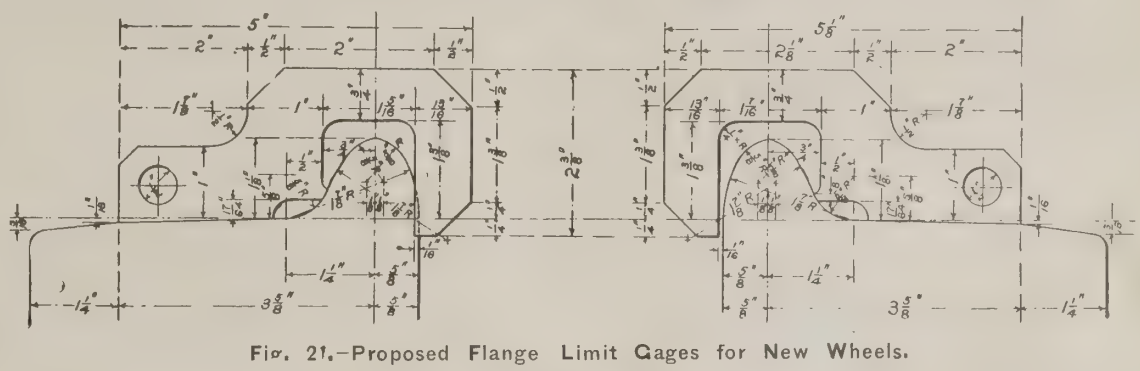


Fig. 21.—Proposed Flange Limit Gages for New Wheels.

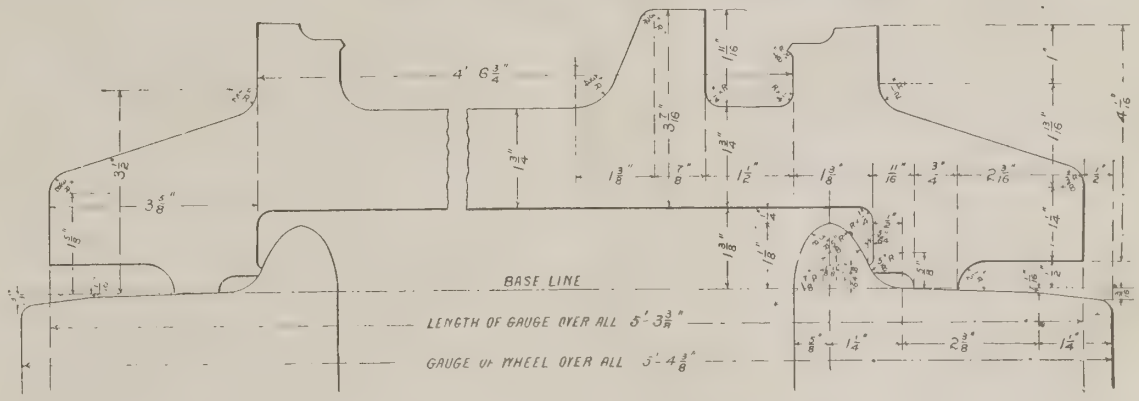


Fig. 22.—Proposed Check Gage.

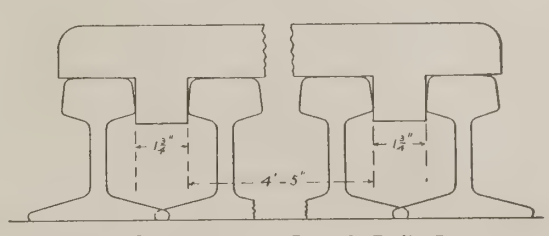


Fig. 23.—Proposed Guard Rail Gage.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction nd management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

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THE CONVENTIONS.

According to programme the Master Car Builders' and Master Mechanics' Associations held their annual conventions at Saratoga in June. The attendance at both conventions was the largest in their history, being 124 for the Master Car Builders' and 198 for the Master Mechanics' convention. Doubtless the dull condition of business contributed to this result, as was suggested in our last issue: the home duties of the members being unusually light permitted their attendance. The entertainment features did not seem to suffer any because of the hard times, and compared favorably with those of former conventions; but there was something of a sameness about them and about the general features of meeting at Saratoga that lost some converts to the belief that the associations should have a permanent meeting place. Variety is not only the "spice of life," but is a great educator. Railroad mechanical officers have enough of sameness in the arduous duties they daily perform at home. They, more than any other class of railroad men, should have variety on the occasions of their annual meetings, both in place and locality, and in opportunities for recreation between the sessions of their meetings. Time is particularly fleet-footed with busy men in middle life, and one or two years is so short a time to these that there is practically little change for them in visiting any particular locality so frequently. Changes in the places of holding the conventions that would take the members to widely separated localities convenient to large railroad shops would exert an educational influence nearly equal to that of their deliberations in convention.

Interesting series of reports were presented to the conventions and received due discussion. Nearly all the space in this issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER is devoted to the publication of these reports, and the gist of the discussions. Our next issue will contain the balance of a report of the proceedings of the Master Mechanics' Association, which is begun in this issue.

The report on the cracking of back tube sheets was read at the first session of the Master Mechanics' convention and excited more discussion than any other report presented to the convention. We reproduce it in full, together with its accompanying illustrations, and a portion of the discussion it brought out, on pages 110 and 111 of this issue. It was the purpose of the report to show if any particular type of boiler is subject to the development of cracked tube sheets more than another. It expressed the conclusions that radial stayed boilers carrying high pressure are more subject to this trouble than other types of boilers are, and that the causes are too rigid staying of the crown sheet adjacent to the tube sheet and placing tube holes too close to the flange of the latter. The opinion was also expressed that the high steam pressure carried may cause some of the trouble.

The remedy suggested was some flexible method of staying the front end of the crown sheet that will allow the free expansion and contraction which seems to be very considerable at the joint of the crown and flue sheets. Drawings illustrating such methods were presented. The discussion of the subject sustained the views of the committee and showed that cracked tube sheets seldom appear in crown-bar boilers or with those having sling stays. It was suggested during the discussion that there were several contributory causes not mentioned by the committee, among these being the too close spacing of tubes causing improper circulation of water and the overheating of the tube sheet; also too numerous tube holes weakened the sheet. It was suggested that increasing the space between tubes to ¼ of an inch or even an inch would decrease the frequency of cracked sheets and increase the economy of steam production.

It must be plain that the investigations of this committee and the points brought out in the discussion of its report will be of great value to locomotive users who are now troubled by flue sheets frequently cracking in radial stayed boilers. The opinions of the committee and the suggestions we have alluded to are in line with plain commonsense and scientific principles. The force of expansion and contraction in metal caused by varying temperature is all but irresistible, and when certain parts of any metal structure are subject to different temperatures at the same time there must be provison for their unequal relative expansion and contraction, or ultimate disaster is inevitable. The action of this force may be prevented by providing for approximately uniform temperature, and it may be diverted by the flexibility of connections, or, in the case under consideration, of staying, but it cannot be suppressed.

The report on steel-tired wheels to the Master Car Builders' convention contained illustrations and descriptions of all the different types of steel-tired wheels in ordinary use on American railroads, and considerable information as to the number of the different types in use and the defects they are subject to. It recommended limits to which tires should be worn, and that to facilitate inspection a groove should be cut on the outer edge of the tires at a radius ¼ inch less than the prescribed limit of wear, one inch. The Committee on Brakebeams submitted a diagram showing proposed standard details for the location of brake beams. Replies to the committee's circular showed that outside hung metal brakebeams were much more largely in use than inside hung metal beams. The committee recommended that 13 inches be adopted as the standard height of the inside and outside beams. The report on safety chains for freight cars showed proposed standard dimensions and location for the same. The discussion showed little inclination to use safety chains on any cars except on such as carry material of unusual length and extending over two cars.

The subject of lubrication of cars furnished one of the most valuable reports that have been submitted to the association in years. Its scope was confined to the features of construction and lubrication calculated to avoid hot boxes. It pointed out that there is much diversity and carelessness in the construction of journal brasses and keys, and maintained that these parts should be accurately fitted, as in locomotive practice, in order to secure the best results. Proposed gages for testing the accuracy of such parts were submitted, and good oil and woolen waste were recommended for lubrication. To the view of the committee the field for profitable investigation broadened as the subject was studied in its various phases, and it recommended the study during the coming year of the "economics of journal bearings." The convention very sensibly continued the same committee, and it is reasonable to hope that another year's study of the subject by a committee evidently interested in it will be fruitful of results. We commend to the committee an investigation of what is the best practice in regulating the consistency of car lubricating oils for summer and winter use.

Another report that was creditable alike to the association and the committee rendering it was that on the ventilation of passenger cars. The report is presented in full on another page, and deserves the careful perusal of every one connected with the operating department of railroads. A number of experiments were made by the committee to determine the condition of the air in sleeping, chair and suburban cars, and these showed that, especially in winter months, the air in these was in a wretchedly unhealthful condition. The report properly laid particular stress on the fact that while improved means of ventilation are necessary, yet a vast improvement over present common conditions is possible by compelling trainmen to pay proper attention to the ventilation of cars, and it suggests that a set of instructions should be issued to intelligently guide such action. Unfortunately, the report does not contain such a set of instructions, but the suggestion is an eminently sensible one and deserves adoption on every road.

THE PULLMAN BOYCOTT.

As we go to press there are between 25 and 30 railroads in the West, North and South that are involved in a strike of employees, including shop, train and engine men, which is the outcome of the strike at the Pullman Car Works, May 11. Included in this number are the Illinois Central, Chicago, Milwaukee & St. Paul, Chicago, Rock Island & Pacific, Northern Pacific, Southern Pacific, Denver & Rio Grande and the Atchison, Topeka & Santa Fe. Our readers are familiar with the cause of the strike at Pullman, it being simply one for the restoration of wages to the basis of those paid during prosperous times. At the time of the strike the works employed 4,300 men and the payroll was $7,000 a day, an average of over $1.60 per day for each employee, and the company in order to furnish employment for its men and bridge over the hard times was losing from $12 to $79 on every car turned out. The men became dissatisfied, however, joined the American Railway Union, and, declining to inspect the books of the company which were submitted for the purpose, struck—struck when they were among the very few workmen in the car building industry that had any work at all. At the time they struck it was plain to every one with even a superficial knowledge of the condition of the car building business in this country that it was simply a strike against their bread and butter. Numerous car shops were closed for want of orders, and their thousands of employees were idle.

The cause of this idleness and of the shops being closed was the fact that the railroads had not been making any money to buy cars with, or to even maintain the cars they had in proper condition. As a cure for this evil, which is the underlying cause of the Pullman company's inability to pay the rate of wages demanded, the American Railway Union has inaugurated a strike on nearly all the principal railroads in the country, and indeed all are threatened. The purpose of the strike is to compel the reopening of the Pullman shops and the payment of the former rate of wages. The strike is estimated to be costing the numerous roads involved $250,000 a day. This is "killing the goose that lays the golden egg" with a vengeance, as the loss to the railroads occasioned by the strike will long postpone their disposition and ability to buy new cars, and just so long will be postponed the ability of the Pullman or any other car building company to build cars and sell them at a profit that will enable the payment of good wages.

It is the hope of the American Railway Union to force its demands by boycotting Pullman sleeping cars and by preventing these being hauled in the trains of any railroad. The railroads without exception insist on hauling the boycotted cars in all trains that usually have them. How far the complications will extend cannot be foreseen, but it can be predicted from the history of other boycotts that this one will be a failure, its chief effect being to deprive members of the union of work, and long delaying the time of their re-employment at remunerative wages.

There are good reasons why this boycott should fail, and why the influence of every railroad and allied interest should be exerted to cause its failure. Should it succeed (which it cannot) it would be but the beginning of boycotts and discriminations against other manufacturers of railway rolling stock, supplies and appliances. There is no limit to the length that such discriminations might be carried if unreasoning and unreasonable labor organizations were once allowed a free hand. In our time we have heard much of the tyranny of corporations and employers, but, of all the evils we know, that of the supremacy of labor organizations would be the most dreadful and unbearable, because it would have back of it little but selfishness, ignorance and unreasoning vindictiveness.

We trust that our readers will not jump to the conclusion that the NATIONAL CAR AND LOCOMOTIVE BUILDER has gone into politics because a political advertisement appears on its front cover this month. In a journalistic way we try to keep out of politics, but a part of the business of publishing a paper is the rental of advertising spaces in its advertising pages. When rented these spaces belong to those who pay for them and they are at liberty to insert therein what they choose. This simply by way of explanation.

A new form of report has been adopted by the Chicago, Burlington & Quincy Master Mechanic Association. It is in the form of a printed pamphlet, M. C. B. standard in size, 6 inches by 9 inches, and contains a complete alphabetically arranged index. This information may interest the members of other local master mechanics' associations. It will not be of great interest to others, as copies of these reports are not obtainable for love or money. We have been graciously allowed to look on the outside of one, and at the index; but its contents remain a sealed mystery which has caused us much aggravating curiosity.

In our last issue we announced that the Chicago, Burlington & Quincy was experimenting with petroleum as fuel on some of its locomotives, and that on May 24 the oil on one of these engines exploded, seriously burning the fireman and engineer. Our information was based on press dispatches received shortly before going to press. What was said of the experiments with petroleum as fuel is true, but the explosion noted was on a locomotive burning coal and equipped with a device for automatically feeding kerosene to the boiler to prevent the formation of scale. This device held a quantity of kerosene and was equipped with a gageglass. In some way the oil caught fire, whether from leakage or the glass breaking is not known, and an explosion, resulted with the effects described. The experiments with, the device have been discontinued on the C., B. & Q., as have also the experiments with petroleum as fuel. The information gained by the tests made on the "Q." show that for road purposes the consumption of oil may be estimated with an average six-car passenger train at one gallon of oil per mile run. Estimating one pound of oil as the fuel equivalent of two pounds of coal, it is calculated that with oil costing 1.7 cents per gallon it is as cheap as coal costing $3 per ton. When coal can be bought for less than this figure it is the cheapest. Some of the Western roads that pay between $5 and $10 a ton for coal can, therefore, it appears, afford to give this matter some attention.

Convention Memorial Service.

An impressive service was held at Congress Hall, Saratoga, Sunday evening, June 17. by those attending the Master Car Builders' and Master Mechanics' conventions, in memory of Joseph K. Bole, of the American Steel Castings Company; A. Reed Slack, of the Cambria Iron Works, Pittsburg, Pa ; Major John C. Paul, of the American Steel Wheel Works of New York, and Robert Ross, of the Ross Valve Works, of Troy, N. Y., each of whom died during the year.

The service was begun by the band softly playing "The Vacant Chair," after which Rev. Joseph Carey, rector of the Bethesda church, Saratoga, conducted the short service of the Episcopal church, the surpliced choir assisting. The hymns rendered were "Jesus, Lover of My Soul" and "Nearer My God to Thee. At the close of the service the audience joined in singing the anthem "Lead Kindly Light," and B. R. Church gave the "Last Call" on the cornet, accompanied by drum taps. Resolutions and expressions of sympathy were read.

Mr. M. N. Forney spoke feelingly of Mr. Bole, and among other things said:

It would be a vain effort to attempt, in the few words which are allowed to me here, to summarize the life, depict the character, or describe the charming nature of our friend, whose presence at these annual reunions has cheered us for so many years past, has uplifted those who were despondent, and strengthened our hope in the future and our faith and confidence in ourselves and associates. The characteristic, which probably those who knew him best will hereafter recall first, and with the greatest pleasure, will be what may be called his *gladness*. Few will ever forget the beaming smile with which he welcomed his friends and acquaintances—and even his enemies. Probably none of those who knew him well could now recall his face shaded with a frown or with a look of anger on it. He always seemed to wear a joyous expression both in his countenance and in his heart and his whole bearing seemed to imply a desire that there should be "Peace on earth," and indicated a feeling of "Good Will to Mankind."

But besides being a delightful friend and companion, Bole—as we all delighted to call him—was a man of remarkable strong traits of character. He had the kind of capacity which is needed to make great enterprises successful. Most of us to whom the path of life has not always been a smooth one, but who have had to encounter many heavy grades, sharp curves and bad track, and realize the difficulties which must be met and overcome in order to succeed, can appreciate the ability which is required in the successful conduct of important business affairs.

It has been said, very truly, that the difference in the mental organization of men is not very great, but that in the conduct of affairs, their differences are of the utmost importance. Those who achieve great results seldom believe in luck, but every man who has ever accomplished much, always places a high estimate on the value of energy—or motive power—that characteristic which makes things go. You may fashion a locomotive as skillfully as you choose, make all its parts as perfect as possible, but its efficiency will, nevertheless, be dependent upon an abundant supply of steam or energy. The latter is just as essential for efficiency in men as it is in machines.

In physical endowments, nature had been very generous to our friend, and this perhaps has more significance than we sometimes think. Not only does a liberal physical organism give to its possessor power of exertion and endurance, which those of slighter physique have not, but there are certain mental and moral characteristics which seem to go with it. In our minds we naturally associate the traits of cunning, shrewdness, discernment and mental acuteness with small people, but good humor, generosity, magnanimity and broad and liberal views, we expect will be combined with a well-developed body. This impression was confirmed by the character of our associate and friend. Usually he was the picture of health and strength, and seemed to be overflowing with animal spirits. Generous always, with open hand he dispensed whenever he was called upon, and often when he was not. With friends and enemies, he was ever magnanimous.

It has been said that the only faculty which is essential in making money, is that which the oyster possesses—which opens and takes in, then shuts and keeps in. Probably if the oyster was endowed with human facilities, and went into business it would get rich ; and most of us have known a good many animated oysters who are in business. But something more than this faculty is needed to engage and succeed in great business enterprises ; enter the fierce contest which competition always wages ; carry them to a successful issue and yet at the same time during all of the campaign to retain the respect and admiration of both colleagues and adversaries, and inspire friends with enthusiastic affection, which now that such a person is gone, leads them to meet together in this way to give expression to their feelings.

In the analysis of the character of a successful man, it is not always easy to discern exactly the traits which led to success. To produce the greatest results there must be a conservation of energy in men as well as in machines. The man whose efforts are not properly employed will waste his vitality and accomplish little. He must have a good mental valve gear, so to speak, to distribute his energy in order to produce the maximum effect. Probably there was no mental trait which was more marked in the character of our friend, whose loss we mourn, than that of what may be called right-mindedness. He seemed to know instinctively what was the right course to pursue under doubtful and perplexing circumstances.

American Locomotives for Brazil.

The Brooks Locomotive Works have received an order for 30 freight and 30 passenger locomotives for the Central Railroad of Brazil. Fifteen of the freight engines will have cylinders 21 ins. by 26 ins., and will be of the 12-wheel type. The boilers will be 72 ins. in diameter, and the engines will weigh about 170,000 lbs. The other 15 freight engines will be of the 12-wheel type also, but will have cylinders 16 ins. by 20 ins. Twenty five of the passenger engines will be of the suburban type, and have cylinders 18 ins. by 24 ins., copper fireboxes, and will have Pintsch gas applied to two headlights and lamp in cab. They will weigh about 166,000 lbs. The other five passenger engines will have cylinders 14 ins. by 20 ins., and will also be equipped with the Pintsch system of lighting. All but the heavier passenger engines will have Belpaire boilers. All will have copper fireboxes. All the wheels will have Krupp steel tires. It is said that the 18 in. by 24 in. suburban engines and the 21 in. by 26 in. 12-wheel freight engines will be the heaviest of their respective types ever built. Messrs. R. J. Gross, Vice-President of the Brooks Locomotive Works, and H. Tandy, Assistant Superintendent, have gone to Brazil to familiarize themselves with the conditions these engines will have to work under.

The Norfolk & Western Railroad shipped 208,000 tons of coal from Norfolk during May, the largest shipments in the history of the road.

Personal.

Mr. W. L. Tracy has been appointed Master Mechanic of the Georgia Pacific, vice W. H. Owens, resigned.

Mr. F. C Dodds, Chief Clerk of the Chicago, Peoria & St. Louis, has been appointed Purchasing Agent of that road.

Mr. E. A. Cheney has been appointed Purchasing Agent of the Buffalo & Susquehanna, in Pennsylvania, with office at Austin, Pa.

Mr. R. G. Mathews has been appointed General Superintendent of the Buffalo, Rochester & Pittsburgh, vice J. H. Barrett, resigned.

Mr. J. Van Dell has been appointed to succeed Mr. J. D. McIlwain as Superintendent of the Harvey Steel Car Works, at Harvey, Ill.

Mr. John Foulk has been appointed General Foreman of Rolling Stock of the Jacksonville, Louisville & St. Louis, with headquarters at Jacksonville, Ill.

Mr. O. J. Grammer has been appointed Assistant General Manager of the Chesapeake, Ohio & Southwestern. Mr. Epes Randolph, General Superintendent, has resigned.

Mr. J. D. McIlwain has left the service of the Harvey Steel Car and Repair Works to accept the position of Superintendent of the Union Car Company, at Depew, N. Y.

Mr. F. M. Stevens, late of the Baldwin Locomotive Works, has been appointed Master Mechanic of the Hoosac Tunnel & Wilmington Railroad, with headquarters at Reedsboro, Vt.

Mr. J. F. Sechler has been appointed Master Mechanic of the Elgin, Joliet & Eastern Railway, in charge of motive power and rolling stock, with headquarters at Joliet, Ill., vice T. Downing, resigned.

Mr. W. H. Owens, formerly Master Mechanic of the Georgia Pacific Railroad, has been appointed General Master Mechanic of the Richmond & Danville Railroad, with headquarters at Manchester, Va.

Mr. H. R. Nickerson has resigned the position of General Superintendent of the Atchison, Topeka & Santa Fe, and is succeeded by Mr. H. U. Mudge, who has been Superintendent of the lines west of Dodge City.

Mr. M. A. Kimmet, who has been in the service of the Central Railroad of New Jersey for a long tine, has been appointed Superintendent of the company's car works at Mauch Chunk, the appointment taking effect June 14.

Mr. William Rutherford has been appointed Superintendent of Motive Power and Equipment of the Plant system with headquarters at Savannah, Ga. He was until recently General Master Mechanic of the Jacksonville, Tampa & Key West.

Mr. A. Dolbeer, formerly Superintendent of Motive Power of the Buffalo, Rochester & Pittsburgh, and Master Mechanic of the Lehigh Valley in Buffalo when the road was operated by the Philadelphia & Reading, has been made General Foreman of the Florida Central & Peninsular shops at Tallahassee. Fla.

Mr. F. W. Sargent, who was formerly Engineer of Tests of the Chicago, Burlington & Quincy Railroad, and has since been General Agent of the Sargent Company, of Chicago, has been appointed Western Representative of the Ramapo Wheel & Foundry Company. Mr. Sargent will represent both companies conjointly.

Mr. Willard A. Smith, who was the efficient and popular Chief of the transportation department of the Columbian Exposition, was presented with a large and beautiful silver testimonial vase, June 5, by the American exhibitors at the Fair, as a token of their appreciation of his able management of the transportation department, and of the courteous treatment he accorded all.

Mr. J. H. Barrett, General Superintendent of the Buffalo, Rochester & Pittsburgh, has resigned, and is appointed General Superintendent of the Cleveland, Akron & Columbus and the Ohio Southern railroads, which, though operated separately, are controlled in the same interest. Mr. Barrett will be in charge of the operating department on both railroads.

Mr. C. W. Mead, formerly General Superintendent of the Missouri Pacific, died at Los Angeles, Cal., June 14. He retired from the general superintendency of the Missouri Pacific, Jan. 1, 1877, having held that position about a year, and was previously at different times General Manager of the Northern Pacific, Superintendent of the Hannibal & St. Joseph and Superintendent of the Missouri Pacific.

Mr. Joseph K. Bole, President of the American Steel Casting Company, and formerly a director of the Otis Iron and Steel Company, died suddenly of appoplexy, at Chester, Pa., June 8. Mr. Bole was 47 years old, and was widely known and warmly admired in railroad mechanical circles. A resolution was adopted by those in attendance at the Saratoga Mechanical Convention, June 17, expressive of regret and sympathy.

Major John C. Paul, President of the American Steel Wheel Company, died at Plainfield, N. J., from paralysis, on June 12. In 1881 Major Paul became Superintendent of the New York Division of the Woodruff Sleeping and Parlor Coach Company, then General Superintendent and General Manager in 1884. He was with the Pullman Car Company as Superintendent of Equipment, but resigned it in 1891 to become Vice-President of the American Steel Wheel Company, of which he soon became President. He was 53 years old, and leaves a widow and one son.

In our last issue we illustrated and described a 76-ton mogul locomotive built for the Delaware, Susquehanna & Schuylkill Railroad by the Baldwin Locomotive Works. This is the largest engine of this class ever built. In commenting on this feature our description said that the largest previous engine of this type known to us weighs 61 tons. Mr. Dixon, of the Rogers Locomotive Works, informs us, however, that those works have built mogul locomotives weighing 66 tons.

Master Car Builders' Convention.

(*Continued from page* 105.)

Report of Committee on Wheel Flanges and Gages.

9. *Over-all Gage* is the distance from outer edge of one wheel to outer edge of mate wheel.

In accordance with the above definitions, and taking M. C. B. standards already adopted we have the following dimensions:

Gage of track	4 feet 8¼	inches
Inside gage of flanges	4 " 5⅝	"
Gage of wheels	4 " 8¼	"
Thickness of flange	1⅜	"
Width of tread	4⅛	"
Check gage	4 " 6¾	"
Over-all gage	5 " 1⅜	"

Having now fixed definitely the points from which measurement should be taken and the principal dimensions as established by the M. C. B. standards, it remains to present and recommend such gages as will secure the closest practical adherence to these standards in new wheels, in mounting wheels, and in inspecting wheels at interchange points.

For this purpose your committee recommends a pair of flange gages, Fig. 21, such as Mr. Rhodes reccommends, for determining the maximum and minimum thickness of flanges for new wheels, and a combination gage for mounting and inspecting wheels in service. Fig. 22, which is essentially what the Pennsylvania R. R. Committee and Mr. Rhodes jointly recommend, but the dimensions are materially changed.

It will be seen by an inspection of Fig. 21 that the flange gages allow a variation of one-sixteenth of an inch above and below the standard thickness of flange, which is 1¾ inches.

Your committee is satisfied that this is a liberal allowance and that manufacturers of wheels can readily meet these requirements. In view of the tendency of wheels to impinge on frog points as the thickness of the flanges increases, or to strike guard-rails and split-switch rails if distance between flanges is reduced owing to thickness of same, it is exceedingly important to maintain close limits on flange thickness. It will be observed that these gages are all laid out with reference to the base line and dimensions as given in Fig. 20.

These dimensions vary from those given in the report of the P. R. R. Committee, partly because the base line from which all measurements were made by your committee differs from that taken by the P. R. R. Committee, and partly because the standard thickness of flange as established by the M. C. B. Association differs from that taken by the P. R. R. Committee. In view of the above discussion it is considered of the utmost importance to adhere closely to the M. C. B. standard flange, as a thicker flange is certainly detrimental to the life of wheels, rails and frogs.

Your committee would recommend as follows:

1. That for mounting wheels the check gage, Fig. 22, be used without delay.
2. That all wheels should be purchased subject to the limits of the flange gages, Fig. 21.
3. That the old system of gaging wheels be continued for wheels cast prior to some future date as established by the M. C. B. Association, and that for wheels cast after said date the check gage, Fig. 22, be used. Your committee do not favor an interchange gage measuring 4 ft. 7 in. instead of 4 ft. 6¾ in., being of the opinion that doing this would render the future of the 4 ft. 6¾ in. gage impossible.
4. That the present worn flange gage be continued.
5. That the guard-rail gage, which was abandoned at M. C. B. Association meeting of '93, be re-established as standard. This gage is shown in Fig. 23.
6. That the limits between flanges of 4 ft. 5 in. and 4 ft. 5¾ in. be reduced to come nearer to the standard of 4 ft. 5⅝ in.

In conclusion, your committee would say that 43 replies were received to its circular of inquiry. Of these replies all except five considered present gages satisfactory. The recommendations of the other five replies are practically embodied in your committee's report.

J. N. BARR, THOS. ANDERSON, THOS. FILDES, *Committee.*

Mr. Marshall: I move that the portion of the report which refers to standards be recommitted to the committee to put in shape for action and report at to-morrow's session; and the recommendation in regard to the rules of interchange be taken up in connection with the rules, when they are considered.

Mr. Rhodes: In seconding the motion, I would state that there was a meeting held last evening, at which a number of the members of the association were present, and the differences between some of the reports quoted—reports from the Western Railroad Club and reports presented by the Pennsylvania Railroad—have been reconciled, and I think if we recommit the matter, the committee will present something which will probably be acceptable to the whole convention, and there will not be the differences now apparent in the report.

Mr. Blackall: I see the committee has been figuring on making the distance from the throat of the frog one and three-quarter inches. The established practice is two inches in my part of the country. I think all through the east we have a two inch space.

Mr. Barr: Mr. Blackall speaks of the guard rail gage. My understanding is that any road can get the guard rails as far from the track as they please, but that they should not come inside of that distance—one inch and three-quarters from the main rail; if they do, they will spread our wheels.

The motion was carried, and in accordance with it the subject came up for further discussion on the following day. Mr. Barr, the chairman of the committee proceeded to give an extended description and illustration of the gages mentioned in the committee's report.

Mr. Bissell: What kind of an apparatus would you use to measure from the throat of the wheel to the center of the axle, so as to get the wheels on the proper distance?

Mr. Barr: There are several problems coming in there that your committee have not taken up. The mounting of the first wheel has got to be right, not so much as to the relation of the wheels, as the relation of the wheels to the track is concerned. If you push one wheel on too far, you will push the other one, and have the wheels over toward one rail all the time. It might be made a subject for proper investigation for the next meeting; especially the proper mounting of second hand wheels. I think Mr. Fildes' idea, of a pointer at the center of the axle and the center of the wheel, is the correct idea, to get the first wheel mounted properly.

Mr. Marshall: I move that the recommendation of the committee be submitted to letter ballot for adoption as a standard.

Mr. Wallis: As to mounting second-hand wheels, and

starting with the first point of the wheel, I think we considered that the over-all measurement—4 feet 8⅛ inches—is only intended, and will only be practiced, for new wheels. Second hand wheels will never meet those dimensions in the over-all gage. You can mount these wheels from the end of the axles, just allowing the difference that exists between the worn flange and a perfect flange; mount it that much further in. In mounting second-hand wheels you would not get the same distance between the backs as with new wheels. One will be pressed in half the distance that is worn off the flange. The fact of the 4 feet 6¾ inches is the important point. The distance from backs, and distance over all, will come right, so long as you keep the correct measurement from the back of one wheel to the throat of the other, and you can locate it in that way.

Mr. Marden: Would it not be right to measure it from the back of the flange? We are measuring it in one instance from the back of the flange to the throat of the wheel. Why would it not be right to measure from the back of the flange in both cases? That is our practice at the present time. We have a T square and we mount our first wheel from the back of the flange to the center of the axle, and we intend to have a standard flange.

Mr. Marshall: Investigations have shown that as the thickness of the flange is decreased, in order to obtain the best results, it is desirable to increase the distance between the backs, and therefore it is desirable to hold to that dimension of 4 feet 6¾ inches from the back of one flange to the face of the other. If you mount a wheel originally $1\frac{7}{8}$, if it has worn down to $1\frac{5}{16}$, you may as well mount it 4 feet 6¾ inches and put it in shape to avoid blows on guard rails. I amend my motion, that the secretary is authorized to confer with the chairman of the committee, and get the points in shape to submit to letter ballot.

Mr. Rhodes: One of the difficulties in the matter of wheel gages has been the two gages, 4 feet 9 inches and 4 feet 8⅛ inches. I believe the time is coming in this country when we will have a standard track on account of these irregularities in our gage, which have been hidden until this committee has got to work and brought out the defects, There is no greater safety appliances that can be produced than having a uniform gage of track. One thing is to mount the wheels in accordance with the recommendations of the committee; but you must also attend to the track. It can be accomplished by changing the guard rail, and having the 2 inch opening in the frog. The guard rails should be 1½ inches from the gauge rail, and if that is done with the 4 feet 9 inch track there will be a great difficulty removed. I walked down the track here at Saratoga the other day. I ran across one frog and guard rail. I don't know what the gage is, but I presume it is 4 feet 8⅛ inches. The guard rail was 2¼ inches from the gage rail. I do not cite that as being particularly pertinent to this neigborhood. Perhaps on the line I represent it could be found just as bad. Some investigations were made in Chicago recently, and in 72 measurements taken, the distance of guard rails from the gage rails were found to be from 1½ to 3¾ inches. We should have the co-operation of the American Railway Association in this matter.

Mr. Forney: About ten years ago I read a paper upon the subject when it was in a state of even greater confusion than it is now. The great trouble encountered is there is not the co-operation there should be between the car builders and the engineers who have charge of the permanent way. A perfect solution of the question would be possible with this co-operation. I agree with the suggestion that this matter should be brought to the attention of the American Railway association, so that the officials could call in both departments and confer together, and have some agreement with reference to the matter. We ought first to confer with the American Railway Association and then submit the matter to letter ballot. The great trouble often is in the formation of the head of the rail. On the Lehigh Valley the corner of the rail is on a ⅝ radius. A pair of wheels that would run quite snugly on the Lehigh Valley, with a radius of 2⅛, would have much more play on the New York Central, where it is $\frac{5}{16}$. The corner of the rail should be of a standard size as well as the edge of the wheel.

Mr. Barr: I think if we wait until we do the things suggested by Mr. Forney, we may never accomplish anything. We have had to go ahead and do things in a bullheaded way, and we have accomplished them in that manner.

Mr. Forney: The jurisdiction of this society extends only to the wheel; it has no authority over the rail. I think it would be proper to go to this association and tell the difficulty and state what is wanted, and secure the co-operation of the permanent way department.

Mr. Bissell: We have got all our calculations ready, and the only way for us to get any immediate relief is to act on the conditions as they are to-day.

The motion to refer the matter to letter ballot was carried.

Mr. Rhodes: I move that a committtee of three be appointed to confer at once with the American Railway Association on the subjects of standards for wheel and track gages. I think this committee ought to get into communication with the American Railway Association before the managers of the roads sanction the letter ballot on our recommendations here. Carried.

Mr. Marshall: The Pennsylvania Railroad Company is not prepared to favor the continuance of 1½-inch guard rail throat. While it relieves the wheels from inpingement on the frog opening, it gives us more blows on the guard rails.

Mr. Rhodes: As to the matter of the guard rail, take the four foot nine track first, for instance; the distance from the gage rail to guard rail is 2 inches; between the guard rail and wing of frog, 4 feet 5 inches; the throat is 2 inches, that makes 4 feet 9 inches; in the other case the distance between the gage rail and guard rail is 1⅝ inches; between the guard rail and wing of frog, 4 feet 5 inches, and throat distance 2 inches, which makes 4 feet 8⅛ inches.

The President appointed Messrs. Barr, Rhodes and Marshall the committee to confer with the American Railway Association.

Amendments to the Rules of Interchange.

A number of changes were proposed in the rules of interchange by the different railway clubs. Some of these were approved by the Arbitration Committee and adopted, and the Arbitration Committee proposed some changes which were adopted. The convention appeared to be in a better temper to discuss and adopt changes than last year.

Rule 3.

Mr. Mitchell: I move that the secretary request all the wheel manufacturers to put the month and year on all wheels cast after Sept. 1, 1894, and that the flanges must conform to the new rule; that the size of the letter should be at least 1¼ ins., and should be put on the inside plate. Carried.

Mr. Barr moved the insertion, after section d, the following:

Thick Flanges.—Flanges over $1\frac{7}{8}$ inches thick. The same as maximum gage shown by Wheel Gage Committee. This does not apply to wheels cast prior to September 1, 1894. Carried.

Section (r). The Western Railway Club suggested that this section be changed to read "out of gage, or wheels that measure less than 4 feet 5⅛ inches, or more than 4 feet 5⅝ inches between flanges, or less than 5 feet 4 inches over treads." Adopted.

The recommendations of the Central Railway Club that paragraph 17 be made to read, "If the car has air brakes the cylinder and triple valve must have been cleaned and oiled within twelve months, and the date of the last cleaning and oiling marked on the brake cylinder," was, on motion of Mr. Waitt, adopted; and paragraph 18 was superseded by the foregoing.

The suggestion of the committee that a paragraph, No. 24, should be added, was adopted as follows: "If the car has airbrake pipes, but no air brakes, the hose and couplings on the car are at the owner's risk, unless the car is stenciled that it is so equipped."

Section (t) was, on motion of Mr. Soule, changed to read: "Steps, ladders, hand-holds and running boards in bad order or insecurely fastened. Steps must be fastened by bolts or lag screws. Hand-holds must be of wrought iron or steel."

Section (u). The Central Railway club recommended the addition of two figures, Nos. 8 and 9 here shown, between Sections (g) and (h), and that the present Fig. 8 be numbered Fig. 10; these figures to show the limit of cracks admissible in fillet of shank of coupler immediately back of the head as in Fig. 8, said limit to be ¾ inch vertically or horizontally, or both. Also a limit for length of crack in front walls or face of coupler either at top or bottom, as shown in Fig. 9, it being understood that the crack shown in this figure should not extend back into the main body or horizontal walls of the coupler. The Arbitration Committee considered that this might be a useful addition to the rules.

In reference to the proposed change in Section U there was considerable discussion. Mr. Casanave considered the defects shown in the figures as being in a dangerous part of the coupler, but the majority of those present believed that one or two cracks back of the head, as in Fig. 8, were not dangerous if less than ¾ of an inch in extent. The matter

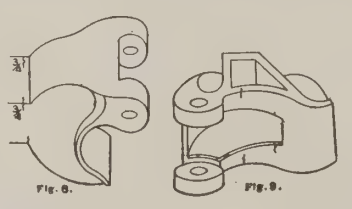


Fig. 8. Fig. 9.

had been watched closely by some of the members, and no cases of breakage on the road had resulted from such cracked bars. Mr. Peck said, "They never pull out in service, but are knocked off in the switch yards," and this seemed to be the general experience. Mr. West moved that the recommendation be adopted, and it was carried, on the understanding that the cut, Fig. 8, should be so changed as to show the two cracks on the upper side of the shank behind the lug.

Section H, Rule 3, the words "These defects in knuckles are safe, but should be carded for" were stricken out. In reference to the recommendation of the New York Railroad Club that the words "indelible pencils" be stricken out, a motion by Mr. Barr was made and carried that the words "indelible black pencil" be inserted instead of simply "indelible pencils."

Rule 6.

On the suggestion of the Central Railway Club, the Arbitration Committee presented the following addition to Rule 6:

Any company finding a car with defect card attached may make such partial repairs as may be necessary for the safe running of the car. It shall strike the items repaired from the card by drawing two lines in ink through such items on both sides of the card, and replace the card upon the car. It shall notify the company which issued the original card of the items repaired, and the latter company shall issue a defect card covering the partial repairs made, that card to be used as a voucher, and to accompany the bill for such partial repairs.

On motion, this recommendation was adopted and added to Rule 6.

Rule 8.

Section B was altered to read as follows: "Brakeshoes worn out, no charge to be made for labor of renewing, or credit allowed for scrap."

Section C was made to read as follows: "Journal bearings requiring renewal," etc., the two last words being substituted for "worn out."

The recommendation of the Arbitration Committee that Section A should be made to read as follows, "truck transoms, body bolsters, spring planks or truck springs, broken or lost, or such broken or cracked, providing that the car was not derailed or wrecked," was, on motion of Mr. Waitt, duly adopted.

The Western Railway Club suggested that a new Section (F) should be added to read as follows: "Oil box lids lost off when not caused by wreck or breakage due to rough usage."

On motion Section F was adopted, as read.

Mr. Marden moved to add a Section (G) to read as follows: "Brakebeams, levers and attachments less than 2½ inches from the rail." Carried.

Mr. Crone moved to add a new section (H) to read as follows: "Center plate bolts broken or missing." Carried.

Mr. Barr moved that a new section be added to this rule reading "drawbars or couplers, drawbar timbers, drawbar springs and sills cracked over transoms." The motion excited a good deal of discussion.

Mr. Marden said: I have believed in this thing for ten years. Some six or eight years ago I advanced that opinion in the convention, stating that I believed that repairs should be chargeable to the owners of the car, and if necessary an increased mileage should be charged. I believe it is a move in the right direction; and I think sooner or later we will come to having nearly all repairs charged to the owners of the cars. It will facilitate the movement of the cars. I have demonstrated that in quite a number of cases at our interchange points, wherever I have made arrangements with connecting roads.

Mr. Waitt said: The idea is to facilitate the movement of the cars. The inspectors would not stop to question, when they saw a defect of that kind coming, as to whether the road was going to get stuck. They would let it go, and we would get a greater return out of the cars. I think every move we can make, in the line of facilitating the movement of cars, ought to be done and carried out by the convention.

Suggestions were made from different members, and the motion as finally put read: "Broken or defective draft timbers or draft springs, or center plates, or sills cracked over transoms, if damage is not caused by derailment or wreck."

The vote on the amendment was taken according to the number of cars represented, and resulted in yeas 386, and nays 465. Therefore the motion was lost.

This concluded the business for the day. Mr. Blackall announced that the Delaware & Hudson Canal Company had arranged for an excursion on Saturday. Discussion of the rules of interchange was resumed next morning.

Rule 9.

Section (k) of rule 9 was made to read, "One or more cracked brackets."

Mr. Mitchell: I move that we omit the entire last paragraph of rule 9, reading, "When axles are removed, the axle applied shall be stamped or prick punched near the center with the initial of the road doing the work and the date of renewal," for the reason that I cannot see any use of it; if we slide wheels, we will put in axles anyway, and we ought not to be required to prick punch or to make any report of them. Again, we are shipping axles all the time to interchange points, where we are obliged to put in axles. We have no means of prick punching or stenciling, and it is only once in a while that we have to investigate the case of an axle supplied.

A motion, to the effect that axles under 30,000 pounds capacity cars should have the wheel seat 4¼ inches and the center 3⅛ inches, prevailed.

The amendment proposed to Rule 12 by the Central Railway Club was read as follows: "That in case owners remove axle on account of defective wheels, the road responsible for damaging wheels shall not be charged for any difference in value between axle used and that removed." Carried.

Rule 16.

The recommendation of the New York Railroad Club to amend this rule, by adding "Cars should be marked M. C. B. pocket or stem drawbars, as the case may be," was adopted.

The Arbitration Committee expressed the opinion that the last paragraph of this rule ought to be made clearer, and it suggested that when wrong attachments are used with M. C. B. equipment, the card should be for the wrong drawbar with attachments, because the wrong drawbar on the car with the wrong attachments may not be useful to the owning road.

Rule 17.

Mr. Grieves: I move to amend Rule 17, "Wheels applied must be marked on the inside with the date, the initials of the road doing the work and the place where the work is done." I move to omit the words "and the place where the work is done." I think this rule has not been lived up to, and no notice was taken of the rule until a few months ago. All wheels used have either the maker's name or the road's initials, and many of them have numbers. I think it is putting us to an unnecessary amount of work.

Mr. Wade: I move to strike out the date of the work. It is unnecessary, and it takes a large quantity of stencils, which are scattered all through the country. It is easy enough to mark the name of the road, but to stencil the date is considerable difficulty. I move to amend it by striking out the date, so that it will read: "Wheels applied must be marked on the inside with the initials of the road doing the work." This amendment was accepted and the motion, as amended, was carried.

Rule 23.

Mr. Wade: After the words "When cars of 60,000 pounds capacity and over" I would like to add the words "and so stenciled." There is advantage being taken of that section without much regard to the capacity of the car. A great many old cars of 60,000 pounds capacity are running around the country with journals 4, 4½ and 5 inches long, and sometimes these cars are billed with $25 additional. If you will add to that "The cars must be 60,000 pounds capacity, and as stenciled," I think it will correct that trouble.

A motion to amend the rule as suggested prevailed.

Rule 26.

The suggestion of the Central Railway Club, that an additional charge of five hours labor should be allowed in replacing intermediate and center sills on cars equipped with air brakes was adopted.

Mr. Marshall: There were several points brought up yesterday, which were carried over, with a view of having them incorporated in Rule 26. One was a motion of Mr. Mackenzie in regard to the weights of journal bearings, and also some question about an arbitrary credit for couplers. I suggest that these prices be referred to a committee to revise that list of prices, and incorporate the arbitrary scrap credit for couplers and the prices for journal bearings; the committee to report at to-morrow's session. It is intended to incorporate the two sizes of journal bearings and the arbitrary credit for M. C. B. couplers.

The motion was carried and the president appointed the following committee on revision of prices, in accordance with the motion: R. E. Marshall, J. H. McConnell, George W. West.

This committee, in reporting the next day, expressed the opinion that no change should be made in the present prices, except as follows: It recommended adding to the list the following: One M. C. B. standard journal bearing for 3¾ by 7-inch box to weigh 10 pounds. One box or stock car, half side door, applied, $3.

It also recommended removing from the list the prices for M. C. B. couplers and attachments and inserting immediately under the list a new paragraph to read:

"M. C. B. couplers or parts of same to be charged at current market prices which are to be quoted by the Secretary semi-annually. Credits to be allowed at scrap rates as given in above list."

These recommendations were adopted.

Rule 31.

The Arbitration Committee, at the suggestion of the Executive Committee, recommended that this rule be changed so as to read as follows: "In the revision of these rules by the association, a two-thirds vote shall be necessary for adoption.' On motion of Mr. Casanave the recommendation of the committee was adopted.

The Secretary gave notice that at the next annual meeting the following amendment to the Constitution would be offered for adoption: "Representative members shall have one vote on all questions, and in addition thereto shall, on all measures pertaining to the revision of the rules of interchange, and to the adoption of the standards, or to the expenditure of money," etc., changing article III, section 3.

After finishing the discussion on proposed amendments to the rules of interchange Mr. Soule read the preliminary report of the committee on road tests of brakeshoes.

Road Tests of Brakeshoes.

The report of the executive committee of the general committee of twelve appointed on this subject at the last convention simply stated that the work was progressing and requested that the committee be continued for another year. Five of the roads represented by the members of the general committee (the P. R. R.; N. Y. C. & H. R.; Northern Pacific; Chicago & Alton, and the C. R. R. of N. J.) declined to participate in the tests. The roads represented by the other seven members of the committee (the C., B. & Q; C., B. & N.; L. S. & M. S.; N. Y., L. E. & W.; Fitchburg; C. & O.; and

the Norfolk & Western) are now conducting a series of service tests. These tests had not advanced sufficiently far to enable a report to be made to this convention. The kind and number of shoes used in these tests are as follows: Hard cast iron 48, soft open hearth steel 52, hard open hearth steel 52, malleable iron 48, S. T. malleable iron 44, S. W. malleable iron 44, Congdon 48, Sargeant special 44, Meehan 48, Lappin 48, Safety 44, soft steel 48, wrought iron 48, and enough of soft cast iron shoes to wear out all the others.

The seven roads last named are making tests on the following number of passenger cars: Fitchburg 26, C., B. & N. 18, C., B. & Q. 26, C. & O. 6, L. S. & M. S. 26, N. Y., L. E. & W. 26, N. & W. 13.

The number of shoes used on cast iron and steel tired wheels, respectively, in both freight and passenger service is about equally divided.

Mr. Rhodes suggested that as some of these tests are very nearly completed, the report should be published as soon as the figures are gathered. Mr. Soule said that the tests would probably be terminated within three months, and that it would require about a month to tabulate the results. The committee had contemplated taken measurements to determine the wear of wheels as affected by different brakeshoes, but the scheme was abandoned because impracticable. The tests are simply of the wearing quality of 13 different mixtures as against soft cast iron. The cast iron shoes are made of new metal, no scrap being used.

The preliminary report of the Committee on Laboratory Tests of Brakeshoes was read by Mr. Bush, the chairman of the committee.

Laboratory Tests of Brakeshoes.

This report was of a preliminary character and was devoted to outlining previous tests of this character and the earliest tests to determine the laws of friction. The tests of Morin, Poiree, Dalton, and the shop tests conducted on the Chicago, Burlington & Quincy Railroad in 1893 were described. Continuing the report said:

With the information briefly outlined, the first work undertaken by the Laboratory Committee was commenced in August, 1893, and consisted in planning all the conditions that should be covered, information that should be obtained and the apparatus that it was necessary to have in order to obtain it. Of course, the conditions of service were to be followed as closely as possible, and it was decided that the apparatus necessary would have to be similar in effect to the conditions surrounding one wheel of a freight car, passenger car, sleeping car or a locomotive, so that the energy to be destroyed by means of friction applied to the periphery of the wheel might be accomplished in a similar manner. This involves:

First.—Machinery in which the energy may be stored.

Second.—Proper facilities for generating the energy.

It was decided that a fly-wheel of the proper proportions, capable of being run to any desired speed up to the equivalent of 100 miles per hour, and having attached directly to its shaft the wheel against which the different brakeshoes would be applied, should comprise the first part of the apparatus. An independent motor, either steam or electric, was found necessary for the second part, and a modern type of high speed steam engine was finally deemed best.

At this stage the Westinghouse Air Brake Company volunteered to have the experiments conducted at their shops at Wilmerding, Pa., and to furnish the services of their mechanical engineer, Mr. Arthur Johnson, to assist in conducting them, as well as to assume the work of putting up the apparatus and supplying the motive power for operating it. In view of the advantages offered, the convenience of location, and the fact that the Purdue University could hardly furnish the necessary facilities, it was decided to accept the proposition of the Westinghouse Air Brake Company, and arrangements were made accordingly.

The question of indicating, measuring and recording apparatus was then considered, and it was finally decided that the apparatus for these purposes should be so complete and accurate as to make the results unquestionable, and that human agency should be eliminated as far as possible by making the apparatus automatic and self-recording. The dynamometer for measuring the friction, decided upon, is that designed by Professor Emory, which has for its principles the elastic resistance of steel plates as fulcra, and which eliminates all friction, and is acknowledged as the best for all measurements of this kind. Permission to construct and use this dynamometer was obtained from Professor Emory, through Mr. Vogt, Mechanical Engineer of the Pennsylvania Railroad, who, with the latter and Wm. Sellers & Co., of Philadelphia, kindly undertook its design. It was constructed by Wm. Sellers & Co., and the sum of $1,360 was paid for it by the Westinghouse Air Brake Company.

To accurately determine the speed of the apparatus at all times it was decided to use the Boyer railway speed recorder, and the Boyer company kindly consented to furnish two recorders specially adapted to the purpose, free of charge.

In order that the speed of the machine and the friction of the brakeshoes might be conveniently and accurately recorded, it was decided to have the records taken graphically. A chronograph was therefore obtained, designed and constructed by Warner & Swasey, of Cleveland, O. Its function is to move a drum carrying with it a record paper at a practically constant velocity, so that all variations of speed and friction, and the relation of one with the other, may be shown in the case of each material tested for any length of time desired. It has for its principle a conical pendulum operated by a weight, and is the same as that used at all of the principal observatories in the world for operating telescopes in connection with the work of astronomers, it having been found to be the most reliable known to science. This device was also furnished by the Westinghouse Air Brake Company at a cost of about $560.

A thermometer for measuring the temperatures of brakeshoes and wheels has been obtained from the Crosby Steam Gauge Company, and scales sufficiently sensitive for weighing down to grains and having a capacity of 30 pounds have been obtained from Henry Troemner, of Philadelphia, both being furnished gratuitously. The chilled wheels to be used in the experiments were donated by Bass & Co., of Fort Wayne, and the steel-tired wheels by the Paige Car Wheel Company, of Cleveland. The fly-wheel, shaft, levers, etc., were made at the shops of the P. C. C. & St. L. R'y Co., the cost of which is to be borne by the association, besides the personal expenses of a draftsman, whose services were furnished gratuitously by the Pennsylvania Railroad Company.

The report contains an illustration and detailed description of the apparatus. The above outlines the work of the committee so far accomplished. Experiments will begin at once, and the committee expects to obtain much new information.

The committee acknowledges having received valuable assistance from Mr. A. S. Vogt, Mechanical Engineer of the Pennsylvania Railroad; Professor Emory; Mr. Bancroft, of Wm. Sellers & Co.; the Westinghouse Air Brake Company; the Pennsylvania Railroad Company; the Crosby Steam Gauge Company; Bass & Co.; the Paige Car Wheel Company; the Boyer Speed Recorder Company; Henry Troemner and Mr. F. W. Sargent, formerly Engineer of Tests of the C., B. & Q. R. R., which is appreciated very highly.

The brakeshoes obtained from the following parties were furnished without charge: The Solid Steel Company, Alliance, Ohio; the Dayton Malleable Company, Dayton, Ohio; Schoen Brake Shoe Company, Philadelphia, Pa.; the Sargent Company, Chicago, Ill.; Safety Brake Shoe Company, Boston, Mass.; Ramapo Wheel & Foundry Company, Ramapo, N. Y.; the Lappin Brake Shoe Company, 18 Broadway, N. Y.

S. P. BUSH, D. L. BARNES, JNO. W. CLOUD, *Committee.*

The committee requested to be continued for another year, and extended a cordial invitation to those interested to witness the tests at any time. Information in regard to time of tests will be furnished on application.

On motion of Mr. Barr, the report was received and the committee continued.

The secretary read a communication addressed by Mr. Bush, Chairman of the Committee on Laboratory Tests of Brakeshoes, to the chairman of the executive committee in reference to the bill incurred in arranging appliances for the tests, and submitting an itemized account of expenses so far incurred. In a report of the executive committee, the latter was referred to the association with a statement to the effect that the committee proposed to pay the bills unless otherwise directed.

On motion of Mr. Barr the association authorized the executive committee to pay the bills, amounting in the aggregate to $1,154.83, deducting the amount, $500.00, previously appropriated.

Mr. Hennessey, chairman of the Committee on Freight Car Trucks, read the following report:

Freight Car Trucks.

Your committee, appointed to report on the advisability of adopting standard sizes and shapes for arch bars and channel transoms for diamond trucks, and to recommend sizes and shapes if desirable, and to ascertain the results obtained from trucks of various designs, with special reference to newer forms of trucks, respectfully submits the following. With a desire to obtain all the information possible from the association, the committee issued a circular letter to all the members, which was answered by 46 members, as follows:

1. Do you consider it advisable to adopt standard size and shape of arch bars and channel transoms for diamond trucks for cars of 60,000 pounds capacity? Forty-one replies, 35 "yes" and 6 "no."

2. If so (referring to question No. 1), what would you recommend for length of wheel base? Thirty-seven answers, ranging from 4 feet 6 inches to 6 feet.

3. What dimensions would you recommend for arch bars? Thirty-six replies, recommending from 1 by 4 inches to 1⅛ by 4 inches for the top and ⅞ by 4 inches to 1¼ by 4 inches for the bottom.

4. What do you recommend for rise or set of top arch bar? Thirty-two replies, recommending from 4 inches to 9¼ inches.

5. What would you recommend for depth or set of bottom arch bar? Thirty-two answers, ranging from 6 inches to 13¾ inches.

6. What size of column bolts would you recommend and how many to each side of truck? Thirty-five answers, recommending from 1 inch, four to each side, to 1⅜ inch, four to each side, and from 1⅛ inch, two to each side, to 1⅜ inch, two to each side.

7. What size of journal box bolts would you recommend? Thirty-nine answers recommending from ¾ inch to 1⅛ inch.

8. Give dimensions of channel transoms which you recommend. Twenty-eight replies, 14 of which would not recommend using them, and in the balance of the answers there was practically no uniformity of opinion as to dimension.

9. Is there, in your opinion, any advantage in the use of swing bolster over the rigid truck as to flange wear, roadway or load carried in car? Forty-four answers, 12 "yes," 23 "no," 6 undecided, and 3 little or no difference.

10. Would you prefer to adopt swing bolster truck for freight car, provided it did not increase cost of construction and maintenance over that of a rigid truck? Forty-two replies, 14 "yes," 27 "no," 1 "yes, for rough roads only."

11. What style of truck do you consider the most practical and economical to maintain? Forty replies, as follows: 28 diamond rigid, 5 swing motion, 5 Fox pressed steel, 1 Schafer American, one rigid center with equalizers or independent swings over the boxes.

12. Do you prefer brakes attached to trucks or car body? Forty-three replies: 15 preferred brakes attached to the car body and 28 to the trucks.

13. If to trucks, is it advisable to hang the brakes below the truck springs? Twenty-three answers: 16 "yes," 6 "no," and 1 "if for rigid truck hang below the spring plank, and if for swing motion truck hang above the spring plank."

14. How many cars have you with trucks constructed exclusively of iron and steel? If any, what make? Twelve replies, showing that nine roads, or 1,544 cars, have the Fox pressed steel trucks, one road has 4 cars with the Drexel truck, one road has 4,000 cars with the Theidson and American truck, one road has 8 cars (kind of trucks not given).

15. What has been your experience with such trucks? Eleven answers, showing that the roads using the "Fox" pressed steel trucks make a generally favorable report. One road having about 1,100 cars with the "Drexel" truck, have obtained very satisfactory results. The road using the "American" cast steel bolster truck make a favorable report on same (number of cars not given).

16. How many cars have you with new design of trucks? If any, what make? Seventeen replies; nine roads, or 1,544 cars, using the "Fox" pressed steel trucks, one road with about 1,100 cars with the "Drexel" truck; the other answers show that they have trucks very similar in design to the "Diamond" rigid, which has been in service for years.

17. How many cars have you with metal truck bolsters? Twelve replies, showing that nine roads, or 1,544 cars, have the "Fox" pressed steel trucks, one road four cars with the "Drexel" trucks, one road eight cars with the Schafer American, and one road 2,755 cars with the Norfolk & Western Class "T. C." truck.

18. What has been your experience with metal truck bolsters? Six answers, four saying they were good if properly constructed, one that they were too expensive to replace on account of the faulty construction of the combination of truck and bolster, and one that they settled with loads and not springing back when load is removed, requiring the shimming of the center plates.

19. What has been your experience with later designs of wood trucks for 60,000-pound capacity cars? Nineteen replies; eleven satisfactory, five unsatisfactory, two give fair service, but shrink and get loose, and one that they are not of sufficient strength.

While there were blueprints of several new designs of trucks forwarded to the committee, there were but three styles of trucks which radically changed from the old style diamond truck which is in general use, the "Drexel" truck being one of these, which is constructed very similar to the rigid truck, but at the same time has roller bearings to receive lateral shocks, which practically makes it a swing motion truck, and it has not the dangerous swing hanger and swing plank which are liable to break and allow the spring plank and truck bolster to drop on track and cause derailments.

It is the opinion of the committee that the American cast steel bolster truck has some practical features, as it does away with many pieces, and in the opinion of the committee it would be advisable to have the association pay particular attention to the above mentioned three designs of trucks in service, so that in the near future they could give some very valuable information to the association. A large majority of replies received were in favor of a 5-foot wheel base.

The committee begs to make the following recommendations: It would recommend a 5-foot wheel base. After the wheel base is once established it will enable us to use standard fulcrums for brakebeams for airbrakes, and standard bottom rods. The committee further recommends that standard sizes of arch bars be, top 1¼ by 4 inches, bottom 1 by 4 inches, and tie bar ⅝ by 4 inches. It considers it useless to recommend special designs for arch bars, as it would not be approved by the association, as there seems to be no uniformity in this particular. For the same reason it did not consider it advisable to make recommendations for standard channel transoms.

J. J. HENNESSEY, SAMUEL IRVIN, WILLIAM VOSS, JOHN H. DAVIS, F. H. STARK, *Committee.*

Mr. Waitt: I move that the report be received, and the recommendations submitted to letter ballot as recommended practice in connection with the diamond trucks.

Mr. Mitchell: I make an amendment, that we change the base to 5 feet 2 inches, for the reason that with a 5-foot wheel base it is almost impossible to get the inside hung brake-beam under the car. When the Fox truck was first introduced in this country, the wheel base was 5 feet, and I tried at that time to get an inside hung beam on that truck. I found it impossible to have the beam any height from the track. The Fox truck people changed the wheel base to 5 feet 3 inches, and all their designs and dies are on that basis, and subsequently all of Fox's trucks—and there are over 9,500 running in this country—are 5 feet 2 inches. Out of over 40,000 cars, I presume eight-tenths of our cars are 5 feet 2 inches. We would get better service results with 5 feet 3 inches.

Mr. West: I would indorse Mr. Mitchell's views. We have some Fox pressed steel trucks running very satisfactorily. It has been shown by the committee that there is no standard, and I think we should work toward a standard, certainly so far as the wheel base is concerned.

Mr. Hennessey: I have looked into that thoroughly, and a large majority of the replies were in favor of 5 foot wheel base. I watched to see how many of these people recommended a 5-foot wheel base, that were using inside hung brakes, and I think there were few exceptions that recommended anything larger.

Mr. Mitchell: With 5 foot 2 inch wheel base, with the diamond truck, we have only ¾ of an inch clearance between the back of the brakebeam and spring plank; 12 inch wide, channel iron spring plank.

The amendment was adopted. Mr. Waitt's motion was carried.

Report of the Committee on Correspondence and Resolutions.

Your Committee on Resolutions and Correspondence beg leave to make the following report:

On account of the conveniences and courtesies extended, we recommend the adoption of the following resolution:

Resolved, That the thanks of the Master Car Builders' Association be extended to the Delaware & Hudson Company, the Fitchburg Railroad Company, the People's Line steamers, the New York Central and other lines; the entertainment committee, the "Railway Age and Northwestern Railroader"; the village of Saratoga and the management of Congress Hall.

And the committee especially desire a vote of thanks by the association to Mr. R. C. Blackall, Superintendent of Machinery, the Delaware & Hudson Canal Company, and Mr. J. W. Marden, Superintendent of Car Department, Fitchburg Railroad, for their untiring efforts in providing for the comfort and entertainment of the members of this association.

JOHN MACKENZIE, H. C. MCCARTHY, E. D. BRONNER, Committee.

The recommendations of the committee were unanimously adopted by a rising vote.

The Committee on Subjects reported that it would name the subjects for consideration at a later date, and that it intended issuing a circular asking members to name new subjects.

The list of officers reported by the Nominating Committee was read.

Mr. Waitt moved that the Secretary cast the ballot of the Association for the persons nominated. Carried.

The Secretary cast the ballot, and the President declared the following gentlemen elected:

President—J. S. Lentz.

Vice-President—S. A. Crone.

Second Vice-President—E. D. Bronner.

Third Vice-President—J. C. Barber.

Treasurer—George W. Demarest.

Member of Executive Committee, to fill unexpired term of J. C. Barber—Samuel Irwin.

Three members of the Executive Committee—J. T. Chamberlain, G. W. Rhodes, Pulaski Leeds.

The following places were named as desirable for the next place of meeting: Atlanta, Old Point Comfort, Montreal, Waukesha Springs, Saratoga, Colorado Springs, Denver, Omaha and Salt Lake City.

A rising vote of thanks was given to the retiring officers, and the convention adjourned.

The Parent of Knowledge.

An examiner once said to the young man in the philosophy class: "Sir William Hamilton makes the remark that wonder is the mother of knowledge. Now, sir, speaking on your own account, what should you consider as the mother of wonder?" The youth paused, and then replied, "Ignorance, sir, I suppose." "Very good," said the professor; "and that being so what relation is ignorance of knowledge?" The poor boy was perturbed by the audacity of his own reply as he mildly answered, "Grandmother, sir." "Quite right, sir," said the examiner, who was an Irishman. "You have caught the right end of the philosophical stick. And let this be a lesson to you for the rest of your life, so that you may know how to take off your hat to all ignorance, which is the aged relative—though the essential one—of all knowledge."

The Master Mechanics' Convention.

The Twenty-seventh Annual Convention of the American Railway Master Mechanics' Association met at Saratoga, June 18. Hon. Chauncey M. Depew was expected to address the Convention, but was prevented by sickness from attending. When President John Hickey arose to address the convention he was greeted with applause that showed the high esteem and warm regard in which he is held by the members of the association. In the address which he delivered he said that while all are agreed that strict economy is necessary, yet there is difference of opinion as to what is the best practice, and that such discussions as are held at the conventions are the surest means of arriving at the best practice. Referring to the cost of operating locomotives, he said the chief items are the cost of fuel and of wages paid enginemen, and the cost of repairs, being of relative importance in the order named, and that these constitute about 30 per cent. of the total operating expenses of a large railroad. As fuel is the chief item of expense, the greatest attention has been bestowed on means for economizing in its use, but not enough has been accomplished, and "we must seek channels of greater efficiency than any yet reached, toward a reduction in the expense of generating locomotive power and energy." He spoke favorably of compound locomotives, and gave an instance of 18 per cent. fuel economy being effected by a compound engine in freight service. The period of trial extended over three years, and the comparison was made with a number of simple engines in the same service and of the same weight and capacity. The cost of repairs in this case was a fraction greater for the compound, but "it was a matter of insignificance as compared with her saving in fuel." In view of these facts the President recommended the trial of compound locomotives by those contemplating it, but advised care in the selection "of the best type and the adoption of the most improved construction of the vital parts." He said that while the chief efforts of the association had been toward improving the design and increasing the efficiency of locomotives, yet the importance of improved facilities for repairs is very great, as with these the shopping period is lessened, permitting greater mileage per engine, lessening the cost per mile for repairs and enabling the traffic to be handled with fewer locomotives.

Continuing, Mr. Hickey said:

In our zeal toward carrying out the policy of economy we may be led to press too heavily on the established price of material, and while efforts in this direction may be entirely proper they should never go so far as to cause a reduction in the grade or quality of the articles or the material in question. When the quality of enduring features of an article are in any way reduced to meet the apparent necessities of reduced price, then economy ceases and the opposite promptly takes place. There is not a point connected with our official duties more worthy of continued remembrance than the dual facts that the highest standard of quality in material entering construction or repairs of rolling stock should be maintained, and that the first cost is insignificant when compared with the cost of maintenance and replacements.

Referring to the general tendency of combining efforts to get far-reaching results, the address suggested the amalgamation of the Master Car Builders' and Master Mechanics' associations. It expressed the belief that this would save much routine work, and that the work of the conventions would then be accomplished within five consecutive days, thus enabling all interested to attend the sessions. It was suggested also that the union would result in increased membership, and that this would enhance the influence and efficiency of the work done. The need of better testing conveniences than the association possessed was expatiated on, and it was recommended that the association should make arrangements with some institution of learning which is supplied, or with the help of the association could be supplied, with the necessary testing conveniences.

Roll Call.

The following members were present during the sessions of the convention:

Aldcorn, Thos., New Durham, N. J.
Allen, G. S., Phil. & Read., Tamaqua, Pa.
Ames, L., Beech Creek, Jersey Shore, Pa.
Antz, Oscar, L. S. & M. S., Cleveland, O.
Anderson, J. J., Cent. R. R. Ga., Savannah, Ga.
Bradley, W. F., Tol., Ann Arbor & N. Mich., Ann Arbor, Mich.
Brown, F. R. F., Int., Moncton, N. B.
Brown, W. A., Abl. & Danville, Portsmouth, Va.
Bryant, J. T., Rich., Fred. & Pot., Richmond, Va.
Barnett, J. Davis, Gr. Trunk, Stratford, Ont.
Barnes, Chas.
Beltz, A. J., Del., Susq. & Schuy., Drifton, Pa.
Benson, A. E., Ulst. & Del., Rondout, N. Y.
Bissett, John, W., W., C. & A., Wilmington, N. C.
Blackall, R. C., Del. & H. C. Co., Albany, N. Y.
Boon, J. M., West Shore, Frankfort, N. Y.
Briggs, R. H., K., M., C. & B., Memphis, Tenn.
Brooke, Geo. D., St. P. & Dul., St. Paul, Minn.
Brown, David, Del., Lack. & West., Scranton, Pa.
Bushnell, R. W., Bur., C., R. & North., Cedar Rapids, Ia.
Butcher, George W., Tex. & N. O., Houston, Tex.
Butler, L. M., N. Y. P. & B., Providence, R. I.
Carey, John L., D. & H. Canal, Green Island, N. Y.
Campbell, John D., New York, N. Y.
Chamberlin, E., Rood & Brown, Lancaster, N. Y.
Clark, David, Lehigh Valley, Hazelton, Pa.
Clifford, C. J., Chic. & B. Island, South Chicago, Ill.
Cullen, James, N. C. & St. L., Nashville, Tenn.
Campbell, John, Lehigh Valley, Delano, Pa.
Casey, J. J., Ill. Cent., Vicksburg, Miss
Chambers, John, S., Ill. Cent., Amboy, Ill.
Childs, H. A., N. Y., L. E. & W., Jersey City, N. J.
Cleaver, F. C., Vandalia, Terre Haute, Ind.
Collinson, James, A. T. & S. F., Fort Madison, Ia.
Connolly, J. J., D. S. S. & A., Marquette, Mich.
Cooper, Charles G., Tol., Col., & Cincinnati, Kenton, O.
Cooper, H. A., N. Y., L. E. & W., Hornellsville, N. Y.
Cook, John S., Georgia, Augusta, Ga.
Cooke, Allan, Ch. & E. Ill., Danville, Ill.
Cory, C. H., Cin., Ham. & Day., Lima, Ohio.
Crawford, S. B., Balt. & O., Baltimore, Md.
Cromwell, A. J., Balt. & O., Baltimore, Md.
Cushing, G. W., Cin., N. O. & Tex. Pac., Ludlow, Ky.
Davis, Ed. E., Boies Car Wheel Wks., Scranton, Pa.
Clark, B., N. Y., L. E. & W., Susquehanna, Pa.
Duncan, T. G., B. & O. S. W., Chillicothe, O.
Davis, E. F. C., Rich. Loco. Works, Richmond, Va.
DeWitt, Ch. H., Lehigh Valley, Weatherley, Pa.
Drury, Michael J., A., T. & S. F., La Junta, Cal.
Deems, J. F., C., B. & Q., Ottumwa, Ia.
Deibert, F. M., Chic., Milw. & St. P., Portage, Wis.
Dickson, G. L., Dickson Loco. Wks., Scranton, Pa.
Dickson, J. P., Dickson Loco. Wks., Scranton, Pa.
Dorsey, J. B., Ohio River, Parkersburg, W. Va.
Downing, Thos., El. Jol. & East. Joliet, Ill.
English, Richard, A. & Pac., Albuquerque, N. M.
Ennis, W. C., N. Y., S. & W., Wortendyke, N. J.
Fenwick, A., G. B. W. & St. P., Green Bay, Wis.
Ferguson, G. A., Conc. & Mont., Lakeport, N. H.
Forsyth, Wm., C., B. & Q., Aurora, Ill.
Foster, W. A., Fall Brook Coal Co., Corning, N. Y.
Fuller, C. E., Vermont Cent., St. Albans, Vt.
Galbraith, R. M., St. L., Ark & Tex., Tyler, Tex.
Graham, Chas., Jr., Del., Lack. & West., Kingston, N. Y.
Garrett, H. D., Penn., Philadelphia, Pa.
Garstang, Wm., C., C., C. & St. L. Indianapolis, Ind.
Gentry, T. W., Rich. & Danv., Richmond, Va.
Gibbs, A. W., Penn., Altoona, Pa.
Gibbs, Geo., C., M. & St. P., Milwaukee, Wis.
Gordon, Jas. T., Concord, Concord, N. H.
Graham, J. A. L., S. & M. S., Cleveland, O.
Gray, Robert, So. Pac., Tucson, Ariz.
Griggs, Albert, Dorchester, Mass.
Hainen, R. J., N. Y., L. E. & W., Port Jervis, N. Y.
Harrington, John, Mex. Nor., Escalon, Mex.
Harrison, W. H., Balt. & O., Newark, O.
Haskell, B., C. & W. Mich., Grand Rapids, Mich.
Hatswell, T. J., Flint & P. M., E. Saginaw, Mich.
Hedley, F., Lake St. Elevated, Chicago, Ill.
Henderson, G. R., Norf. & West., Roanoke, Va.
Hickey, John, Nor. Pac., St. Paul, Minn.
Hancock, Geo. A., G. Col. & S. F., Galveston, Tex.
Harris, Geo. B., Ga. So., Macon, Ga.
Hudson, E. E., C. C. C. & St. L., Cleveland, O.
Jackson, C. H., Brightwood, Ind.
Joughins, G. R., Norfolk & S., Berkley, Va.
Keegan, Jas. E., G. R. & Ind., Grand Rapids, Mich.
Kenney, Geo. W., Cent. Vt., Rutland, Vt.
Lauder, J. N., Old Colony, Boston, Mass.
Lawler, F. M., C., C., C. & St. L., Mattoon, Ill.
Lawes, T. A., C., C., C. & St. L., Indianapolis, Ind.
Leach, H. L., Boston, Mass.
Leeds, Pulaski, L. & Nash., Louisville, Ky.
Lewis, W. H. D., L. & W., Kingsland, N. J.
Lewis, Wm. H., C., B. & Nor., Lacrosse, Wis.
Macdonald, A. V., New Zealand Rys., Christ Church, N. Z.
Mackinnon, Geo., Can, Pac., Farnham, Que.
Manning, T. B., Union Pac., Omaha, Neb.
McCreery, Frank, C., H. & D., Dayton, O.
McGee, F. H., Cent. of Ga., Macon, Ga.
McIntosh, Wm., Chi. & N. W., Winona, Minn.
McKenna, John, I. D. S., Indianapolis, Ind.
Medway, John, Fitchburg, Boston, Mass
Millen, Thos., N. Y. & N., High Bridge, N. Y.
Minshall, P. H., N. Y., O. & W., Middletown, N. Y.
Mitchell, Alva, A. T. & S. F., Ottawa, Kan.
Mitchell, A. E., N. Y., L. E. & W., N. Y.
Morris, W. S., Ches. & Ohio, Richmond, Va.
Maglenn, Jas., Car. Cent., Laurenburg, N. C.
McConnell, J. H., Union Pac., Omaha, Neb.
McMasters, Chas. Jr., Bennington & Rutland, Rutland, Vt.
Miller, E. A., N. Y., Chic. & St. L., Conneaut, O.
Mills, Stott, Lehigh & Hud., Warwick, N. Y.
Manchester, A. E., C. M. & St. P., Kaukauna, Wis.
Montgomery, Wm., Cent. of N. J., Manchester, N. J.
Nettleton, W. A., Kas. Cy., Ft. S. & M., Kansas City, Mo
Noble, L. C., A. French Spring Company, Pittsburgh, Pa.
Nauffer, John G., B. & O. S. W., Chillicothe, O.
O'Herin, Wm., Mo., Kan. & Tex., Parsons, Kan.
Peck, Peter H., Chic. & W. Ind., Chicago, Ill.
Petriken, C. L., Union Iron Works, Galeda, Ala.
Pitkin, A. J., Schen. Loco. Works, Schenectady, N. Y.
Paxson, L. B., Phil. & Read., Reading, Pa.
Player, John, A., T. & S. F., Topeka, Kas.
Pomeroy, L. R., New York.
Purves, T. B. Jr., B. & A., E. Albany, N. Y.
Quayle, Robert, M. L. S. & W., S. Kaukauna, Wis.
Quinn, John A., C. V. & C., Mt. Carmel, Ill.
Roberts, Mord, St. L. I. M. & S., Little Rock, Ark.
Redding, R. E., Man. El., New York, N. Y.
Roberts, E. M., So. Car., Charleston, S. C.
Roth, Frederick, Lehigh Valley, Wilkesbarre, Pa.
Ryley, G. N., McKeesport Connecting, McKeesport, Pa.
Rettew, C., D. & H. C., Carbondale, Pa.
Rutherford, Wm., Plant System, Savannah, Ga.
Ryan, Pat., Louis. & Nash., Russelville, Ky.
Shaver, G. O., P. R. R., Pittsburg, Pa.
Silvius, E. T., J., St. Aug. & I. R., St. Augustine, Fla.
Sinclair, Angus, New York.
Skinner, H., M. C. F., Fall River, Mass.
Small, W. T., Buff., Roch. & Pitts., Rochester, N. Y.
Sprague, H. N., Jamestown, N. Y.
Steele, J. A., West. & Pitt., Weston, W. Va.
Smith, H. O., D. & H. Canal, Oneonta, N. Y.
Sague, J. E., Schen. Loco. Wks., Schenectady, N. Y.
Setchel, J. H., Pitts. Loco. Wks., Cuba, N. Y.
Seward, J. P., A. & B. Short L., Annapolis, Md.
Small, H. J., So. Pac., Sacramento, Cal.
Smith, Geo. W., A. T. & S. F., Topeka, Kan.
Smith, Wm., Ch. & N. W., Chicago, Ill.
Smith, W. T., Newport News & M. V., Lexington, Ky.
Stewart, A. F., Ches. & O., Huntington, W. Va.
Stewart, O., Cambridge, Mass.
Stinard, F. A., Paterson, N. J.
Swanston, Wm., C. St. L. & P., Indianapolis, Ind.
Taber, W. G., Dunk., Al. & Pitts., Dunkirk, N. Y.
Thomas, C. F., Rich. & Danv., Alexandria, Va.
Thomas, J. J., Birm. & Abl., Talladega, Ala.
Todd, Louis C., Bost. & M., Lyndonville, Vt.
Turner, Calvin G., Phila., Wil. & Balt., Wilmington, Del.
Thomas, H. J., D. B. C. & A., E. Tawas, Mich.
Thomas, W. H., E. T. V. & G., Knoxville, Tenn.
Thompson, C. A., Richmond Hill, N. Y.
Tonge, John, Minn. & St. L., Minneapolis, Minn.
Traver, W. H., A. T. & S. F., Argentine, Kan.
Tuggle, T. R., Kentucky Central, Covington, Ky.
Turner, J. S., Eames Vac. Brake Co., New York, N. Y.
Tyrrall, Thos. H., S. I. R. T., New York, N. Y.
Vauclain, Samuel M., Bald. Loco. Works, Philadelphia, Pa.
Waitt, A. M., L. S. & M. S., Cleveland, O.
Wells, Reuben, Rogers Loco. Works, Paterson, N. J.
West, Geo. W., N. Y., O. & W., Middleton, N. Y.
White, A. M., Schen. Loco. Works, Schenectady, N. Y.
Wilson, Geo. F., Ch., R. I. & Pac., Chicago, Ill.
Weane, James N., Lehigh Valley, Sayre, Pa.
White, E. T., Balt. & Ohio, Baltimore, Md.
Wade, R. D., Rich. & Danv., Washington, D. C.
Weiss, C. P., N. Y., L. E. & W., Rochester, N. Y
Wightman, D. A., Pitts. Loco. Works, Pittsburgh, Pa.
Wiggin, C. H., Boston & Maine, Concord, N. H.

HONORARY MEMBERS.

Coolidge, G. A., Charlestown, Mass.
Johann, Jacob, Springfield, Ill.
Robinson, W. A., Hamilton, Ont.

ASSOCIATE MEMBERS.

Baker, George H., New York.
Barnes, David L., Chicago, Ill.
Dean, F. W., Boston, Mass.
Divine, J. F., Wilmington, N. C.
Forney, M. N., New York, N. Y.
Hill, John A., New York.
Leeds, John H., New Haven, Conn.
Marshall, Waldo H., Chicago, Ill.
Pomeroy, L. R., New York, N. Y.
Robinson, H. P., Chicago, Ill.
Smith, John Y., Doylestown, Pa.
Smith, W. A., Chicago, Ill.
Thompson, John, Boston, Mass.
Wheelock, Jerome, Worcester, Mass.
Number of members attending, 198.

The secretary's report showed that the association had 552 active members, 17 associate members and 18 honorary members, a total of 587. The death roll for the year contains the names of R. Derby, Basil Manley, Thomas Midelton, John Robinson and E. J. Whittington. The report said:

At the last convention the Executive Committee was requested to raise a fund of $5,000 to be used in conducting tests of locomotives at Purdue University, and your secretary was directed to solicit the money required from railroad companies and from locomotive builders. The existing depression of business swept like a flood over the country shortly after the last convention, and its effects rendered the raising of the required money impracticable.

The reply given by President Ingalls, of the Cleveland, Cincinnati, Chicago & St. Louis, was an epigrammatic summary of nearly all the others. He wrote: "Wait till the clouds roll by."

On motion of Mr. Mitchell, as amended by Messrs. Forney and Barnes, the Secretary was instructed to have committee reports printed as soon as received by him, and sent out to the members without delay.

The name of Prof. W. F. M. Goss, as an associate member, was referred to a committee.

On motion of Mr. Setchell, Mr. A. W. Sullivan was elected an honorary member.

On motion of Mr. Swanston, Mr. Charles Graham was elected an honorary member.

On motion of Mr. Peck, Mr. B. R. Harding was elected an honorary member.

On motion of Mr. Setchell, Mr. W. H. Selby was elected an honorary member.

The report on the Cracking of Back Tube Sheets was then read by the chairman of the committee, Mr. T. B. Purves, as follows:

Cracking of Back Tube Sheets.

A large mass of information has been gathered, the members being particularly free and obliging in tendering the committee the results of their experience. It has been the purpose of your committee to ascertain if any particular type of boiler, more than another, is subject to cracked tube sheets, and to bring out the facts on this and other points, the following circular was framed and sent out:

Your committee having in charge the investigation of cracking of back tube sheets and methods of overcoming the same, desire information on the following points:

Have you experienced any difficulty with the cracking of back tube sheets? If so (*a*) In what class of boilers? (*b*) What part of sheet is most liable to crack? and (*c*), To what do you attribute the cause? In describing the various cracks, please submit sketches.

Is any one particular type of boiler more subject to this difficulty than others? Is this difficulty in radial stayed boilers due to a want of flexibility in staying between the crown sheet and the roof sheets? What remedies do you suggest? (Please forward sketches or blue prints to the committee on this point.)

In the radial-stayed type has the difficulty been materially lessened by using so-called sling stays at the front end of the crown sheet? If so, describe and submit sketch of the kind of sling or flexible stays you would use.

In addition to the replies to the above circular, your committee has made a personal canvass of the general subject, and inspected numerous boilers where cracked tube sheets have developed and verified the results contributed by the members.

The overwhelming and well-nigh universal testimony of the members is:

First, That radial stayed boilers carrying high pressure are more subject to cracked tube sheets than other types. Second, That the causes are two-fold; primarily that cracking is due to too rigid staying of the crown sheet adjacent to the flue sheet and flange thereof; and, second, placing flue holes too close to flanges, and possibly some of the difficulty is chargeable to the high steam pressures carried. There is quite a unanimity of opinion as to principle involved in curing the difficulty, namely:

Such a provision for staying of the front end of the crown sheet as will give the requisite support, coupled with sufficient flexibility to allow for the force developed from expansion and contraction concentrated at the joint of the back tubesheet with the crownsheet. Figs. 1 to 10 show the different methods furnished by the members to accomplish the object. Figs. 1 and 2 furnished by Allen Cooke, of the C. & E. I. Ry.; this method is in common use abroad. Fig. 3 by Henry Schlaacks, of the Denver & Rio Grande. Fig. 4 by H. Roberts, of the C. & G. T. Ry. Fig. 5 is furnished by the Schenectady Locomotive Works, and is in use on the C. & N. W., C. & O., E. Tenn., Va. & Ga., M. C. R. R., Fall Brook Ry. Fig. 6 by the Pittsburgh Locomotive Works, for the K. C., F. S. & M. R. R. Fig. 7 by John MacKenzie, of the N. Y. C. & St. L. Fig. 8 by A. W. Gibbs, Asst. M. E., Pa. R. R. Fig. 9 by A. Vail, of the Western N. Y. & Pa. Fig. 10 by John Player, Supt. M. P., A., T. & S. F. R. R.

The experience of Canadian roads on this point is particularly valuable, as it covers a longer period than any of the others. They have been using radial stays for a number of years and long ago realized the necessity of providing for the difficulty, and claim the crown bars give better satisfaction than sling stays for the first two rows at front end of crown sheet. Others admit that in building new boilers they would use crown bars at this point, but in repairs to old boilers the sling stays can be applied more cheaply and have seemed to answer every purpose. Two roads give an experience of from 16 months to two years with sling stays and claim that up to this time these boilers have given satisfaction and show no symptoms whatever of the difficulty experienced before the remedy was applied.

In a paper read before the Institution of Naval Architects, Mr. Yarrow says:

"With regard to the water space stays uniting the inside and outside fireboxes, too much care cannot be exercised in arranging these with a view to secure for the inside firebox the necessary freedom of movement due to the variations of temperature. In the year 1878 we built a torpedo boat for a foreign government, and had no less than eight unsuccessful trials, in every case coming home with the tubes leaking. To ascertain exactly what was going on in the region of the tube plate, we removed the row of stays nearest to the tube plate flange on the side and top of the box. We replaced these stays by others working in stuffing boxes and having a nut on the outside, so that if a tensile strain had to be met they were there to receive it, while if the inside box wanted to expand it had freedom to do so (Fig. 11). This experiment was most interesting. Every time the fire was urged these stays would all move outward through their stuffing-boxes, owing to the expansion of the box. In some cases the movement was sufficient to enable a penny piece to be inserted between the nut on the stay and the gland. Each time the fire door was opened and the temperature reduced these stays would move inward, and when the boiler was cool the nuts pressed hard on

the glands. From the moment the new stays were fitted the boiler was altogether free from leaky tubes, and the boat was duly taken over by the Government. It is, of course, dangerous to draw a conclusion from an isolated experiment; at the same time it seems more than probable that these stays, as originally fitted, had much to do with the leaking of the tubes, because it is evident that a tensile strain coming on a tube plate weakened by being perforated by a number of holes, is likely to distort the plate. As a matter of fact, prior to the new stays being fitted, this tube plate was more or less altered in shape after every trial. We think we may assume that tube plates should be free from external strains, and, as far as possible, be allowed freedom to move as the change of temperature requires. With a view to carry this out, we made a practice of having the first row of stays 7 inches from the edge of the tube-plate flange, and even those stays in large boilers are so designed as to be free to move."

While the foregoing conclusions are in harmony with the majority of the replies received, yet your committee is not prepared to go on record as fully indorsing same, more especially that portion devoted to the proposed methods of cure, for the reason that said methods have been in use too short a time (two years at the longest) to fully demonstrate their utility. Inside of this time (the two years cited) we have valuable testimony as to satisfactory services rendered, yet the users themselves feel that a longer experience is necessary before they could speak positively.

Methods similar to some of the forms presented are quite common on European roads, and have been for some years, and the inference is that these roads would not continue the practice if not satisfactory.

T. B. PURVES, J. M. BOON, R. C. BLACKALL, DAVID BROWN, L. R. POMEROY, Committee.

Mr. Mitchell: We have a large number of wagon top engines, and in our experience very few cases of cracked tube sheets occurred except in bad water districts. I do not know that we have had any except in those districts. I found the tube sheets cracked between the flue hole and flange. In building most of our boilers we omitted the top flues and moved the stays back a little. With these boilers we have had no trouble so far.

Mr. Vauclain: We are told the front two rows of radial stays usually have sufficient lost motion to allow the tube sheets to rise up or expand. When that sheet is expanded these stays are loose; what holds the crown sheet? In figuring the strength of the firebox especially, we found it unwise to move the stays farther apart than four inches, centers. If you put the stays at four inches, and leave them loose, something certainly must hold the crown sheet, if the crown sheet goes up. I think the trouble with cracked tube sheets is not due to the manner of staying, but is due to other causes. We have had trouble with back tube sheets and radial stay boilers, in one instance, especially, where the back tube sheets went up three inches above the crown sheets. You could not see the top of the tube at all. We have that tube on hand at the locomotive works as a horrible example of what can be done. Some of the tube holes were five-eighths, and a great many of them half an inch, longer one way than the other. The whole trouble is caused by bad water and lack of attention. We found trouble also due to the water space being too small between the tubes; too many tubes in the boiler. It is the repeated reheating of the tube, contraction and expansion, that causes the tube sheet to crack, and not the fact that there is radial stays in the boiler. My cure is to take out some of the tubes of the boiler. There is no use in them if there is no water around the tubes to heat. Increase the water space from $\frac{9}{16}$ to $\frac{3}{4}$ of an inch; and if you have it an inch you are better off, better results will follow, not only in the life of the boiler, but in the amount of fuel consumed. This turned out to be so in a case where the heating surface was cut down 20 per cent., and the boilers were better steamers than before with large heating surfaces and no water to heat.

Mr. McConnell: I am not in favor of the radial stay boiler. Our experience with radial stay boilers has been, that with bad water the flue sheets will crack and door sheets will crack in every engine. We probably have as bad water as anybody in the States. We have 91 grains of solid matter to the gallon in one place, and 82 grains of that is soda. The only way we have overcome the trouble is by the use of crown bars; we have run crown bars without cracking of the flue or door sheets.

Mr. Peck: I must stand up for radial stay boilers. Thirty-four of our engines have radial stays, and have been in service 12 years. There has been no cracking of crown sheets in 12 years. We had one radial stay boiler go down, but any sheet would go down under the circumstances—the water glass got stopped up and the engine fell short of water.

Mr. Henderson: I would like to ask whether his flue sheets are continued straight down in the fire-box?

Mr. Peck: Yes, we have had several cases of cracking between flues and lower part of the furnace; but they have been in cases where the flue sheet and throat sheet were in one piece clear down to the mud ring.

Mr. Henderson: How thick was the metal on the tubes that cracked? Mr. Peck: About five-eighths.

Mr. Pitkin: I want to ask the question whether this cracking does not take place only as the boiler is fired up. As the plates are heated, and as the heat is not transmitted rapidly to the water, these plates expand and produce this effect, and when the temperature in the water is raised and the steam is raised, the inner plates will not expand and resume their normal relation, so the stay is to accomplish the purpose of securing against the pressure when the steam is raised and the working pressure maintained. It seems to me that this is the point to which it would be well to give attention. Of course, the metal in the box can rise to a higher temperature than the water next to it. Recently we had a case of a burnt side sheet. We sent an expert immediately to investigate the trouble, telling him to put holes through the side sheet, before any alternations were made in the boiler, Much to our surprise we found the water space was entirely free, and yet next to the firebrick the side sheets showed unmistakable signs of having been burnt. The heat was such as to drive the water from the sheet. There is no other cause we can think of which would have produced the effect we found. The water there was bad. I firmly believe that firebox plates are heated to such an extent as to raise the crown, and if they are held rigid, something has got to give way, and the weakest place is the tube sheet, and that, consequently, cracks. I would like to ask whether the report covers only wagon top boilers or straight boilers. I have never known of any difficulty of this kind taking place with straight boilers.

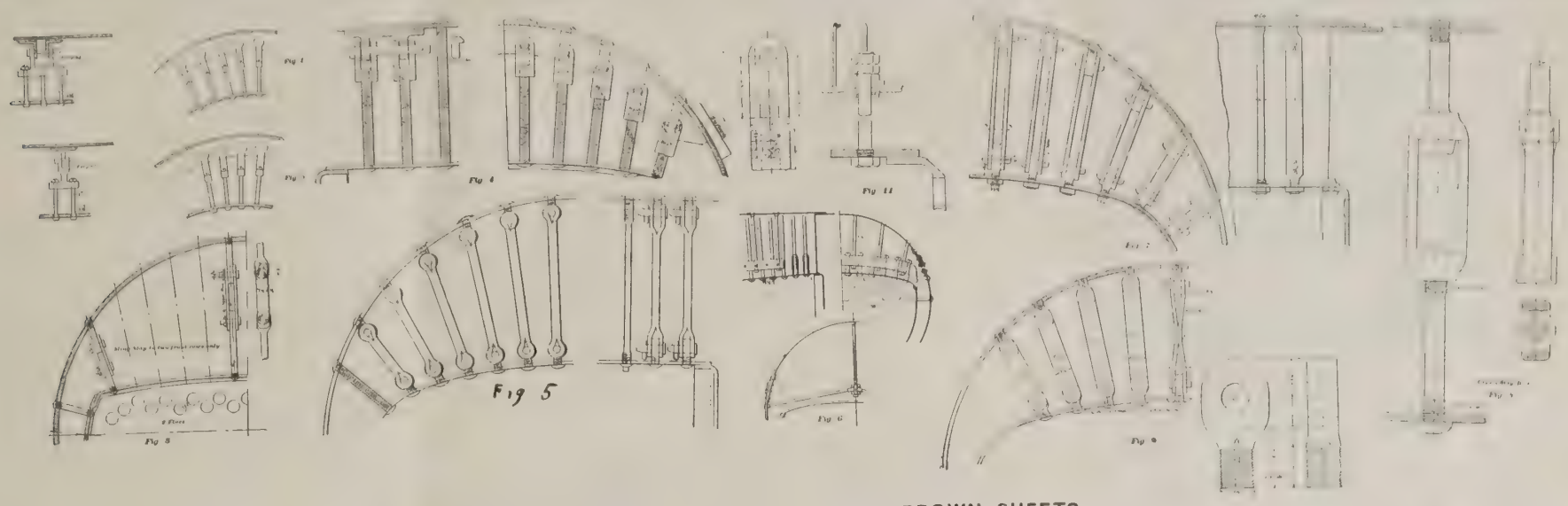
Mr. Purves: This report is not a compilation of the ideas of the committee. It it compiled from the answers received to the letters of inquiry. It covers wagon top boilers only.

Mr. Cromwell: As I have stated, our standard type of freight engine is the wagon top. For a number of years we used crown sheets supported by bars. The difficulty that we experience now, the same style of engine with the wagon top, radial stays, was not experienced when we used the crown bars, which seems to be caused by the expanding of the head and rigid resistance of the stays, and not due to the flues, because we do not experience the difficulty with the crown. I think it is due to the radial stays.

Mr. Small: We have 12 straight boilers, radial stays, where there is good water, and they have been in passenger service for 10 years, and we have no difficulty whatever.

Mr. Setchell: I have always been an advocate of the radial stay boiler. I think it is an admitted fact that that type of boiler gives better water circulation, and is therefore a better steaming boiler than a boiler with crown bars, that frequently gets filled on top of the crown, the most effective heating surface in the boiler, and requires to be cleaned out at considerable expense every little while. It seems to me in firing up an engine, the first cause that operates against the flue sheet is the fact that the flange has a tendency all in that direction. Otherwise, there is no reason, so far as that is concerned, why the side sheet should not expand just as well as the flue sheet. We find another reason. The flue sheet is cut up. There is not one-quarter of the water space in the flue sheet as in the side. It plays an important part in the destruction of the flue sheet, whether you have a large water space between the flues, or a space so narrow that the flame drive the water from the flue. You must have water there to make steam. You must have water to protect the flues. The water is very easily driven from between the flues when you have a narrow water space.

(To be Continued.)



PROPOSED METHODS OF STAYING CROWN SHEETS.

Locusts Seize a Train.

A Long Branch excursion train on the Pennsylvania Railroad was taken possession of by something worse than Coxeyites at Avenel, N. J., June 10. The train was heavily loaded, and the heat had caused almost every window to be opened. When the train came to Avenel the passengers leaned out to look at millions of 17-year locusts on the ground and in the air. They would have been satisfied with this, but the locusts were not. Before the passengers were aware what was happening the pests had swarmed up the sides of the cars and through the windows and doors inside. Women screamed, and stood on the seats with their skirts drawn up, so as to avoid immediate contact with the crawling objects. They soon had to let go their skirts and pay undivided attention to keeping the locusts from their hats and faces. When the train started and resumed its usual speed the locusts deserted the exterior of the cars, and were soon swept from the interior by the passengers and trainmen.

Mr. Chugwater—The paper says that, owing to the continued scarcity of coal, the cable car companies are experimenting with crude petroleum for fuel at the power-houses.

Mrs. Chugwater—To run the cars with?

"Of course."

"That's all I want to know. I won't travel on cars smelling of nasty coal oil, now I tell you."

The *Pall Mall Gazette* has been publishing opinions as to "the worst railway in England." The following letter may be recommended as an admirable model: "Sir: The Southeastern Railway is the very worst railway in the world. Its engines are asthmatic; its lamps are trimmed by foolish virgins; its fares are excessive; its carriages let in the snow in winter, and are furnaces in summer; its motto is unpunctuality; its principal station is approached through the neck of a bottle. It ruins the temper, destroys the digestion and enables one to realize the horrors of Dante's Inferno.—I am, sir, yours obediently, The Worm Who Turns."

The West Shore Railroad has just issued its summer book of excursions along its picturesque route, and those who contemplate a vacation in the country will find in its pages some valuable information about the summer resorts on the west bank of the Hudson in the Catskill Mountain region. The West Shore route affords the traveler every convenience and comfort found on the great railways of this country, and its summer book is replete with all the details which the traveler should know in visiting the many resorts along the road. The road traverses some of the most beautiful parts of New York State, and the scenery along its line is noted for its attractiveness.

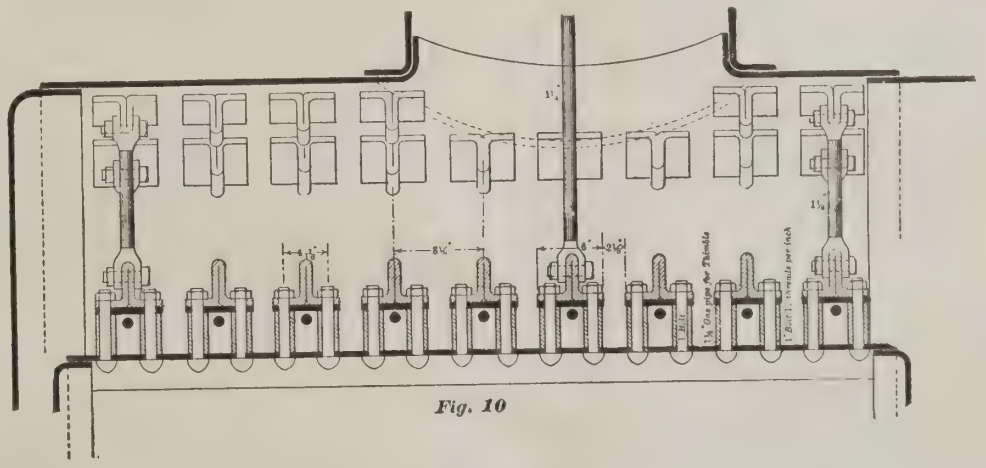


Fig. 10

Ben, the Porter.

[Dedicated to the Committee on Ventilation of Passenger Equipment, with apologies to the memory of Leigh Hunt.]

Ben Jones, the porter (may his ways improve!)
Dreaming within his berth, closed tight above,
Saw, seated at his ease upon a rack,
With cloven hoof, and tail coiled round his back,
A demon, writing with red-hot pen;
Exceeding fear had paralyzed poor Ben,
But of the Devil, as he twirled his tail,
He asked, "Wha' doin' thar?" with lips all pale.
The Imp replied, "I write to show
The places careless porters have below."
"Yo' don' got me?" asked Ben. "O, yes, you see,"
Replied his Impship. Porter spoke more free,
But doubtful still. "'Don' promise, then,
To air dis cyar befo' yo' comes again."
The Devil winked, and vanished. The next night
He came again, in bluish brimstone light,
And showed his diagram—how seats were placed—
And lo, the porter's name had been erased.

—*Railway Age, Saratoga Daily Edition,*

The Leslie Locomotive Fire Kindler.

In our issue for May we briefly described the operation of the Leslie locomotive fire kindler as witnessed in the Chicago roundhouse of the Chicago, Rock Island & Pacific Railroad, where it had accomplished very satisfactory results. The following figures show the economy effected by the apparatus up to April 12, five months after being installed:

OIL.

Fitting up Forty-seventh street roundhouse (35 stalls) with automatic three pipe system	$669 00
One tank of oil, 6,117 gallons, costing 1.71 cents per gallon	104.60
Number of fires kindled with oil 4,078, average per engine 1½ gallons, costing 2.56 cents per fire kindled, total	104.39

WOOD.

509¾ cords wood required to kindle 4,078 at $2.65 per cord, average per engine ⅛ cord wood, cost 33⅛ cents, total	1,350.85
Saving in favor of the oil system	1,216 54

In our previous remarks about this device it was said that the plant was put in by the Leslie Brothers Manufacturing Company, of Paterson, N. J. This was an error. The device is controlled by Mr. J. S. Leslie, of the firm named. The complete success of this device has been fully established in the kindling of many thousands of fires on several large railways where it has been adopted and put into general use. It has attracted much attention on account of its cheapness of application, convenience in operating, and large savings which have been effected through its use. The following is a more complete description of the apparatus than we were able to give in the previous article.

It consists of a suitable storage tank for storing the desired supply of oil for the different sized roundhouses; a small tank or auxiliary reservoir is fed from the storage tank, suitable globe and check valves being located between them—the former to shut the whole supply from the storage tank if necessary, and the latter to automatically feed the required oil to the auxiliary reservoir. An ordinary air pump which supplies air to a storage reservoir at a pressure of 60 or 70 pounds for shop purposes can be utilized to supply sufficient air for the kindler, through a pipe connected with said storage reservoir and entering a locker suitably located in the roundhouse. In this locker an air-pressure regulator reduces the pressure to about 20 pounds, and the main air-pressure pipe extends from there round the house over each stall, a smaller air-service pipe enters the auxiliary reservoir, and, passing through the locker, extends, in close proximity to the main air-pressure pipe, around the house, and is connected with the latter by suitable branch pipes and the intermediary of a lock combination valve over each stall. An oil service pipe emerges from the auxiliary reservoir, and, passing also through the locker, follows the same course as the two former pipes, a branch pipe being connected to the same and also to the lock combination valve above the stalls, the latter being so located as to be conveniently unlocked and opened from the engine. The whole supply of air and oil to these pipes is controlled by suitable valves placed in the locker before mentioned, in which also are located the gauges, all being placed under lock and key. In this way the absolute control of the whole system is in the charge of one person; and when the system is opened to service the control of the supply to each stall is governed by its respective lock combination or regulating valve. When a fire is to be kindled, sufficient coal is thrown into the firebox to cover the grates thoroughly, a light and easily handled burner with two small hose attached for air and oil is connected by suitable hose couplings to the lock combination valve, after the burner has been connected by unlocking and opening the combination valve, the oil is brought into the house automatically and the air and oil simultaneously admitted to the burner. A small piece of greasy waste is then lighted and thrown into the firebox on top of the coal, and the air and oil are then turned on to the burner by their respective valves, the necessary quantity of oil only being fed automatically, making it impossible to injure the firebox sheets either through carelessness or otherwise. When the fire has been kindled, by the closing of the lock combination valve, the supply of air and oil is cut off simultaneously, and the oil remaining in the pipe is automatically returned to the auxiliary tank, after which the burner is disconnected.

The storage and auxiliary tanks are buried in the ground outside of the buildings and below the frost line fully protecting the oil, not only from fire, but also from all kinds of weather and at the same time economizing space. The location of the pipes over the stalls, where they are entirely out of the way, the means of controlling the whole system by having the controlling valves, including those which are placed out of reach over the stalls securely locked, prevents persons passing through the roundhouse from interfering with them. Thus the safety in kindling fires with this device is not dependent upon the operator, but is due to the fact that all parts which have to be manipulated by him are so arranged that they are either automatically adjusted, or it is compulsory for him to adjust them properly to enable him to do the work, in this way protecting the property from all risks through carelessness or otherwise. The details of the device have been carefully worked out as the result of experiments extending over a series of years.

The following report of some tests made of the merits of this device shows that time as well as money is saved by its use in firing up locomotives, as from 30 to 40 minutes is saved in the time of getting an engine "hot," or raising steam enough to run it from the house. The figures are furnished by Mr. George F. Wilson, Superintendent of Motive Power and Equipment of the C., R. I. & P. Railroad. The report is of tests made between kindling fires in the usual way with one-eighth of a cord of wood at a cost of 33 cents, and with the Leslie kindler, using 1½ gallons of crude oil, at a cost of 1.71 cents per gallon. The coal used in each case was Illinois coal:

Test No. 1.

Engines 936 and 938, with fireboxes 6 feet 3¼ inches long by 2 feet 9⅝ inches wide, were washed out and filled with two gages of water, temperature 65 degrees.

Engine 938, fire kindled with ⅛ of a cord of wood and 576 pounds of coal, raised 10 pounds of steam in 1 hour and 50 minutes; raised 60 pounds of steam in 2 hours and 37 minutes.

Engine 936, fire kindled with 1½ gallons of oil, 576 pounds of coal, raised 10 pounds of steam in 1 hour and 5 minutes; 60 pounds of steam in 2 hours and 2 minutes.

Test No. 2.

Engines 936 and 937. Both engines washed out and filled with two gages of water; temperature of water 68 degrees.

Engine 936, fire kindled with 1½ gallons of oil and 454 pounds of coal, raised 10 pounds of steam in 48 minutes; 50 pounds of steam in 1 hour and 36 minutes.

Engine 937, fire kindled with ⅛ of a cord of wood and 454 pounds of coal, raised 10 pounds of steam in 55 minutes; raised 50 pounds in 1 hour and 48 minutes.

Test No. 3.

Engines 808 and 822, Class 25 A, fireboxes 8 feet 6 inches long by 2 feet 10 inches wide. Both engines washed out and filled with two gages of water, temperature 65 degrees.

Engine 808, fire kindled with ⅛ of a cord of wood and 605 pounds of coal; raised 10 pounds of steam in 3 hours and 46 minutes; raised 35 pounds of steam in 4 hours and 26 minutes.

Engine 822, fire kindled with 1¾ gallons of oil, at a cost of 2.99 cents, and 605 pounds of coal. Raised 10 pounds of steam in 3 hours and 45 minutes. Raised in 35 pounds of steam in 4 hours and 35 minutes.

Test No. 4.

Was made on two standard passenger engines, Nos. 937 and 936. Both of these engines were washed out and filled with two gages of water, and fired up with an equal number of pounds of coal; one with ⅛ of a cord of wood, and the other with 1½ gallons of oil, to ascertain which would generate the most steam.

Engine 937 was fired up with ⅛ of a cord of dry hardwood and 454 pounds of coal, which raised 98 pounds of steam.

Engine 936 was fired up with 454 pounds of coal and 1½ gallons of crude oil, and raised 123 pounds of steam.

Test No. 5.

Standard passenger engine 934 was washed out and filled with two gages of water, temperature 60 degrees; fire kindled with 500 pounds of coal and ⅛ of a cord of dry hardwood. Firebox was hot on the outside in 55 minutes.

Had 5 pounds of steam in 2 hours and 30 minutes.
" 20 " " 2 " 45 "
" 40 " " 3 " 11 "
" 60 " " 3 " 35 "
" 75 " " 4 " 5 "

Standard passenger engine 936 was washed out and filled with two gages of water, temperature 60 degrees; fire kindled with 500 pounds of coal and 1½ gallons of oil. Firebox was hot on the outside in 16 minutes.

Had 5 pounds of steam in 50 minutes.
" 20 " " 1 hour and 2 minutes.
" 40 " " 1 " 30 "
" 60 " " 2 " 8 "
" 75 " " 2 " 33 "

The following table gives a record of the performance of this kindler for the months of April, May and June at the C., R. I. & P. roundhouse in Chicago:

Date. 1894.	Galls. oil used.	No. engines kindled.	Av. galls. per engine.	Av. cost in cents.
April 12	160 14	115	1.39	2.37
19	150.80	116	1.30	2.22
24	123.12	79	1.55	2.64
May 1	177.53	125	1.42	2.42
8	165 94	129	1.28	2.18
15	146.56	116	1.26	2.15
24	188.65	131	1.44	2.46
31	111.26	113	.98	1 67
June 7	141.09	118	1.22	2.08
Total	1,368.09	1,042	1.31	2.24

The two following tables show the performance of this kindler in the Cedar Rapids roundhouse of the Burlington, Cedar Rapids & Northern R. R. during the first two months of its use. They also show how the cost of kindling fires was reduced as those handling it became familiar with its operation.

MONTH OF MAY, 1894.

Date.	Number of engines.	Gallons of oil used.	Amount of gals. per eng.	Cost per eng. in cents.
6	7	22.919	3.274	6.87
7	13	26.313	2.024	4.25
8	17	27.724	1.680	3.52
9	15	208.503	1.366	2.87
10	17	19.518	1.14	2.39
11	17	26 620	1.565	3.25
12	17	18 255	1.738	2.25
13	7	7.421	1.06	2.22
14	16	19.772	1.236	2.59
15	19	23.991	1.263	2.65
16	18	41.198	2.28	5.80
17	19	38.845	2.044	4.19
18	18	31 688	1.760	3.69
19	21	27.775	1.389	2.91
20	14	22.923	1.637	3.43
21	16	22.424	1.401	2.94
22	19	13.012	0.685	1.44
23	15	14.480	0.965	2.03
24	16	20.837	1.302	2.73
25	19	23.158	1.219	2.56
26	18	15.548	0.864	1.81
27	11	10.437	0.949	1.99
28	13	12.967	0.997	2.09
29	20	15.954	0.798	1.68
30	15	11.226	0.751	1.58
31	19	16.196	0.852	1.79
Total	415	551.704	1.329	3.00

MONTH OF JUNE, 1894.

Date.	Number of engines.	Gallons of oil used.	Amount of gals. per eng.	Cost per engine in cents.
1	20	17.592	0.879	1.85
2	22	20.533	0.933	1.96
3	7	6.815	0.973	2.05
4	19	14.771	0.777	1.63
5	14	9.041	0.646	1.36
6	17	11.926	0.702	1.47
	Total, 99	Total, 80.678	Av., 0.318	Av., 1.72

A series of 12 tests was made on the Wisconsin Central Railroad. We give herewith the data of the first four tests, which show practically the results accomplished.

Test No. 1.

Engine 95, with oil.			Engine 82, steam with wood.		
Steam pressure.	Hours.	Minutes.	Steam pressure.	Hours.	Minutes.
5	..	40	5	..	43
20	1	4	20	..	57
40	1	14	40	1	4
60	1	20	60	1	10
80	1	32	80	1	19

Class, 8 wheel.	8-wheel.
Cylinder, 17 × 24.	17 × 24.
Firebox, 72 × 34.	72 × 34.
Flues, 234.	234.
Temp. of feedwater, 94 deg.	112 degrees.
Blower used, 17 minutes.	17 minutes.
Coal used, 314 pounds.	314 pounds.
Coal used, Ohio.	Ohio.
Oil used, 5 qts.	Wood used, ¼ cord.
Cost, 2⅞ cents.	Cost, 38⅛ cents.

Note.—The wood used in this and all other tests was air dried hemlock and pine, 4 feet 2 inches long. Good bed red coals on grates of both engines.

Test No. 2.

Engine 69, with oil.			Engine 88, with wood.		
Steam pressure.	Hours.	Minutes.	Steam pressure.	Hours.	Minutes.
5	1	0	5	.....	35
20	1	23	20	.....	40
30	1	31	30	.....	46
40	1	35	40	.....	52

Class, 8-wheel.	8-wheel.
Cylinder, 17 × 24.	17 × 24.
Fire-box, 72 × 34.	72 × 34.
Flues, 234.	234.
Blower used, 23 minutes.	23 minutes.
Temp. of feed water, 94 deg.	118 deg.
Coal used, 259 pounds.	259 pounds.
Coal, "Ohio."	"Ohio."
Oil used, 5 quarts.	Wood used, ⅛ cord.
Cost, 2⅞ cents.	Cost, 19¼ cents.

Heavy fires in both engines.

Test No. 3.

Engine 95, with oil.			Engine 99, with wood.		
Steam pressure.	Hours.	Minutes.	Steam pressure.	Hours.	Minutes.
5	1	0	5	..	56
20	1	23	20	1	16
40	1	30	40	1	29

Class, 8-wheel.	8-wheel.
Cyls., 17 × 24.	17 × 24.
Firebox, 72 × 34.	72 × 34.
Flues, 234.	234.
Fire kindled without blower.	
Tem. of feed water, 98 deg.	93 deg.
Coal used, 207 lbs.	207 lbs.
Oil used, 5 quarts.	Wood used, ¼ cord.
Cost, 2⅞ cents.	Cost, 38⅛ cents.
Ohio coal.	Ohio coal.

Condition of fire: Good body red coal in engine 95. Fire burnt out in engine 99.

Test No. 4.

Engine 105, with oil.			Engine 67, with wood.		
Steam pressure.	Hours.	Minutes.	Steam pressure.	Hours.	Minutes.
5	.....	33	5	1	5
20	.....	44	20	1	19
40	.....	51½	40	1	30
50	.....	55½	50	1	35

Class, 8-wheel.	8-wheel.
Cylinder, 17 × 24.	17 × 24.
Firebox, 72 × 34.	72 × 34.
Flues, 234.	234.
Fire kindled without blower.	
*Temp. of feed water, 98 deg.	*102 deg.
Coal used, 243 pounds.	243 pounds.
Oil used, 6 quarts.	Wood used, ⅛ cord.
Cost, 2⅞ cents.	Cost 19¼ cents.
Ohio coal.	Ohio coal.

Condition of fire: Fire in engine 105, fair; fire burnt out in engine 67.

Aside from the economy effected in actually kindling fires with this device, money is saved in several other ways by its use. One car tank containing 6,000 gallons of crude oil will kindle as many fires as 71 carloads, or 500 cords, of wood. This dispenses with hauling 71 cars of wood and loading and unloading same, and of handling them at terminal yards, as well as the cost of maintaining them in repair. In using wood the regular allowance of one-eighth of a cord per fire is frequently exceeded, and oil barrels are frequently burned, as are also illuminating and lubricating oils to hasten steam raising. These items of expense are avoided in a system such as has been here described.

Automatic Train Blocking and Stopping.*

BY RALPH W. POPE.

The subject of railroad block signaling has been under discussion for many years with varying degrees of interest. During the decade following 1840 considerable activity was shown and some practical work accomplished, but up to the time that the track circuit was invented by Mr. Franklin L. Pope no substantial progress was made, owing to the defective operation of track instruments and such other mechanical devices as the inventive mind of that time was able to produce. The records of the Patent Office, however, show considerable ingenuity in this line, but practical railroad men were adverse to expending money for signal systems which were liable to be disarranged by the various conditions which surround the use of movable apparatus upon the roadbed. This kind of apparatus may be divided into two classes known as "trigger" or "tripping" and "depression" or "wheel tread" devices," the latter being the most practical and most generally accepted. The most prominent of this class of signals is the Hall system. The former systems are chiefly conspicuous by their absence in actual railroad service.

Referring to the color or position signal, there seems to be no question as to the greater value of the position signal. The disk or color signal serves the purpose under most conditions, but when any question arises in the mind of the engineer as to color, the position of signal serves as a clincher, and might possibly be used regardless of color with a good degree of success. But in these times of "limited" express trains a point has been reached where in the controlling of trains we must go beyond the signal, the operator, or the engineer. It is at this point that the Kinsman system recently introduced upon the Chicago, Milwaukee & St. Paul Railway has taken up the work, and carried it on to a point beyond which it would seem impossible to go, for having performed the work of the locomotive engineer, nothing remains to be done. We must admit the well known fact that a signal itself cannot stop a train. It must be seen and obeyed. Destroy this combination in any particular, and the most expensive signal is valueless so far as that particular instance is concerned. Many of our most serious accidents are caused by leaving out some feature of this combination. It is therefore most desirable to add to the present signaling facilities a means of overcoming the well known facilities of human nature by providing a practical and efficient means of accomplishing this end without interfering with the generally adopted methods of operating railway trains. This has been accomplished by Mr. Kinsman in a most simple and effective manner.

Owing to the lack of confidence in electrical devices, the track circuit was a long time in attaining the position to which it was entitled. The general and successful introduction of electrically operated apparatus has however, of late years induced in the minds of railroad men a sufficient degree of confidence in such apparatus to warrant a well founded belief in its reliability for practical every day use. There are now numerous instances of the most satisfactory service depending upon track circuits, the most notable being the installations made by the Union Switch & Signal Company on the Central Railroad of New Jersey, between Jersey City and Bound Brook, and that of the Hall Signal Company on the Illinois Central Railroad at Chicago.

The Kinsman system is not only automatic up to the point of giving a visual signal which may or may not be obeyed, but it is automatic in the broadest sense of the word,

* Paper read before the Convention of the Railway Telegraph Superintendents at Detroit, June 13, 1894.

inasmuch as it not only gives the signal to an engineer, but in case of his neglect to obey such a signal, it actually cuts off the motive power and applies the air brakes by the employment of the same means as ordinarily used by an engineer. It is safe to assert that it would operate as well upon a run-away engine as upon one carrying the most trustworthy engineer.

The inventor seems to have fully comprehended the difficulties to be overcome, and employed means and apparatus which the most astute railroad man could not in any way object to. [The Kinsman block system was illustrated and fully described in the NATIONAL CAR AND LOCOMOTIVE BUILDER for May, 1894. See pages 80-81.] The track apparatus is as immovable as the way itself, guard rails having been in use for an indefinite period. The point of electrical contact is as positive and as simply obtained as mechanical skill could suggest. The employment of air pressure for operating the motive power is simplicity in itself. The act of shutting off the steam sets the brakes in the most approved manner. The fact that no changes are made in the method of handling the throttle lever, or engineer's valve relieves the engineer from the necessity of acquiring special electrical or mechanical knowledge. The fact that the locking of the throttle lever can be as effectually done as at present without interfering with its operation, makes the introduction of the power-controlling cylinder of no moment. Seven engines have been equipped with a somewhat modified apparatus, and operated for the last 12 months without ever becoming disconnected or disarranged in any way.

Exhibits at the Convention.

The following is a complete list of the exhibitors and exhibits at the recent Master Car Builders' and Master Mechanics' conventions at Saratoga:

Ajax Metal Co., Philadelphia. Metals.

The American Dust Guard, Columbus, O. Full size.

Adjustable Saw Table Co., Fitchburg, Mass. Model of saw table. Represented by H. A. Hawley.

American Steel Bolster Co., St. Louis. The Schaffer bolster. Represented by R. H. Parks.

Adams & Westlake Co., Chicago. Acme car window shade. Represented by L. A. Gray and F. B. Jones.

Alexander Car Replacer, Scranton, Pa. Represented by Thos. Aldcorn.

Association of American Inventors, Philadelphia. Collection of couplers, etc.

American Steel Casting Co., Philadelphia. Represented by H. Thickett and W. A. Blanchard.

Adjustable Saw Table Co., Fitchburg, Mass. Model of saw table. Represented by H. A. Hawley.

American Railway Electric Light Co., New York. Blue prints showing system. Represented by H. C. Frink.

Automatic Lubricating Car Box Co., Cincinnati. Improved car box. Represented by Albert R. Morrison.

Baker Car Heater. Represented by W. C. Baker, New York.

Buckeye Automatic Car Coupler Co., Columbus, O. Model of passenger car equipment. Represented by S. P. Peabody and James Tims.

R. Bliss Manufacturing Co., Pawtucket, R. I. Wood's patent safety gate. Represented by George S. Tingley.

Berry & Orton Co., Philadelpia. Photographs and catalogues. Represented by Philip J. Fraker.

Bushnell Manufacturing Co., Easton, Pa. Car seats. Represented by E. M. Bushnell.

Bundy Manufacturing Co., Binghamton, N. Y. Workman's automatic time recorder. Represented by H. E. Bundy and Lewis Allen.

Berry Bros., Detroit, Mich. Railway varnishes. Represented by John A. Williams, Chicago; George J. Higle, Buffalo; Jesse Cornelius, St. Louis.

F. A. Barbey & Co, Boston. The Hampson flexible steam joint. Represented by Frank A. Barbey.

Butler Drawbar Attachment Co., Cleveland. Improved drawbar attachment. Represented by George W. McGuire and W. W. Hayward.

The Bellamy Company, New York. "Perfect" wood filler. Represented by C. L. Bellamy.

Central steel draft gear and steel body bolster, invented by T. C. Salveter. Represented by R. H. Parks.

Chapman Jack Co., Cleveland, O. All kinds of lubricating jacks. Represented by George W. McGuire, vice-president.

Columbia Metallic Rod Packing Co., Philadelphia. Represented by George P. Wilson.

Crowley Car Coupler Company, Youngstown, O. Models of two cars showing the Crowley coupler in operation. Represented by R. W. Barmodale.

Coale Muffler and Safety Valve Co., Baltimore. Represented by Van Vleet.

The Coburn Trolley Co., Holyoke, Mass. Car door. Represented by H. O. Nourse.

Chicago Railway Equipment Co., Chicago. Self-adjusting spring head hollow break beam. Represented by A. J. Farley, E. B. Leigh and L. C. Burgess.

L. C. Chase, & Co., Boston. Mohair car plushes. Represented by R. R. Bishop, Jr.

Chicago Grain Door Co., Chicago. Grain door. Represented by E. A. Hill and J. L. Mallory.

Consolidated Car Heating Co., Albany, N. Y. Car heating apparatus and Pope light. Represented by Wm. G. Rice, J. F. McElroy, J. H. Sewall, D. D. Sewall, O. Wethered, H. U. Woolastan, Edwin A. Smith, R. P. Scales, J. Frank Lightford, Andrew Lester and F. P. Foley.

W. G. Creamer & Co., New York. Car ventilators.

Crosby Steam Gage and Valve Co. Bromide enlargements of the Crosby company's specialties; vacuum test pump; Crosby's steam engine indicator, with Sargent's electrical attachment (working model); improved steam gage testing machine; Johnstone blow-off cock; locomotive chime whistles; Branden pump valve. Represented by Edward C. Bates.

DeKalb Ventilating Car Window, Syracuse, N. Y. Represented by E. E. DeKalb, the inventor.

Detrick & Harvey Machine Company, Baltimore. Adams automatic bolt threader; the Cook threader and the open-side iron planer. Represented by Thos. M. Brown.

Dyer Williams, Chicago. The Williams coupler.

Drexel Railway Supply Company, Chicago. Working model of Barber passenger truck. Represented by A. C. McCord.

Davis Car Shade Company, Portland, Me. Car shades. Represented by E. E. Piper.

Evans Artificial Leather Company, Boston. Artificial leather. Represented by W. N. Dole and E. A. Prince.

Eldridge Coupler Company, Murfreesboro, N. C. Coupler. Represented by J. T. Eldridge, the inventor.

A. French Spring Company, Pittsburgh. Springs. Represented by D. C. Noble and Geo. Morris.

Fairbanks, Morse & Co., Chicago. Improved duplex steam pump; Sheffield hand car; Barrett car jack; Sheffield improved automatic stand pipe (model). Represented by George J. Akers.

Gould Coupler Co., freight and passenger couplers; freight car buffer, pilot and tender couplers and vestibule. Represented by C. A. Gould, C. W. Gould, C. M. Gould, George Widner, A. Dowdell, F. P. Huntley and W. F. Richards.

Gold Car Heating Co., New York. System of car heating. Represented by Edward Gold and E. H. Gold.

Thomas J. Gleason, New York. Represented by A. G. Richardson.

Hale & Kilburn Manufacturing Co., Philadelphia. New car seat. Represented by C. E. Barrett and T. R. Freeman.

M. C. Hammett, Troy, N. Y. Cary's force feed lubricator.

The Hendrick Manufacturing Co., Carbondale, Pa. Perforated metal. Represented by George W. Cross.

Hinckley Brake Co., Trenton, N. J. Hinckley Automatic Brake Pressure Regulator. Represented by Howard Hinckley and F. W. Stevens.

Hutchins & Sons, Detroit. Car roof. Represented by C. H. Hutchins and Major Frank Wood.

International Automatic Air Brake Coupler Co., St. Louis. Represented by N. F. Niederlander and S. W. Summers.

Jenkins Bros., New York. Valves. Represented by J. D. Stiles and Charles W. Martin, Jr.

H. W. Johns Manufacturing Co., New York. Asbestos goods. Represented by F. M. Patrick.

Isaac G. Johnson & Co., Spuyten Duyvil, N. Y. Thurmond-McKeen coupler. Represented by T. L. McKeen and Martin Zimmerman.

The Klingler coupler, Beaver Springs, Pa. Represented by J. I. Woodruff.

Kansas City Steel and Iron Co., Kansas City, Mo. Kansas City car coupler and tool steel. Represented by S. H. Springer, secretary.

Kinsman block system. System of railroad signaling. Represented by W. R. Norris.

A. La Rue, Danville, Pa. La Rue automatic coupler. Represented by A. La Rue and W. D. Zehnder.

Leslie Locomotive Fire Kindler. Represented by J. S. Leslie, of Paterson, N. J.

Ludlow Coupler Co., Springfield, O. The Ludlow coupler. Represented by H. R. Ludlow and John T. Ricks.

Leach's improved sanding apparatus for locomotives, Boston. Represented by Henry L. Leach.

Marden Car Brake Company, Boston. Marden steel brake-beam and Marden's improved bell cord hanger.

McMillan Sash Balance Company, Pittsburg, Pa. Sash balance and lock, combined with their "common-sense" bead fastener.

Manning, Maxwell & Moore, New York, selling agents. Metropolitan injector, Tabor indicators, gages, etc., and locomotive pop valves.

Michigan Malleable Iron Company, Detroit. The Detroit coupler. Represented by W. Carpenter.

Meneely Bearing Company, West Troy, N. Y. Meneely's tubular roller bearing. Represented by C. D. Meneely and S. V. Fearey.

Magnolia Metal Company, New York. Journal bearings and magnolia metal. Represented by F. W. Miller.

W. H. Nicholson & Co., Wilkes Barre, Pa. Represented by George L. Weiss.

National Car Wheel Co., Buffalo, N. Y. Car wheels. Represented by W. W. Turlay.

National Malleable Castings Co. Freight car door fastenings. Represented by George W. McGuire, H. S. Burkhart, J. V. Davidson and S. L. Smith.

N. S. Bronze Co., Cleveland. Bronzes and metals. Represented by W. C. Beckwith.

The M. Ohmer's Sons Co., Dayton, O. Railroad filing cases. Represented by John T. Ohmer.

Peerless Rubber Co., New York. Rubber hose, etc. Represented by C. H. Dale, General Manager.

Pratt & Lambert, New York and Chicago. Panels showing faultless varnishes. Represented by N. B. Arnold, W. H. Andrews, C. C. Larrabee and J. M. Stewart.

Pyrotechnic Railway Danger Signal, New York. Represented by F. A. Fox and D. H. Roberts.

Pratt & Letchworth, Buffalo, N. Y. Malleable iron castings.

Palmer Ventilator Co., Boston. New system of ventilating cars, exhibited on car at Fitchburg station. Represented by James M. Palmer.

Ross Valve Co., Troy, N. Y. Ross valve. Represented by J. C. Ross.

Ridsdale & Lewis, 390 Cortlandt St., New York. Duval Metallic packing. Represented by Thos. A. Lewis. This firm also represented Henry R. Worthington, and the Pulsometer Steam Pump Co.

Saloon door indicator, Philadelphia. Represented by Chas. Lindstrom.

The Standard Steel Works, Philadelphia. Steel-tired spoke and plate car wheels.

Smillie Automatic Car Coupler Co., Newark, N. J. Represented by C. H. Taylor.

Standard Railway Equipment Co., New York. Adams oil box. Represented by Mr. Clark.

Simonds Rolling Machine Co., Fitchburg, Mass. Brake pins, track bolts and bearings. Represented by J. B. F. Gay.

Springfield Malleable Iron Co., Springfield, O. The Miner draw-bar attachment. Represented by H. R. Ludlow and John T. Ricks.

Safety Car Heating and Lighting Company, New York. Pintsch light, etc., in office of hotel. Represented by J. J. Cody and O. G. Gayley.

Sams Automatic Car Coupler Company. Represented by L. D. Sweet, vice-president.

The Standard Fuel Burner Company, Fort Plain, N. Y. Represented by Benj, G. Shults.

Standard Paint Co. P. & B. "Rubberoid" Car Roofing and Paints. Represented by Frank S. De Rande.

Strait & Smith Company, St. Paul, Minn., and New York. Brown emergency link coupler. Represented by Floyd K. Smith.

Syracuse Malleable Iron Company, Syraeuse, N. Y. Burn's automatic car coupler. Represented by T. Alcorn, T. J. Seaman and W. B. Burns.

Tyler Tube and Pipe Company, Washington, Pa. Knobbled charcoal iron boiler tubes. Represented by George E. Molleson.

Taylor Iron and Steel Company, High Bridge, N. J. Wheels. Represented by J. T. Sheldon.

B. E. Tilden Company, Chicago. Wrecking Frogs. Represented by B. E. Tilden.

Utica Extension Car Step Company, Utica, N. Y. Represented by A. Putnam.

Westinghouse Air Brake Co. and American Brake Co. Outside equalized drive brake for 10-wheeled engine; engine truck brake; air brake inspector's machine. Represented by R. A. Park, John B. Gray, E. L. Adreon and F. N. Nellis.

Wright & Jones, Bridgeport, Conn. Rotary lock for car windows. Represented by J. W. Wright.

Wilmington Malleable Iron Co., Wilmington, Del. Hammond coupler.

Wemple coupler, Schenectady, N. Y. Represented by J. V. Wemple.

Willard's sectional grain door, New Philadelphia, O. Represented by W. H. Willard.

William Yerdon, Fort Plain, N. Y. Double hose bands for steam and air-brake hose.

The Eastern steel rail market is exceedingly dull at nominally $24.80, tidewater, for standard sections. There has been some demand for light sections for export.

A Savannah, Florida & Western express train was robbed, June 26, near Homerville, Ga. After securing $1,222 in cash from the express safe the robbers took possession of the engine, compelling both the engineer and fireman to leave it, and ran it 11 miles from the scene of the robbery, where they left the engine and took to the woods. At last accounts bloodhounds were on their trail.

Lubricating Pulley Blocks.

The following is a record of service tests of hoisting tackle recently made by Robert Grimshaw, M. E., at the Brooklyn Navy Yard, in collaboration with Lieut. John A. Bell, of the Equipment Bureau, United States Navy. The tests were for the purpose of determining the percentage of power wasted by unlubricated blocks. For this purpose a four-fold tackle which had been lying by a long time was procured, the bearing surfaces being dry and dirty; this was tested by slowly hoisting various dead weights by man power applied through a 16-fold compound tackle and measured by a spring balance. Next all bearing surfaces were cleaned, but not lubricated, and the same tests were made and then the bearings were lubricated with Dixon's waterproof grease and the tests repeated. The results are shown in the accompanying table:

Including Weight of Block and Hook—41 lbs.

Gross weights hoisted.	Theoretically required to raise gross weights.	Act'l weights required.			Extra power required to raise gross weights.						
		Unlubricated and dirty bearings.	Clean and dry bearings.	Lubr'ed with waterproof graphite grease.	Unlubricated and dirty.	Clean and dry bearings.	Lubr'ed with waterproof graphite grease.	Unlubricated and dirty.	Clean and dry bearings.	Lubricated with waterproof graphite grease.	Saving by lubrication.
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	per ct.	per ct.	per ct.	per ct.
600	160.25	243	213	195	82.75	52 75	34.75	51.7	32.9	21.7	30.0
800	210.25	323	278	255	112.75	67.75	44.75	53.1	32.9	21.2	31.9
1,000	260.25	403	348	315	142.75	87.75	54.75	54.8	33.7	21.8	33.0
1,200	310.25	483	413	378	172.75	102.75	67.75	55.7	33.1	21.8	33.9

Note.—These results show that the use of Dixon's waterproof grease, reduced the friction, in comparison with the case of dirty bearings, about 60 per cent., and when compared with clean, dry bearings, about 33 per cent.

Advertising is to business what steam is to machinery—the grand propelling power.

The publication office of *Poor's Manual* has been moved from 70 Wall street to 44 Broad street, New York City.

The Glazier Headlight Company has been organized to manufacture headlights, lanterns, etc., at Rochester, N. Y.

A very neat souvenir in the shape of a "whist marker" was presented to the members of the convention by the Standard Paint Company, of New York, and was much appreciated by the lovers of the game of whist.

The Sterlingworth Railway Supply Company has been incorporated in New York. F. W. Coolbaugh is President, L. R. Pomeroy, Vice-President, and F. S. Bruen, Secretary and Treasurer. The company will deal in railroad equipment specialties. The office of the company is at 256 Broadway, New York.

The Cleveland Twist Drill Company, has just shipped three of each size of its "grip sockets" to the Norfolk Navy Yard. This is the third navy yard that has been equipped with these grip sockets which the Cleveland Twist Drill company have lately put on the market. Many of the largest manufacturers throughout the country have adopted them for their works and the makers are hard pushed to keepup with their orders.

The Phosphor-Bronze Smelting Company, of 2,200 Washington avenue, Philadelphia, Pa., make a specialty of manufacturing "Elephant Brand" phosphor-bronze and other alloys. Among these are hardened castings which are made by special process applicable mainly to duplicate work, and possess great tensile strength and rigidity, with hardiness almost equal to steel. Also a superior lining metal to be used in the same manner as Babbitt metal for heavy pressure and high speed.

The New Jersey Car Spring and Rubber Company, of Jersey City, N. J., manufacturers of vulcanized rubber goods, has issued a nicely illustrated and well printed little book which relates an interesting story about rubber hunting in the heart of Brazil, a visit to a typical rubber camp, and how the industry is carried on. The story is written by Fannie B. Ward, and those who feel an interest in the subject should send to the New Jersey Car Spring & Rubber Company for a copy.

The American Steel Casting Company, successor to the Standard Steel Casting Company, of Thurlow, Pa., has issued an illustrated catalogue descriptive of specialties in open hearth steel castings. All castings at these works are made strictly of open hearth steel produced from the best known brands of iron, thereby securing the most satisfactory results. The practical difficulties of making good steel for castings are numerous, In making steel of iron, if too much carbon is used it makes cast iron; if too little, it is simply wrought iron. If the mixture is right and the heat too great, the steel is made useless by burning; if too little, it becomes almost worthless, and each effort thereafter either improves or injures the stock before it is in condition to use.

The Peerless Rubber Manufacturing Company, of 15 Warren street, New York, has issued a new catalogue descriptive of the large variety of rubber goods which form its output. The company makes a specialty of "Rainbow" packing, which is especially adapted for very high pressure and is not affected by any degree of steam heat. It will not harden under any degree of heat or blow out under the highest pressure, and will make an air, steam, hot or cold water joint equally well. It is not affected by oils, ammonia, liquors, steam, heat or alkalies, and will not harden or crack. Joints can be made and broken in one-eighth the time consumed with packings that harden, as a tool is not required to break or face off joints. It is said that steam heating companies can make joints in new plants without the use of steam, with the assurance that when steam is applied every joint will be perfectly tight.

The Pope System of Car Lighting.

The Consolidated Car Heating Company, of Albany, N. Y., has been investigating the subject of car lighting by means of compressed oil gas, and has decided to adopt the Pope system, which is widely used in Great Britain. The company has acquired the ownership and sole right of introducing this system in the United States, having satisfied itself that this system is equal, if not superior, to other systems of car lighting now in use. The Pope system has been in operation on some of the large English railways since 1886, and up to the present time over 14,000 cars have been equipped therewith by these roads. The Consolidated Car Heating Company has already entered into contracts for equipping a considerable number of cars in the United States, and has begun arrangements for the erection of gas plants at the principal railroad centers. It is said that this system is practically interchangeable with the Pintsch system, and that the same kind of gas may be used in both.

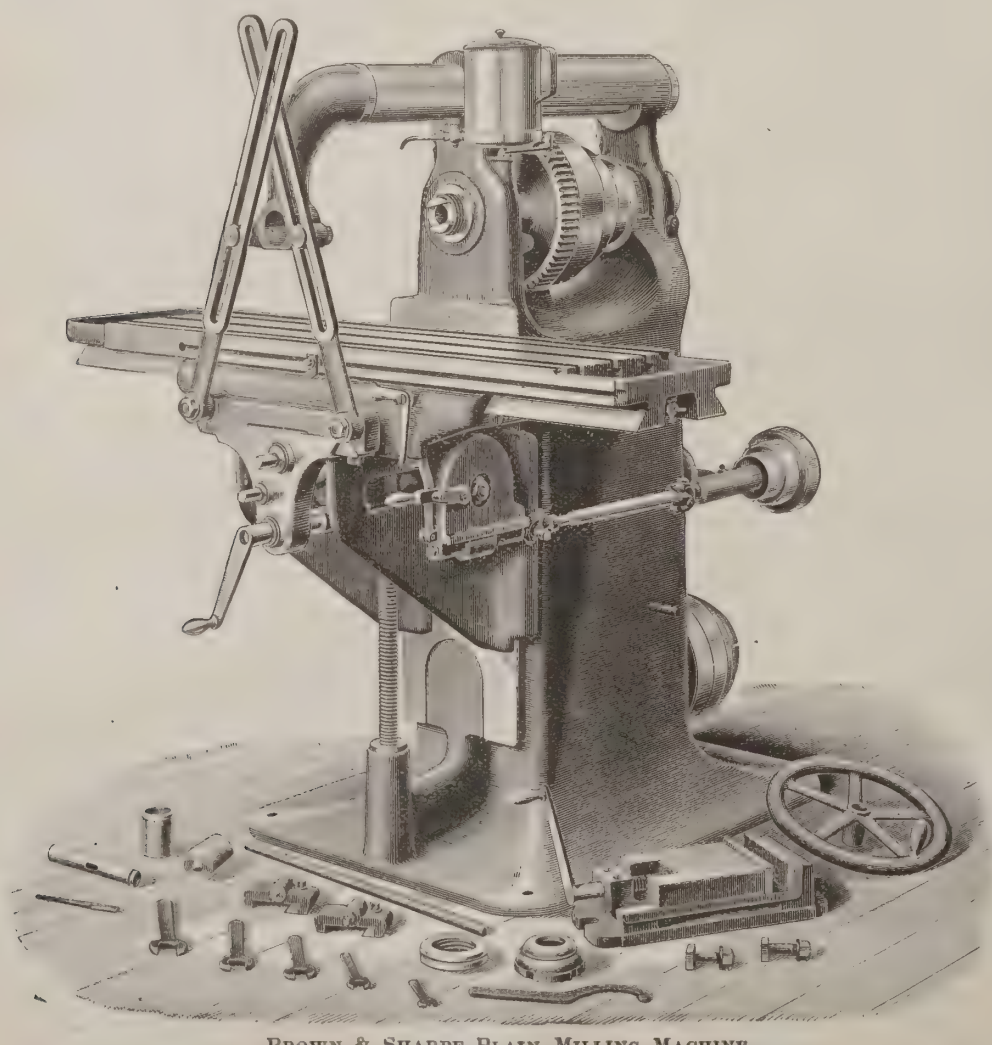
Plain Milling Machine.

This machine has just been placed upon the market, and presents a number of new features, chiefly in connection with the feed. It is made with the intention that it shall be the best machine of its size. The straight bearings are scraped to surface plates, the cylinders are ground and fitted to standards, the feed and elevating screws are accurately cut, and the alignments are correct. In almost every respect, by manufacturing in large numbers with special tools, and by enforcing a thorough system of inspection, the makers have attained much greater accuracy than can be reached by the usual methods of manufacture.

The size of the machine renders it suitable for general shop use. The spindle has a hole its entire length and runs in bronze boxes provided with means of compensation for wear. The front end is threaded and has a hole fitted for arbors with taper ½ inch per foot and 1.25 inches diameter at the small end. The cone has three steps, the largest 13 inches diameter, for 3½ inches belt and is back geared, giving, with two speeds of countershaft, 12 changes of speed. The gears are inside the column. The overhanging arm has a hole for a center, or for a bearing for outer end of arbor, etc. It can be easily reversed to receive an attachment, turned out of the way or removed. The distance from the center of the spindle to the arm is 7 inches; greatest distance from end of spindle to center in arm, 26½ inches. An arm brace is furnished, and with this in position milling can be done to 18½ inches from face of column.

The table, including oil pans and channels, is 60 inches long, 14 inches wide and has a working surface 48 inches by 14 inches. It also has three T slots ¾ inch wide, a transverse movement of 8¼ inches and can be lowered 22 inches from center of spindle. The feed of table, 42 inches, is automatic in either direction and there are 12 changes of feed varying from .05 inch to .23 inch to one revolution of spindle. Adjustable dials graduated to read to thousandths of an inch indicate the transverse and vertical movements of table, and these dials may be adjusted without the aid of wrench or screw driver. The frame is hollow and fitted as a closet to hold the small parts that accompany the machine. On the left side there is a pan for holding small tools, etc., and on the front of this there is a rack for wrenches. The vise has jaws 7⅛ inches wide, 1⅞ inches deep and will open 4½ inches. The countershaft has two tight and loose pulleys 14 inches and 18 inches in diameter for 4-inch belts, and should run to about 200 revolutions per minute.

The machine is made by the Brown & Sharpe Manufacturing Company, of Providence, R. I.



BROWN & SHARPE PLAIN MILLING MACHINE.

The Q. & C. Shop Saw.

In no line of work has there been such a demand for improved machinery in the last few years as in the quick cutting of metal. For small work there has been a very large sale of machines commonly called "hack saws." All of those made up to the present time have been a gravity feed, necessarily slow, with decreasing speed as the size of metal increased. Also a great disadvantage has been that of the expense, the hack saw blade being of short life, and after once using was of no value. In view of these needs the Q. & C. Shop Saw has been designed. It is said to be able to do three times the amount of work of any "power hack saw," and will save its cost in saw blades alone in from two to four months; it is claimed that each saw blade will outlast six dozen ordinary hack saws blades.

The machine is designed for shop use, and will cut all kinds and sizes of metal up to 6 ins. in diameter. It has a positive feed, entirely automatic, and speed can be instantly changed to accommodate hard or soft metal, large or small. With an automatic screw feed adjustable to all kinds of work, the same cutting speed is maintained throughout. The saw blades can be sharpened, and will last 30 days on continuous work.

Some other special features are the horizontal stroke, insuring perfectly square work, and a movable vise, allowing entire length of blade to be used; simplicity of construction and automatic stop.

The claims of speed as above are fully proven by the following comparisons, the cuts made on the old style hack saw having the advantage of a new blade for each and every cut, while the cuts made on the Q. & C. shop saw were made with one blade and without resharpening:

Old Style.			*Q. & C. Shop Saw.*		
1-inch diameter,	9 minutes.		1 inch diameter,	3 minutes.	
2 "	"	36 "	2 "	"	9 "
3 "	"	2½ hours.	3 "	"	27 "
4 "	"	3 "	4 "	"	45 "

These machines are made by the Q. & C. Company, of Chicago and New York.

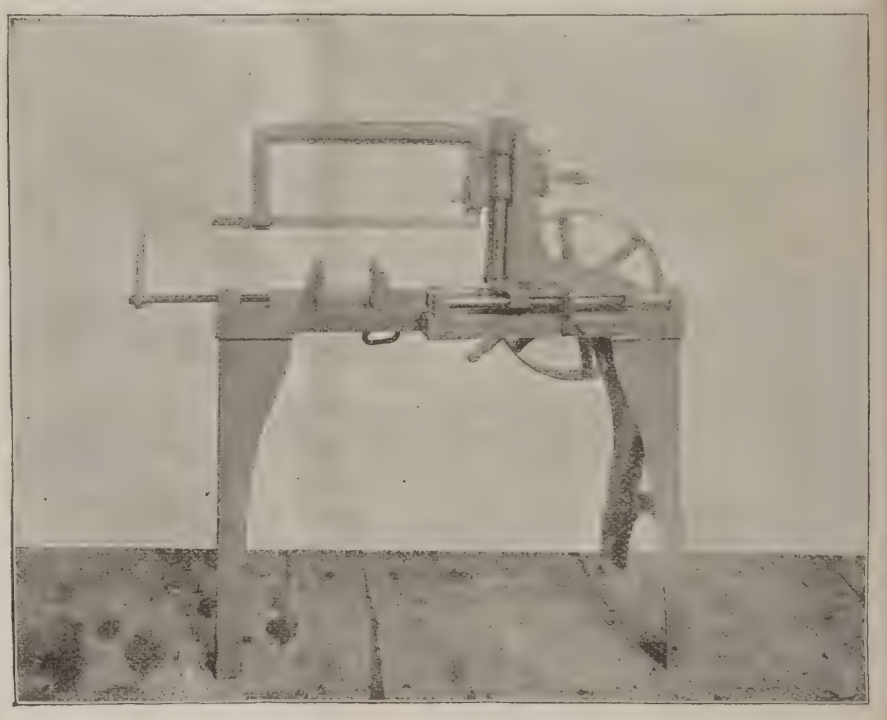
The National Switch and Signal Company, whose offices are at 32 Liberty Street, New York, has about completed its new shops at Easton, Pa., and expects to occupy them about August 1.

Messrs. T. Ibester and H. Woodland, of the Western Union Building, Chicago, have been connected with I. A. Williams & Company, or the Utica Headlight Works, for the past ten and fifteen years respectively; but have now taken the Western agency of the Star Headlight Company, of Rochester, New York, the only company not in the late consolidation of headlight companies.

The courts are evidently according greater credence to the conclusions of the Patent Office and giving more consideration to the rights of inventors. Six important suits decided within a few months in United States courts in various parts of the country awarded damages for infringement and sustain patents for air brakes, for the Edison incandescent lamp, for locomotive brake shoes, for water filters, for hay bands, and for the Cody system of car heating. The more careful system of examining patent applications at Washington in the first instance seems to be bearing good fruit in making such patents as are drawn by competent attorneys, and finally issued, of actual value.

Mr. D. Chase, of the Hygienic Refrigerator Company, of Boston, who are the selling agents for the United States of the material called "Woodnoid," attended the recent M. C. B. Convention at Saratoga for the purpose of introducing Woodnoid to the attention of car builders as a material for use in car construction, and especially the construction of refrigerator cars. Woodnoid is simply spruce wood ground, and then compressed. It is made in sheets of 6 by 3 feet and from ¼ to 1½ inches in thickness. It can be made almost any thickness, but owing to the difficulty of drying when the sheets are of any considerable thickness, it is cheaper to use two or more of the thinner sheets rather than one thick one. Woodnoid is now used largely in the construction of refrigerator and cold storage rooms, and is also used for partition purposes, for the deadening of sound. It is believed that it will prove valuable as an insulating material in refrigerator cars, and, owing to its extreme lightness, that it will come into use in other parts of car construction.

"Mountains, Lakes and Seashore" is the title of a handsomely gotten-up summer guide-book just issued by the passenger department of the New York & New England Railroad, and which makes a decidedly attractive addition to the vacation literature of the season. It is arranged in convenient pocket size and gives in concise and entertaining form a description of the innumerable points of interest along the New York & New England system. The book is profusely illustrated with beautiful half-tone views of scenery, etc., made from special photographs, and besides containing complete information as to routes, excursions, etc., has a particularly valuable list of summer hotels and boarding houses, with rates, distances and all necessary details. Copies of the book may be had on application to W. R. Babcock, General Passenger Agent New York & New England Railroad, Boston. Inclose two-cent stamp for postage.



THE Q. & C. SHOP SAW.

Our Directory

OF OFFICIAL CHANGES IN JUNE.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Atchison, Topeka & Santa Fe.—H. R. Nickerson, General Superintendent, has resigned, and is succeeded by H. U. Mudge.

Buffalo, Rochester & Pittsburgh.—R. R. Mathews is appointed General Superintendent, vice J. H. Barrett, resigned. James Bruce is reappointed Superintendent of the Pittsburgh Division.

Buffalo, Susquehanna & Pennsylvania.—E. A. Cheney has been appointed Purchasing Agent, with office at Austin, Pa.

Butte, Anaconda & Pacific.—C. A. Swindford is appointed Superintendent, vice G. F. Copeland, resigned.

Central Railroad of Georgia.—S. C. Hoge is appointed General Superintendent, vice W. A. Moore, resigned.

Chesapeake, Ohio & Southwestern.—Epes Randolph, General Superintendent, has resigned. O. J. Grammer is appointed Assistant General Manager.

Chicago, Rock Island & Pacific.—W. H. Truesdale is appointed Third Vice-President in charge of the Traffic Department.

Chicago, Peoria & St. Louis—F. C. Dodds is appointed Purchasing Agent.

Cleveland, Akron & Columbus.—J. H. Barrett is appointed General Superintendent.

Elgin, Joliet & Eastern.—J. F. Schler is appointed Master Mechanic, with office at Joliet, Ill.

Georgia Pacific.—W. L. Tracy is made Master Mechanic, vice W. H. Owens, resigned.

Gulf, Colorado & Santa Fe.—John W. Dickinson is appointed Superintendent of the Southern Division, vice C. S. Hayden, resigned.

Hoosac Tunnel & Wilmington.—F. M. Stevens is appointed Master Mechanic.

Jacksonville, Louisville & St. Louis.—John Foulk is appointed General Foreman of Rolling Stock.

Jacksonville, Tampa & Key West.—F. E. Tubbs is appointed Master Mechanic, vice Wm. Rutherford, resigned. The office of General Master Mechanic has been abolished.

Macon & Northern.—A. H. Porter is made Superintendent, vice S. C. Hoge, resigned.

Mexico, Cuernavaca & Pacific.—D. B. Smith, General Manager, has resigned.

Mexican Central—E. H. Whorf, Assistant Manager, has resigned.

New York & New England.—T. H. Fennell is appointed Superintendent of the Western Division, vice H. J. Quigg, resigned.

Plant System.—Wm. Rutherford is appointed Superintendent of Motive Power and Equipment, with office at Savannah, Ga.

Richmond & Danville.—W. H. Owens is appointod General Master Mechanic, with office at Manchester, Va.

NATIONAL CAR AND LOCOMOTIVE BUILDER

AUGUST, 1894.

CONTENTS.

The capital invested in iron and steel mills in Pennsylvania is $200,000,000.

The New York, Susquehanna & Western is in the market for eight freight locomotives.

The Philadelphia & Reading has put 1,000 additional men at work in the car shops at Pottsville.

The Southern Pacific has been contemplating letting a contract for building about 30 locomotives.

The New York, Susquehanna & Western has ordered 400 coal cars from Murray, Dougal & Co., of Milton, Pa.

On July 1 the Richmond & Danville Railroad changed its name to the "Southern Railway" (Piedmont Air Line).

The shops of the Pennsylvania Railroad at Logansport, Ind., have gone to work on full time, 800 men being employed.

The general offices of the Pennsylvania Railroad, at Philadelphia, were moved on July 9 to the Broad street station.

The New York, Ontario & Western has just received two new consolidation engines from the Dickson Manufacturing Company, of Scranton, Pa.

The Portsmouth (Va.) shops of the Atlantic & Danville Railroad are to be removed, it is reported, to Lawrenceville early next year.

The Jackson & Woodin Company, of Berwick, Pa., has received an order from the Delaware & Hudson Canal Company for 150 coal cars.

The old passenger station of the New York, New Haven & Hartford at New Haven, a landmark in that city since 1848, was burned down on the night of July 4.

The New York, Susquehanna & Western has given an order to the Rogers Locomotive Works for eight freight locomoves, the delivery to be made in six weeks.

The Schenectady Locomotive Works have received an order from the Maine Central for 12 mogul, five passenger and three six-wheel switching locomotives.

Three class P engines have just been finished at the Juniata shops of the Pennsylvania Railroad. They weigh 125,000 pounds each and have 80-inch driving wheels.

The Harvey Steel Car Company has received an export order for six steel box cars and six steel platform cars for the Cucuta Railroad, a meter (39 in.) gage railroad in Colombia.

The first passenger train went through the new tunnel of the New York, Susquehanna & Western Railroad Co., under the Palisades Mountains at Fairview, N. J., on July 17.

The car shops of McKee, Fuller & Co., of Fullerton, Pa., which have been idle for a year past, have resumed operations, a contract for 1,500 gondola cars having been received.

The sale of the East Tennessee, Virginia & Georgia Railway to the Southern Railway Company was confirmed at Knoxville, Tenn., July 14, by Judge Lurton, of the United States Circuit Court. The attorneys' fees in the case amounted to $30,000

A steel rail cost twice as much as an iron one, but the universal use of the former means millions to the farmers of the West. It has enabled railroads to use larger and heavier cars, and the results are cheaper freights and quicker transportation.

A mail car on the Atchison, Topeka & Santa Fe road was burned at Timpas, 20 miles from La Junta, Col., July 21. The fire is supposed to have caught from sparks from the engine. More than 200 sacks of papers and 20 pounds of letters, all for California points, were consumed.

First Passenger—Beg pardon, but what are you reading that you find so interesting?

Second Passenger—It's an article showing the terrible effects which are likely to follow reading in a moving railway car. It is very interesting, and so convincing, too. (Proceeds with his reading.)

A company has been formed to build a terminal road at Milwaukee, to be known as the Chicago–Milwaukee Terminal and Belt Line Company. The company will be capitalized for $6,000,000, and purposes constructing a terminal which will be capable of accommodating seven large railroads. Among the Milwaukee men interested are Captain Frederick Pabst, Burnham Brothers and the Pfister & Vogel Leather Company.

A rainmaker in India has an apparatus, consisting of a rocket capable of rising to the height of a mile, containing a reservoir of ether. In its descent it opens a parachute, which causes it to come down slowly. The ether is thrown out in fine spray, and its absorption of heat is said to lower the temperature about it sufficiently to condense the vapor and produce a limited shower.

The M. C. B. Rules of Interchange, as revised at Saratoga in June, and which are to go into effect on Sept. 1, 1894, are ready for distribution, and they will be furnished at the same rates as heretofore, viz.: 25 copies, $1; 50 copies, $1.75; 100 copies, $3. A less number than 20 copies at 5 cents per copy. Parties who wish copies should address the secretary, Mr. John W. Cloud, 974 Rookery Building, Chicago.

Two track repairers were badly hurt near Nashville, on the Louisville & Nashville, a few days ago, by a rail which flew up when they took it out of the track in the course of repairs. By the expansion due to the heat of the sun the rail was so compressed endwise that when the spikes were loosened and the ends were moved laterally the rail tended to take the form of a bow, and sprung out with violent force.—*Railroad Gazette.*

The largest rope in the world is being made by the Lambert Rope Company, of New Bedford. It is to be used on the driving wheel in the engine room of the Chicago Cable Railroad Company. It will be three inches in diameter and eleven inches in circumference. There will be twelve of these ropes on the wheel, each of them will be 1,260 feet long, and the combined length of the twelve ropes will be three miles. The cost will be $5,000.

The statement of the Illinois Central Railway for the 11 months ended on May 31 has been issued. It shows gross receipts from traffic of $19,320,129, an increase over last year of $1,177,343. Operating expenses and taxes were $13,289,083, an increase of $158,784. Gross receipts from traffic for June are estimated at $1,349,763; for June, 1893, the receipts were $1,952,405. The usual dividend of 2½ per cent. was declared, payable on Sept. 1.

Petroleum is to be used instead of coal on the locomotives of the Riga Railway, in Russia. Reservoirs are to be established for this purpose at Reval, Wesenberg, Norwa, Gatschina, and St. Petersburg, capable of containing collectively 1,000,000 poods of petroleum. Petroleum is also to be adopted on the Dwinsk–Riga Railway, but this change cannot take place for some time to come, inasmuch as the coal contracts for the next five years are already arranged. —*Engineering.*

The removal of the offices of the Pennsylvania Railroad to the splendid new building at Broad Street station, which occurred early in July, is an event of considerable significance, not only in the history of this great corporation, but in the development of Philadelphia. The Broad Street station is in itself a monument of Philadelphia enterprise that, together with the corresponding station of the Reading system two squares below, puts the city in the very first rank as regards facilities of travel.

On a 10 per cent. cut in wages being ordered on the East Tennessee, Virginia & Georgia Railroad, the employés appealed to the United States Circuit Court at Nashville, Tenn., for an injunction restraining the receivers from reducing wages. On July 22, Judge Lurton dismissed the petition on the ground that the reduction was advisable on account of business depression. The 30 days' notice provided for in the contract with employés had been given. The road, for reasons satisfactory to the Court, was taxed with the cost of the hearing.

The value of railway material imported by Spain in 1893 is given in a late consular report as follows: Rails, 18,592 tons, as against 11,210 tons in 1892 and 12,491 tons in 1891. Ironwork for bridges, 511 tons, as against 1,192 tons in 1892. Value of rolling stock—First-class carriages, $17,800, as against $51,000 in 1892; second-class carriages, $23,500, against $20,500; third-class carriages, $30,000, against $79,000; freight cars, $64,500, against $206,000. The Spanish railways are evidently putting themselves in shape to supply their own rolling stock.

General Manager Woodford, of the Cleveland, Lorain & Wheeling, has just decided to replace all the small wooden bridges on the road with iron bridges. It has been estimated that the cost of making the substitution will be only $62,000, most of the bridges being single, short spans. Three years ago the same work was under consideration, and the cost was then estimated at $125,000, twice the present expense. Construction now is doubly important. It can be made at minimum cost, and it will give immunity from future possible incendiarism.

The growth of the use of electricity as a motive power is remarkable. Two years ago there were only 161 electric railroads in the United States, while now there are over 500. Six years ago an electric car with two motors cost $4,500, while now it costs about $640. It seems singular that with such a constantly increasing demand there should be such competition as to run prices down to one-seventh of what was paid six years ago, but such is the case, and before it stops there will be comparatively few lines of street railroad in the country not run by electricity.

As showing the effect of high train-speed on coal consumption, a committee of the American Railway Master Mechanics' Association made the following statement in its report to the last convention: The time of a train scheduled to make 100 miles in four and one-half hours with six cars and twenty-seven stops was reduced to four hours, and immediately the fuel bill for that train was increased $100 per month with the same engine and men; and when the running time was changed back to four and one-half hours the fuel record at once dropped to its old figures.

It gives an impressive idea of what subterranean London is fast becoming to learn that, on emerging from the river the new City & Waterloo line will, in its passage up Queen Victoria street, run for a part of the way under the low level main sewer, which, in its turn, runs along beneath the district underground railway. So that at this point in the city we shall have, first, a busy main thoroughfare, below that a steam railway, then a huge metropolitan sewer, then an electric railway, reaching its terminus at a depth of about 63 feet below the streets, and here it will communicate with another line—the Central London—which will lie at a depth of 80 feet.

The passengers on a Colorado Midland train had a curious experience, July 21, near Colorado Springs. While the train was running about 20 miles an hour, a big bull which was in a herd of cattle, turned and charged the engine. The animal's head was cut off and the engine left the track, running on the ties about 70 yards, and dashed into the eastern side of the cut, while the tender was swung across the track and the baggage car plowed into the west bank. The day coach also left the track, but the chair car and Pullman remained on the rails. The engine crew saved themselves by jumping. Had the train run 100 yards farther it would have gone over a high embankment.

The car ferry between Menominee and Frankfort, Mich., in connection with the Toledo, Ann Arbor & North Michigan Railway, has been inaugurated, the first trip having been made July 3. The boat was loaded with 22 cars of lumber, billed to New York, Philadelphia and other Eastern cities. The opening of this direct rail route from Menominee and Marinette marks a new and important departure in the lumber trade on Green Bay. Direct shipments by the carload can now be made from the mills of that district, as well as from the interior of upper Michigan and Wisconsin. It is a cut-off that will divert much product to the east in assorted car lots which otherwise would go from lower Michigan and by the Chicago route.

In a recent address Mr. Berthelon, a noted chemist, suggested as a subject for the attention of the next generation of engineers the substitution of the central store of heat contained in the earth as a source of energy for that derived from coal. The sinking of a shaft three or four kilometers deep is not beyond the power of modern and especially of future engineering. At such a depth water would be found with a temperature of 160 degrees to 200 degrees centigrade, which would develop enough power for any number of machines. This power would be available in any part of the globe, and many thousands of years would pass away before this store of energy would suffer an appreciable diminution.

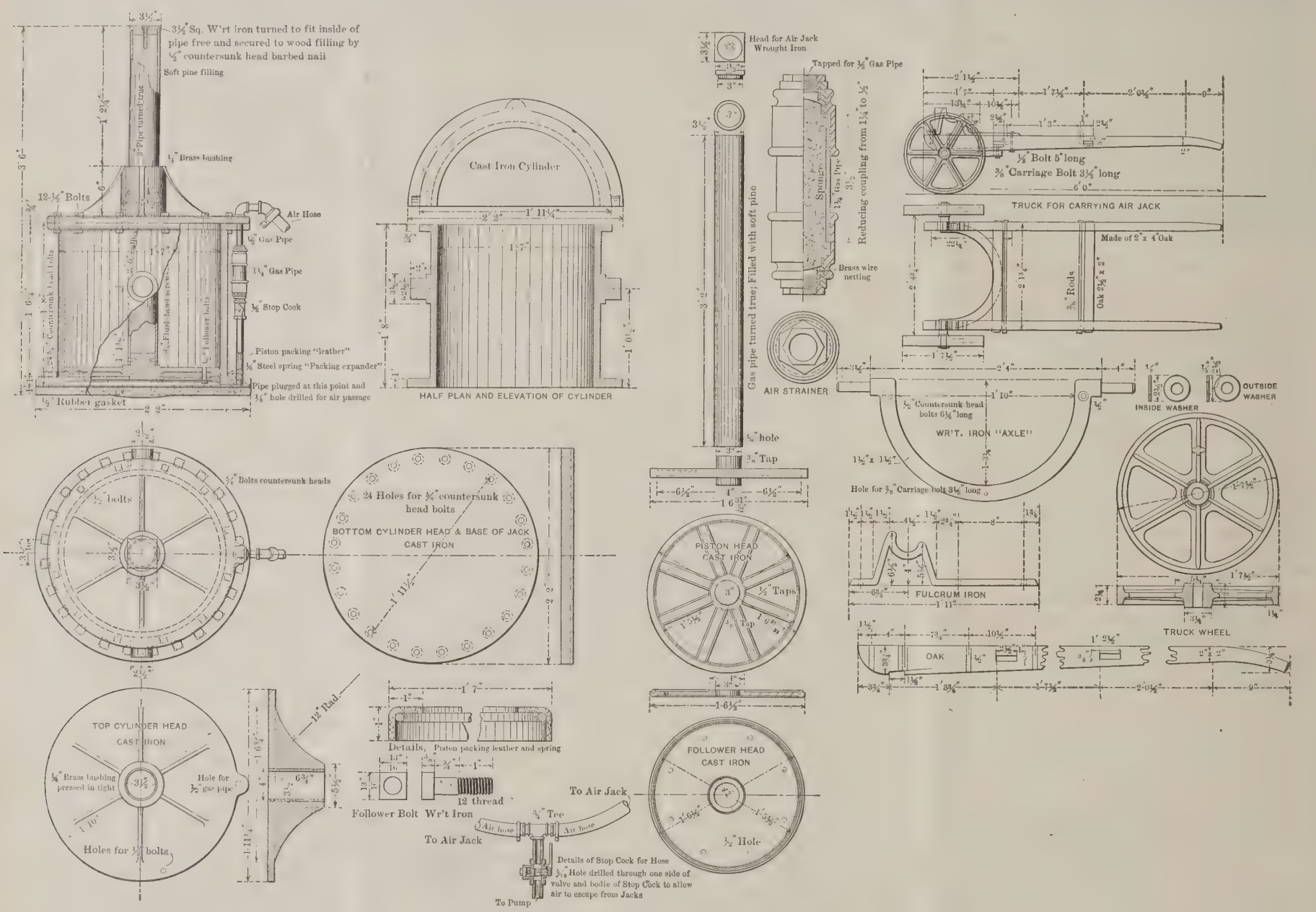
One of the most attractive features of the old Broad Street Station of the Pennsylvania Railroad at Philadelphia was the big map of the country painted on the wall of the general waiting-room, where it was always viewed with much interest. It disappeared in the general tearing-out of the old quarters, but will have a worthy successor in a new map which the Pennsylvania Railroad officials contemplate having painted in the new station. This will be a monster, 115 feet long and 15 feet wide, and will be the biggest thing of its kind in the world. It is to be painted on canvas, and will adorn the Filbert street side of the great waiting-room. Not only will it show the entire Pennsylvania system and its connections, but all the rest of the country as well, from the Atlantic to the Pacific, and from the Gulf of Mexico to Canada.

Pneumatic Jack, 20,000 Pounds Capacity, Union Pacific Railroad.

The engraving presented herewith illustrates a 19-inch pneumatic jack used in and about the Union Pacific car shops at Omaha for jacking up passenger coaches, sleepers and dining cars. With 70 pounds air pressure, it has a capacity of over 19,500 pounds. These jacks are used in pairs. One is placed on either side of the car at the end to be lifted, after the fashion of screw-jacks. By branch hose the jacks are connected to the main supply hose. In the main, at the point where the branches start, is a stop-cock for regulating the supply and discharge; by this cock air is supplied and discharged simultaneously from both jacks. The time required to raise a car after the jacks are set does not exceed 30 seconds.

The cylinder and heads are of cast iron. The piston head and follower are cast iron, fitted with the usual leather packing. The piston rod is formed of 3-inch gas-pipe filled with wood.

By referring to the drawing it will be seen that the bottom cylinder head has a circular swell carried across its face. The jack is set so that this swell will stand cross-wise of the car. This arrangement permits the jack to accommodate itself to the increasing angle assumed by the car body as it rises; the piston rod thereby always stands at right angles with the car, and is thus relieved of all transverse strain.



20,000-POUNDS CAPACITY AIR JACK, UNION PACIFIC RAILROAD.

To the United States for the year was $1,220,751,874, being an increase of $49,344,531 over gross earnings reported in the previous year. Operating expenses during the year were $827,921,299, being an increase of $46,923,303 over the previous year. The final net income available for dividends was $111,058,034, being a sum less than the corresponding amount for the previous year.

One hundred and seventy-three more railway employees were killed during the year than those killed during the previous year, the total number being 2,727. The number of employees injured was 31,729, or 3,462 more than the number injured in the fiscal year 1892–93. Seventy-seven less passengers were killed and two more were injured during the year than in the previous year. The numbers were: killed, 299; injured, 3,229.

Railway Statistics of the United States.

The sixth statistical report of the Interstate Commerce Commission for the fiscal year ending June 30, 1893, which has just been published, shows that the total mileage of railways in the United States on June 30, 1893, was 176,461, being an increase during the year of 4,897 miles. Washington State takes the first place in new construction with 556 miles, Montana showing 409 miles, Minnesota 406 miles and West Virginia 365 miles. Nineteen roads were abandoned during the year. The total length of line, including all tracks, was 230,137 miles, which embraces 10,051 miles of second track and 42,043 miles of yard track and sidings.

The total number of railway corporations in existence was 1,890, being an increase of 68 during the year. Of this number 752 were independent operating roads, and 939 maintained operating accounts. The tendency toward some form of consolidation during the year was marked: 28 roads, representing 749 miles, were merged; 20 roads, representing 1,732 miles, were reorganized; and 16 roads, representing 1,469 miles, were consolidated.

The total number of employees in the service of railways on June 30, 1893, was 873,602, being an increase of 52,187. The aggregate of property properly classified as railway capital was on June 30, 1893, $10,506,235,410, which shows railway capital equal to $63,421 per mile of line. The amount of investment in the railway securities increased during the year from $1,391,457,053 to $1,563,022,233, being an increase of $171,565,180. The total of dividends paid was $100,929,885. The total number of passengers carried during the year was 593,560,612. Passenger mileage during the same year was 14,229,101,084. The number of tons of freight reported by the railways was 745,119,482. Ton-mileage was 93,588,111,833; passenger train-mileage was 335,618,770; and freight train-mileage 508,719,506.

The gross earnings from operations on the railways of

A Tale of Woe.

The Jacksonville, Fla., *Times-Union* relates the following: "Sunday afternoon the pony truck axle on the one engine which the Jacksonville, Mayport & Pablo Railroad boasts, broke eight miles from Jacksonville, and a number of the passengers had to foot it to town. For two weeks past the engine has been run one-sided or with one cylinder. It was unable to develop sufficient power to pull a coach, so a flat car and an unobstructed view of the scenery was what the passengers had to enjoy. On the flat car was placed a hand car. The hand car was there for the same reason that a lifeboat is on the deck of a ship—to provide for accidents. When the axle broke the hand car had to be launched. There were only two ladies on board the flat car, and, of course, theirs was the privilege of riding on the hand car, instead of walking the eight miles to town, which was the lot of the less fortunate male passengers. A mile up the track the hand car ran off, and the ladies were thrown in the air, but landed in soft places, and were unhurt. The same accident happened three times, but they got to Jacksonville uninjured, and are rather proud of their adventure than otherwise. The new engine which Receiver Marvin has ordered for the road is expected daily."

The first iron bridge ever built is still in use. It spans a small stream on the Worcester & Shrewsbury Railroad, in England, and was erected in 1778. It is 96 feet long.

The California International Midwinter Exposition was officially closed July 4. The final celebration was that of San Francisco Day. The admissions were estimated at 75,000.

A passenger train, while going down a heavy grade on the Arcanada Mountain, in Spain, between Lezana and Bilbao, July 7, was thrown down an embankment. Fourteen passengers were killed and fourteen injured.

For the ready handling of the jack the special truck illustrated is provided. When the truck handles are raised the fulcrum irons or bearings can be engaged with the trunnions cast on either side of the cylinder. The drawings show in detail the several parts of the jack and truck.

We are indebted to Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific, for the drawings of this tool, and to Mr. J. H. Manning, Master Mechanic at Omaha, for the foregoing particulars.

Mr. McConnell informs us that the more he studies the subject of the useful application of compressed air the wider grows the field of its apparent usefulness. Since the Omaha shops were visited by a representative of the NATIONAL CAR AND LOCOMOTIVE BUILDER, whose observations were related in the May issue, some further applications of this useful agent have been made on the Union Pacific. An arrangement has been devised for whitewashing cattle guards by its help, and the compressed air arrangement we previously described for whitewashing buildings (see May issue, page 71) recently accomplished an unsurpassed whitewashing feat. It whitewashed the foundry at Omaha, a structure 80 by 250 feet, inside and out, on a Saturday between eight o'clock in the morning and six in the evening—ten hours. An

Repairing Locomotives. XIII.

BY J. T. HEFFERNAN.

(*Continued from page* 88 NATIONAL CAR AND LOCOMOTIVE BUILDER *for June.*)

Main Rods.

This paper will treat on the fitting up and laying out of main rods, and the different rods shown embrace the principal forms of rods used. To commence with we will explain the duty of the main rod. The main rod connects the crosshead with the main driving wheel, and the power of the piston is made effective on the wheels through the action of the crosshead and from the crosshead direct to the wheel by means of the main rod. The main rod has very hard duties to perform, being subject during one stroke to a pull and during the other stroke to a push. The piston acting on the crosshead when it is a push, the strain is directly on the rod and the rod must be strong enough and the area of its cross section must be great enough to withstand the full pressure exerted on it without springing. On the other hand, when the steam acts on the piston so that the force exerted through the main rod is a direct pull, then the straps must be strong enough to withstand this strain without any danger of breaking, and the bolts which connect the straps to the rods must be of an area great encugh to resist the shearing strain which is placed on them. The rod shown in Fig. 102 is designed for very heavy work, and the straps are secured at each end by three bolts.

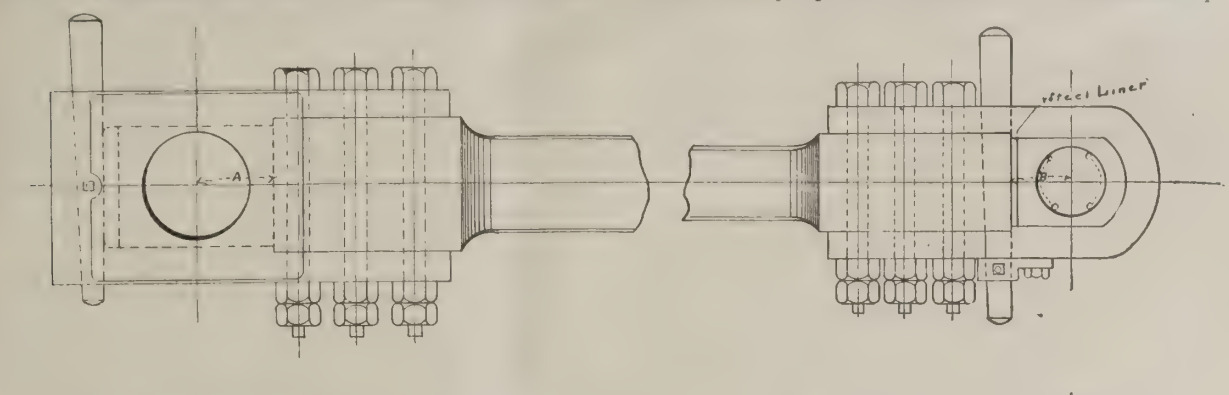


Fig. 102.

Perhaps we had better explain here the method of doing the machine work on a rod—that is, taking it just as it comes from the blacksmith shop. We will suppose that we are going to lay this rod out for an engine which has been in service, but has been wrecked, and among other parts destroyed were the main rods. Now, from the engine we must find the proper length of the main rod before we can do any machine work on the forging for the rods. The length of the main rod is the distance from the center of the main axle to the center of the crosshead pin when the crosshead is in the middle of its stroke. If we measure from the crosshead pin to the center of the axle, and take this distance as the length of the main rod from the center of crosshead brass to center of main pin brass, our rod will be the right length. After having fitted up the brasses and trued up the straps, put the brasses and straps together and measure the distance from the center of the brass to the outer edge of the brass, as shown by the line *A* in Fig. 102. Then, on the forward end, measure the distance from the center of the brass to the back end of the brass, including the steel liner. Add these two distances together and subtract the sum from the distance we have found by measurement on the engine as the proper length of the main rod. The remaining distance will be the length of the rod exclusive of the brasses.

The next move will be to center the rod at each end, drill in and put good centers in it, then put it in the lathe and face off the ends and bring it to the length required. After doing this, mount the rod on centers on a planer, plane off the sides to the thickness of the straps, then plane it to a fit for the straps. To do this with but very little measuring, it is a good plan, while the rod is in the lathe, to draw two circles on each end, one circle corresponding to the width of the rod and the other to the fit of the rod in the strap, then planing close to these lines will bring all the distances of the rod about central. Next fit on the straps and lay out for the bolt holes. After drilling the rod, put the straps in position and ream the holes, being careful to get nice clean holes so that the bolts can be turned for a good fit. In our next paper, which will be on side rods, we will go into detail regarding the fitting up of worn straps, showing the manner of closing them, removing tight bolts, etc., so in this paper we will just explain the principal points to be looked after when fitting up main rods.

In the rod shown in Fig. 102 the forward end of the rod was designed to fit in a crosshead suitable for four barred guides. Now we can readily see that the forward end of the rod makes only a partial revolution on the crosshead pin and for that reason the crosshead pin, and likewise the brasses, will be worn more and have a tendency to wear flat on the forward and back sides. For this reason the crosshead pin is flattened on the top and bottom and the crosshead brass also filed out at the top and bottom so as to bring the bearing on the brass as shown by the dotted lines connecting the points 00 00. This allows the brass to have an overtravel over the flat on the pin, preventing the forming of much of a shoulder. Even with this precaution the brasses and pins still wear more along the center and have to be refitted and filed away to give clearance after they have run for a while. Now as to whether a crosshead brass should be filed "open." That is if the brasses, when they are on the pin, should not butt together or whether they should be fitted so as to come together, is an open question. The general practice is to file them "open," and the writer believes it is much the better way, as then, if a man is careful, there is no need of his keying his rods too tight, and the forward end will not require to be taken down near so often. About $\frac{1}{16}$ inch is the proper distance to leave the brasses apart, then when the brasses butt it will be time to take them down and true up the pin a little and file the brasses for clearance, top and bottom.

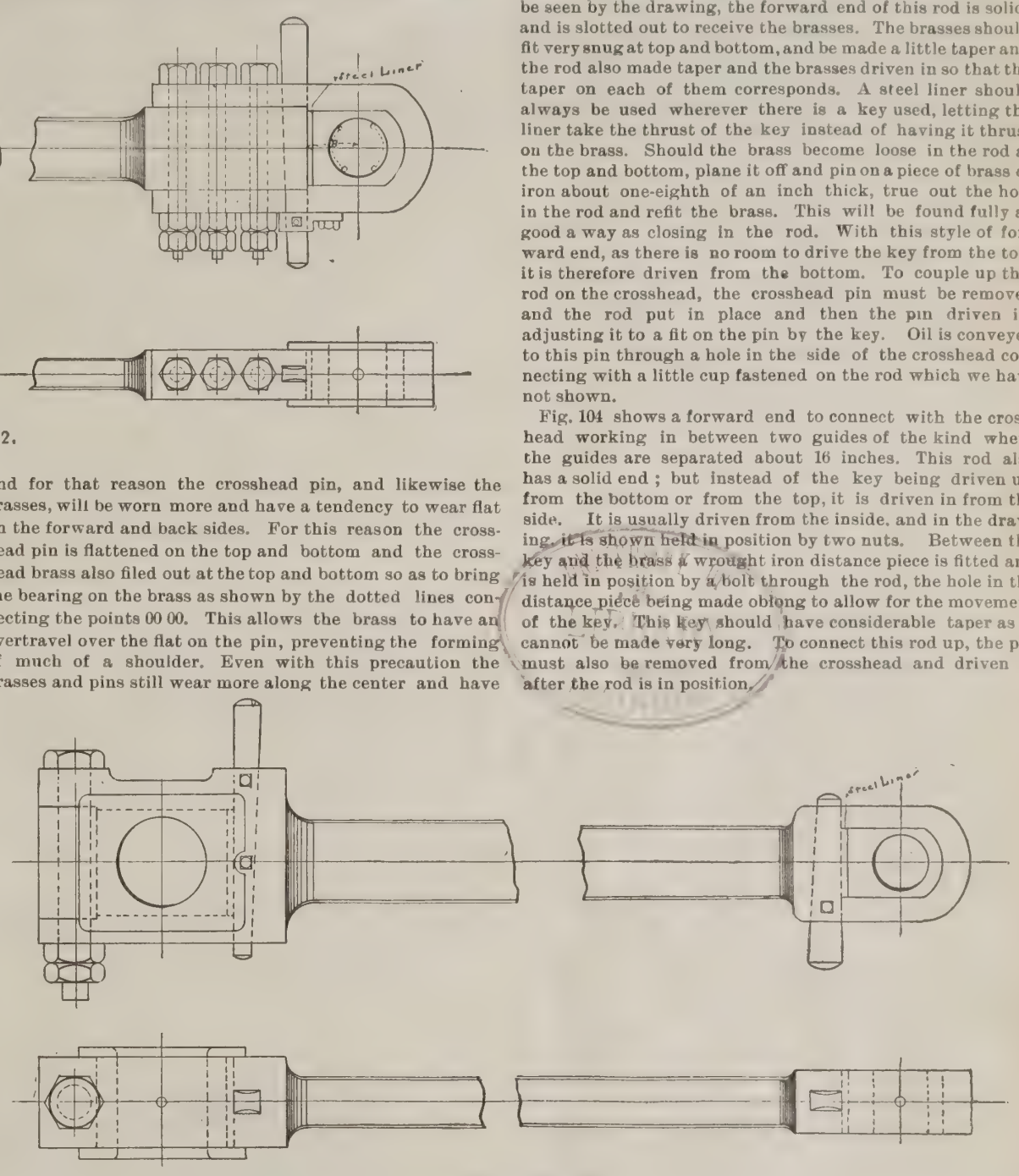


Fig. 103.

The forward end is made with no babbitt in it and is left all brass, and should never be keyed tight enough to make it pinch, for while it will not bother much by heating, still if keyed too tight and it gets to cutting a little it will tear ridges in the pin and in the brass, and besides it will throw a great strain on the crosshead, making it pound at each end of the stroke. If it happens to be a four barred guide with a light crosshead the pound will declare itself loudly, and will sometimes deceive a man by leading him to believe that it is the main rod which requires keying up, when instead of that it is the forward end of the rod that needs to be slacked up a little bit.

In the rod shown in Fig. 103, the forward end of it is made to connect with the crosshead using Laird guides. As will be seen by the drawing, the forward end of this rod is solid, and is slotted out to receive the brasses. The brasses should fit very snug at top and bottom, and be made a little taper and the rod also made taper and the brasses driven in so that the taper on each of them corresponds. A steel liner should always be used wherever there is a key used, letting the liner take the thrust of the key instead of having it thrust on the brass. Should the brass become loose in the rod at the top and bottom, plane it off and pin on a piece of brass or iron about one-eighth of an inch thick, true out the hole in the rod and refit the brass. This will be found fully as good a way as closing in the rod. With this style of forward end, as there is no room to drive the key from the top, it is therefore driven from the bottom. To couple up this rod on the crosshead, the crosshead pin must be removed and the rod put in place and then the pin driven in, adjusting it to a fit on the pin by the key. Oil is conveyed to this pin through a hole in the side of the crosshead connecting with a little cup fastened on the rod which we have not shown.

Fig. 104 shows a forward end to connect with the crosshead working in between two guides of the kind where the guides are separated about 16 inches. This rod also has a solid end; but instead of the key being driven up from the bottom or from the top, it is driven in from the side. It is usually driven from the inside, and in the drawing, it is shown held in position by two nuts. Between the key and the brass a wrought iron distance piece is fitted and is held in position by a bolt through the rod, the hole in the distance piece being made oblong to allow for the movement of the key. This key should have considerable taper as it cannot be made very long. To connect this rod up, the pin must also be removed from the crosshead and driven in after the rod is in position.

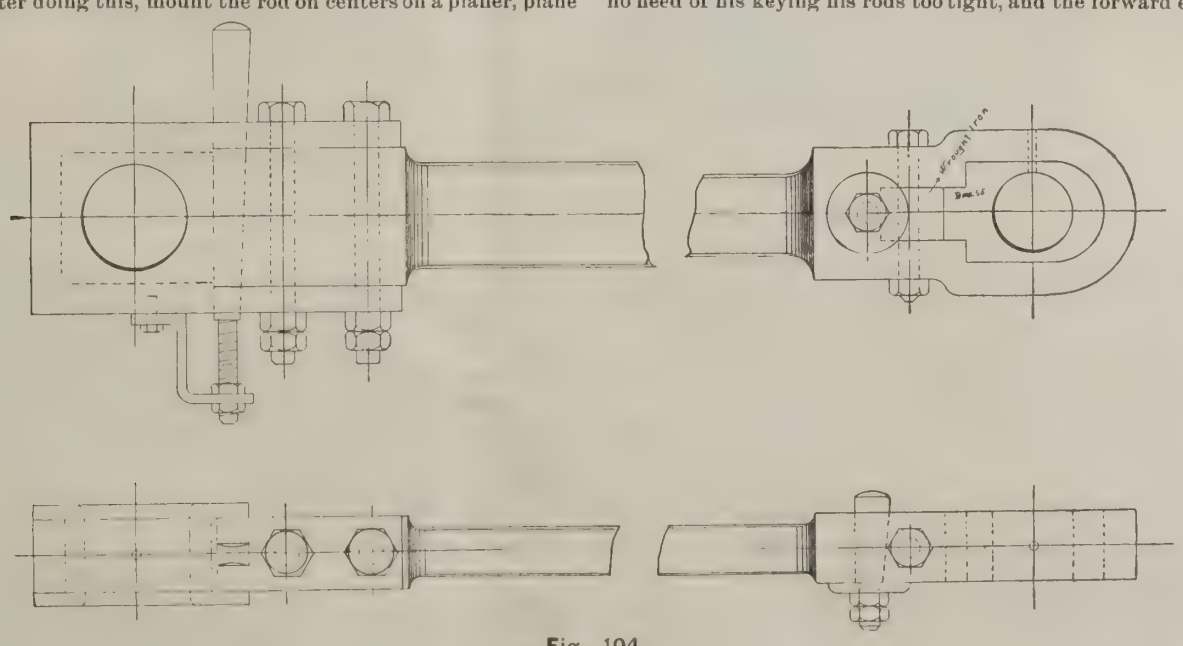


Fig. 104.

In the rod shown in Fig. 105, the forward end is fitted with a strap, and this strap is fastened to the rod with one bolt. Of course at first this looks to be a very weak connection, as it looks as if the whole strain came on the bolt, but with a little study we can readily see that the key carries a great deal of this strain. As we have already explained, the action of the main rod has two strains, one a pushing or upsetting strain and the other a pull acting as a shearing strain on the bolts; now when there is a pushing strain, the force is exerted on the back half of the brass C, and passes through it direct to the rod and on through to the main wheel without throwing but very little strain on the strap; and when it comes to the other half of the stroke it is a direct pull and the force is first exerted on the forward half of the brass, and is transmitted to the strap. The force is exerted in a manner which tends to pull the strap from the rod, causing a shearing strain on the bolt. Referring to the drawing, we see that the key has a bearing in the rod along the line E and has a bearing in the strap on the opposite side or along the line FF. thus taking up its full share of the shearing strain exerted on the strap. In fact the key takes all the shearing strain because the hole in the strap where the bolt passes through is made oblong to allow it to move up on the rod as the key is driven, and therefore as the bolt does not fit the hole there can be no shearing strain on it, and its only purpose is to secure the strap to the rod and serve as a guide or keeper for the key. The writer does not consider this a very safe connection, and can see no real good reason for its use, because wherever this strap can be used an end connection, as show in Fig. 103, which is a much stronger connection, and is lighter, cheaper to make and easier to keep in repair, can be used. Wherever practicable the writer believes a solid end should be used on the forward end of the main rod.

The butt end of a main rod is a bearing which requires the closest attention of any bearing about the engine. In fitting up the brasses in it great care should be taken that they are a good fit in the strap, and when filing them to a fit on the pin the brasses should butt together, and then be just a nice working fit on it.

When reducing brasses, it is well to ease off the fillet a very

little, more especially at the top and bottom; then after the brasses have been closed put a little lampblack or red lead on the pin, then put the brasses in the strap and try them on the pin; drop in the first bolt, and between it and the brass put a piece of iron (a nut is about as handy a thing as can be used), then drive in the key and turn the brasses on the pin. Try them for lateral motion, of which they should have about $\frac{1}{32}$ inch, and see that they move up against the collars of the pin; if so, all right. Drive out the key and take the brasses off the pin and notice if there is any sign of a bearing around the fillet, if there is, ease it off a little. The brasses may not show a good bearing on the pin, but if they have run cool don't disturb the bearing, because that is the way it has been running, and if disturbed it might not run cool again until it has made its own bearing. This rod shows a key on the after side of the crosshead brass and on the after side of the crank pin brass, so that keying up this rod will have but very little tendency to change its length. As the brasses in the crosshead get worn and allow the key to be driven clear down, disconnect it and put a liner in between the steel liner and the brass, thus raising the key again. If

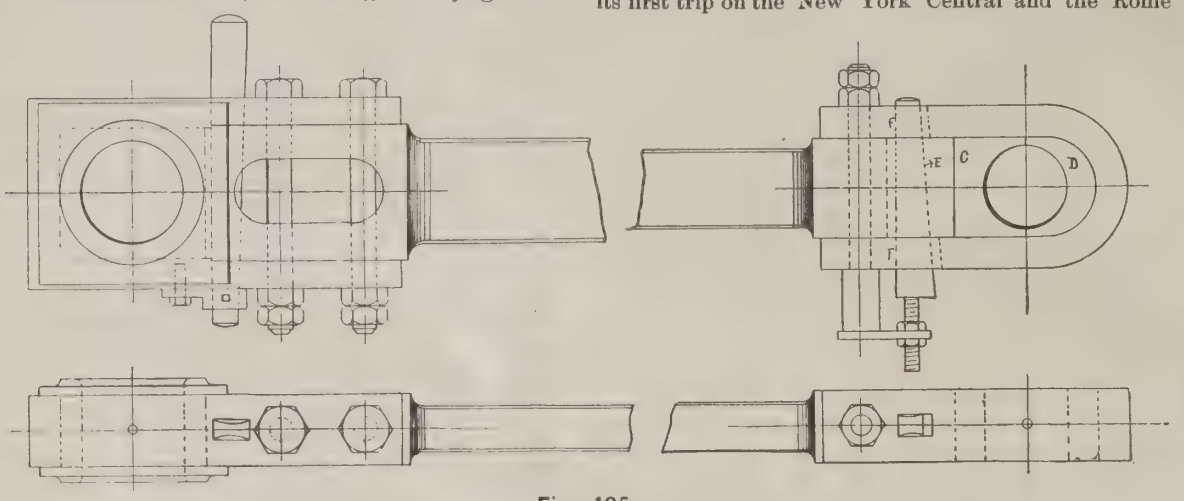


Fig. 105.

possible, always avoid fitting a liner between the forward crosshead brass and the strap, because it is usually on a circle and makes an awkward liner to fit. The rod can usually be kept the right length by putting the liners all in the back of the crosshead brass and all back of the crank pin brass. If it is found that the rod cannot be kept the right length in this manner, divide up the liners.

In Fig. 103 we have a rod that will change its length as we drive the keys. When the keys are driven in, the rod will become longer, but the design of the butt end is such that the key cannot be fitted in the after side. This rod has no strap, but instead the rod itself forms a binder for the brasses and is secured by a block being fitted in and a bolt which passes through the rod and through the block, thus securing all together. This is a very nice form of main rod and one on which repairs can be made with but very little expense. It has much to commend it for general use and is much lighter than the other form of rod having the same size brass. These rods are used extensively on the West Shore road where they have given very satisfactory results.*

Fig. 104 shows the back end of the main rod connected up with two bolts, and instead of set screws being used on the key, the bottom of the key is threaded and the adjustment is made by means of nuts engaging with a keeper which is securely fastened to the bottom of the strap.

Fig. 105 shows a different manner of holding a key—by means of a set screw and keeper, the same as used in the forward end of the rod in Fig. 102. The brasses in this rod differ slightly from the brasses used in the other rods described, and instead of allowing the full width of the brass all along, a collar is formed, the remaining part of the brass being made somewhat lighter, which is of considerable advantage since the use of very large brasses has come into practice. Sometimes to lighten the butt end, a section of the metal is cut out, which is clearly shown in Fig. 105.

A main rod should always work in line, and when fitting the brasses this should be kept in mind. After fitting the crosshead brasses to a good bearing, connect them up to the rod and see if they fit in such a manner that the butt end of the rod is central on the pin, and also that there is no twist. To find out whether there is a twist or not, rest the rod on the top of the pin, then place one straightedge on the collar of the pin and another up the side of the rod. If the two straightedges are parallel the rod has no twist, but if they are not parallel the crosshead brasses should be taken down and refitted until they do come parallel, then when they are found to be correctly fitted, disconnect them and then connect up the crank-pin brasses, trying the rod in just the same manner to see that it lines right for the crosshead pin and has no twist in it. I have known cases were four barred guides were used, and where the crosshead would chafe against the side of the guides and run warm when the trouble was caused by the defective fitting of the crosshead brasses.

In the crank pin brasses, four strips of babbitt are generally used, two in each brass, and occasionally we run across a brass which is drilled and babbitt filled in the holes formed by the drill. The writer has run brasses which had recesses in them for babbitt, but in which the babbitt was chipped out and in its place a thin strip of wood wound with lampwick was used and it gave excellent results. I believe this method is used to some extent on the West Shore road. The lampwick is well soaked in oil before the brasses are connected up, and each slot acts as an oil cellar.*

The Canadian Pacific Railroad at the Montreal shops has in the last 10 years built outright 203 locomotives. The capacity of these works is estimated at seven complete locomotives per month.

* A letter from Mr. James M. Boon, Assistant Superintendent Motive Power West Shore Railroad, appears on page 123 of this issue, relative to these points.

Early Sleeping Cars.

The labor troubles of the last few weeks, in which the Pullman Palace Car Company has been a central figure, have recalled to many of the older people of the present generation the times when there were no such things as sleeping cars, and travelers who were obliged to pursue their journey at night had only the alternative of trying or not trying to catch a few winks of sleep sitting upright in the uncomfortable straight-backed seats.

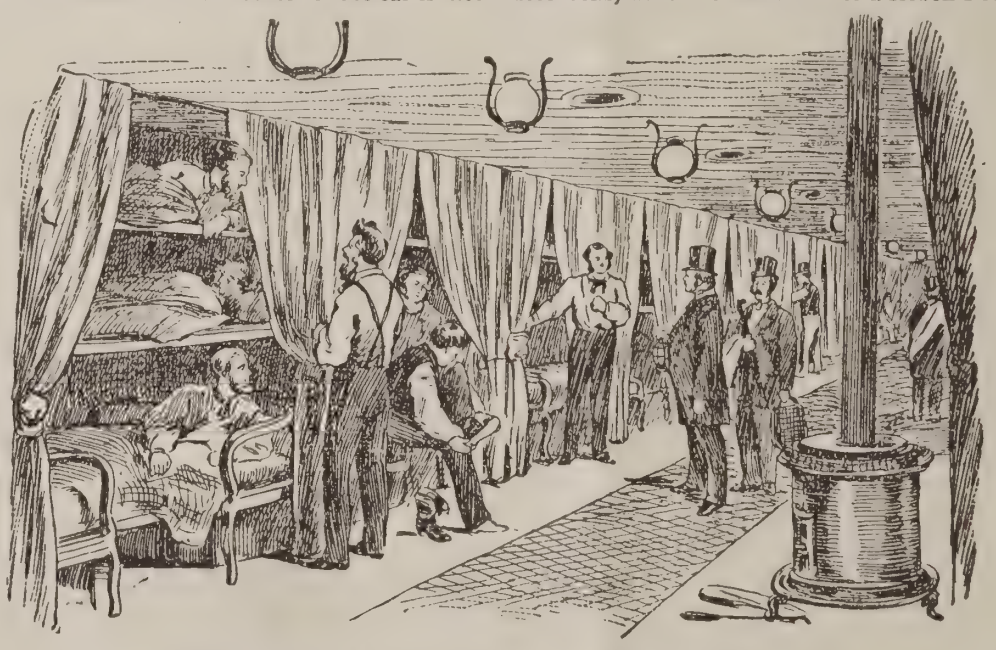
It was just about forty years ago that the idea of a sleeping car for night travel first took tangible form.

According to the tradition preserved by the Wagner Palace Car Company, the originator of the sleeping-car was Theodore T. Woodruff. The honor is also claimed for "Ben" Field, of Albion. Albion was the early residence of George M. Pullman, and it is to him, it is said, that the Pullman cars owe their origin. Mr. Woodruff prepared his model at Rome, N. Y., in 1854.

Mr. Woodruff found a patron in Mr. Watson, the car builder, of Springfield, Mass., to whom the inventor had gone with his precious model wrapped in an old bandana handkerchief. Mr. Watson built a trial car which made its first trip on the New York Central and the Rome & Western Railroad The car was afterward run to Cleveland, Cincinnati and other Western cities, where it was looked on as a great curiosity. It was finally sold to the Ohio & Mississippi Railroad Company, and was regularly run on its line for a number of years.

The first sleepers that were built would not be considered fit to travel in now, but they were regarded as great luxuries then. A picture showing the interior of a Wagner sleeping car in use on the New York Central Railroad, which was published in "Frank Leshe's Illustrated Newspaper" on April 30, 1859, and is reproduced herewith, gives one a good idea of the "luxuries of travel" as they existed 35 years ago. The fittings and furnishings were of the plainest sort. The car was lighted by kerosene lamps attached to the ceiling, and warmed by an old-fashioned wood stove, placed near the center of the car. By taking care in selecting the position of the berth, one might, on a cold night, have the privilege of sleeping in the temperature of the tropics, in the varying degrees of the temperate zone, or in the frigidity of the Arctic circle, according as he should be near to or remote from the stove.

The man with a lantern in the center of the car is not the president of the road. He is the conductor. The coats of all the conductors in those days may not have fitted so well as does the one worn by the subject of the sketch, but all the conductors then wore high hats, and so did the engineers and firemen and almost everybody else for that matter. The exterior of the cars, like that of other passenger coaches of those days, was unornamented.



Wagner Sleeping Car, New York Central Railroad, 1859.

Accompanying the picture in "Frank Leslie's" was the following editorial comment, which is interesting, as showing how this "step in the right direction" was regarded in 1859:

"In days gone by travelers might well have imagined that it was the object of the proprietors of public conveyances to render them as uncomfortable as possible. Now, at least in this country, it appears to be quite the reverse. Formerly, traveling, among other inconveniences, implied a total abstinence from sleep, or, if indulged in, it was in such an uneasy posture that the sleeper awoke more fatigued than before. Now American ingenuity has invented a sleeping-car, which is in use on several of our long lines, in which, for a small increase in the fare, the traveler may enjoy his natural rest, and yet not be retarded in his journey.

"Our illustration was drawn from one of the cars in use on the northern branch of the New York Central Railroad, on which line sleeping-cars are attached to every night train. The cars may be used as ordinary day ones, but at night two shelves are let down from the ceiling, and a third shelf is formed by letting down the backs of the seats. On each of these mattresses and bedding are placed, curtains closely drawn up during the day are let down, and the whole forms a very comfortable sleeping place about the size of a ship's berth.

"We are glad to see that some of the railroad companies have adopted these cars. It is a step in the right direction, which will, without doubt, be soon followed by the directors of other railroads. In a pecuniary point of view it will certainly be profitable, as without calculating the income from the increased travel which always follows improvements, every traveler would gladly pay an increased fare for the accommodation."

Woodruff sold to Webster Wagner the right to build and use sleeping cars on certain roads, and to George Gates the rights of the patent on the Buffalo & Erie. Gates' establishment was kept up from 1859 to 1873, when it was merged into the Wagner Palace Car Company. Wagner, who gave his name to the company which has built all the palace cars for the Vanderbilt roads, was born near Palatine Bridge, N. Y., of German parentage. He learned the wagonmakers' trade, and used his skill to so good advantage that before he died he had the satisfaction of knowing that he was making some of the best vehicles in the world. He was killed in one of his own cars in a railroad accident at Spuyten Duyvil, N. Y., in 1882.

George M. Pullman was formerly a miner in Colorado. In 1858 he entered a train on the Lake Shore road at Buffalo. A sleeping car was making a trial trip on that train, and he resolved to try a berth. He was tossed about and made so uncomfortable that he arose before daybreak and spent the remainder of the night thinking what a pity it was that such an excellent idea as that of a sleeping car should be so crudely and uncomfortably carried out. Before he arrived in Chicago he had made up his mind to build better sleeping cars than the one on which he was riding. His first cars were run on the Chicago & Alton Railroad in 1859. Abraham Lincoln was one of his early passengers, and the future President took the greatest interest in the invention, and had the construction of the car explained to him.

It was not until 1864 that the first combination day and sleeping car of the present type was built by Mr. Pullman. It cost $18,000, and was named "Pioneer." It was lettered "A," for at that time it was not supposed that there would ever be cars enough in use at one time to exhaust the letters of the alphabet.

The Manufacture of Gold Leaf.

A writer in the last issue of the *Painters' Magazine* describes as follows the manufacture of gold leaf:

The manipulation of a bit of gold necessary to its transformation into a leaf of such extreme tenuity that 200,000 of them are required to form a pile one inch in height, is necessarily very instructive and interesting. No other metal admits of such extreme extension as this, at least, not by mechanical means, and this fact, coupled with that of its resistance to atmospheric or chemical action, renders it a most useful and invaluable material for decorative purposes, and for which use it is constantly becoming more popular. Half an ounce of gold beaten out may be made to cover 100 square feet of surface.

Of the manufacture of gold leaf we shall speak but briefly. Seventeen pennyweights of gold are meted out to a workman, and in four days he will have beaten this out into 2,000 leaves, each 3⅜ inches square. The gold is first annealed in hot ashes, then run between polished steel rolls, which converts it into a ribbon 1-800 of an inch in thickness. This ribbon is next cut into inch squares weighing six grains each, and these are placed between fine calfskin vellum and beaten until 4 inches square. These squares are quartered, again placed between skins, this time the membrane from the intestines of an ox, and beated out, and so on, being beaten out and quartered until of the right thickness, when an instrument, called the wagon, cuts them into squares, ready for booking. The fragments are gathered up and smelted. The leaves are then placed in the books, the leaves of which have been lightly rubbed with red ochre to prevent adhesion. To each book go 25 leaves, and 20 "books" make a "pack," containing 500 leaves of gold.

There are several shades of gold leaf, due to the presence of alloys. A pale leaf contains an alloy of silver, and is not, therefore, suitable for outside use, nor indeed for interior use if certain gases or vapors be present to tarnish the silver. A medium colored leaf is best for outdoor use. Dutch metal leaf is simply copper, which has been colored by the fumes from burning tin. It has little decorative value.

To test the purity of gold leaf, drop a little chloride of gold upon it, when a brown spot will appear if an alloy be present. Nitrate of silver will cause a gray spot to appear, if the gold be debased. Neither of these things will affect pure gold.

The Locomotive Fireman.

In a recently published article Si Warman thus describes the work of a fireman on a New York Central fast passenger train :

At least every 30 seconds he throws open the furnace door, and without a false motion or the slightest delay hurls exactly three shovelfuls of coal on the fire. He knows just how to spill and spread it with a dexterous turn of the wrist. Before Albany is reached he must throw 6.375 pounds of coal into the fire, or nearly 40 pounds a minute, or an average of 44 pounds a mile. Then, too, he must know exactly where he is along the road, and when to drop his shovel and seize the bell-cord. He must ring the bell in passing all towns and villages. He must know the proper instant to vault into his seat when important curves are reached, to watch for signals.

He must see that the steam doesn't vary, and he is proud to shout in your ear when you near Albany, "She hasn't varied three pounds since we left New York." He must watch the water gage of the boiler, and is constantly kept changing the pumps and seeing that they do their work properly. All the time he must keep throwing in his 44 pounds of coal on the fire every mile. It isn't long before he surprises you with another motion. He throws open the furnace and thrusts a long, double-pronged fork into the fire. With a twist he prods the glowing mass, and when he pulls his fork out its teeth are cherry red. Then comes the whir of the shovel again and the sound of the hammer as Tompkins breaks up the larger lumps of coal.

When you appproach Montrose, near Peekskill, the engine begins to slow down. If you look ahead you will see a narrow trough between the rails filled with water. The engine is going to take on water at a flying leap Tompkins stands at the side of the tender with his hands on a lever. Engineer Foyle suddenly startles you with a shrill whistle between his teeth that would put to shame the warning signal a New York newsboy gives to his gambling mates when a policeman comes in sight. Instantly the lever flies back, and as you look at the wheels of the tender you see surging up among the trucks a torrent of water.

It splashes and roars, and as you wonder if you won't be carried away, two whistles from Foyle, sharper and shriller than the first, warn Tompkins to pull up the scoop and that the end of the water trough is near. Then Tompkins goes back to his coal, his pump, his pipe, his water gage, his bell, his watch for signals, and you wonder what new work he will do next. Before you are aware of it he touches you upon the knee and motions you to raise your feet while he turns on a hose and wets the floor of the cab to keep down the dust, after which he sweeps up with a stubby broom.

Next he is shaking the grates with a big steel lever that looks like the tiller of a large sailboat. You now begin to take in what it means to be a fireman. Toward the end of the trip you tap his shoulder and shout to him :

"This seems to keep you pretty busy?"

"I tell you there is no funny business about this work," is his response.

Influence of Electric Light on Plants.

An interesting series of experiments made by the Hon. W. W. Rawson, of Arlington, England, to determine the influence of the electric light upon the growth of plants, is mentioned by *Invention*, a London journal. Mr. Rawson claims, as the result of his trials, that he gains five days in each of his three crops of lettuce—that is, two weeks in a season--by using the electric light in his greenhouses. He states further that the gain on one crop pays all the expenses of the electric lighting for the season, thus giving him the gain on the other two as clear profit. His attention was, we learn, first called to the usefulness of the light by the advance made in the growth at the ends of of his greenhouse next the street and in the glare of an electric lamp. This was so marked that he introduced the light throughout his lettuce and cucumber houses with the most satisfactory results. Mr. Baily, another English experimenter in this line, states as the result of his own tests that the influence of the light is greatly modified by the interposition of a glass roof. Plants injured by a naked light were benefited by the protected light. He found that five hours' light per night at a distance of 12 feet hastened the maturity of vegetables a week or ten days, although it proved injurious to young plants.

Changes on the Southern Railway.

Mr. Samuel Spencer, President of the Southern Railway Company, the successor of the Richmond Terminal system, says that the new system will be operated in two divisions, the eastern comprising the Richmond & Danville roads, and the western division the East Tennessee, Virginia & Georgia lines. The system as a whole is to be operated from Washington, D. C. Under the receivership the Richmond Terminal executive offices were established in New York, but the principal office has remained at West Point, Va. The principal office of the Richmond & Danville road was at Richmond, Va.; that of the East Tennessee, Virginia & Georgia was at Knoxville, Tenn., and that of the Central Railroad of Georgia at Savannah, Ga. The Central of Georgia is the only one of the large divisions of the old terminal combination which has not been absorbed by the new Southern Railway Company. The incorporation of this system into the Southern Railway Company is reported as only a question of a short time.

The *Pathfinder* comments as follows on the Pullman boycott:

Debs' deluded followers will soon spell his name Debts.

The only thing lacking in a sympathetic strike is sympathy.

Pullman has clean linen and soap in his cars. Down with Pullman!

The un-American strikers have kicked themselves out of comfortable berths.

The Gatling Gun.

In view of the recent industrial disturbances and the fact that mobs in many sections of our ccuntry have been confronted by Gatling guns, the following recent remarks of Dr. Richard J. Gatling, it inventor, concerning the object of its invention are pertinent:

While interviewing Dr. Gatling, we could not resist the temptation to ask him how it came about that so non-belligerent and peace-loving a citizen as himself should invent such an infernal engine of destruction as the Gatling gun. "My dear sir," he said, "my gun is an instrument for the preservation of *peace*. I have many letters in my possession describing the moral effect of the gun. Howling mobs, ripe for any sort of violence, melt away into nothingness at the mere sight of it, the men suddenly remembering domestic matters that require immediate attention at their own firesides: and streets filled with the shouts of the multitude speedily become transformed into desert wastes, so far as any sight of man is concerned. I will tell you how I came to invent the gun, though I have seldom spoken about this point. I was living at Indianapolis at the time of the war, and many raw regiments came there to be drilled before starting for the South. When the day for the final departure of one of these regiments came, the disconsolate mothers and sisters and sweethearts, and the tearful wives with babies in their arms, came to bid the soldiers farewell. The leave-takings were piteous—Oh! most heartrending; but the soldiers went away, and after a time the bodies of many of them would be returned in boxes, by express, and the loving ones that had bade them farewell so shortly before were filled with grief inconsolable. I remember these touching scenes most vividly, and they beggar description. I remember one morning there were 18 bodies received, and I learned that of these not more than three or four had been killed by bullets; the others had died from disease and from exposure incident to the hardships of war. I wondered if this fairly represented the proportion of deaths from like causes throughout the army, and I found on investigation that only about one man in four is killed by bullets in modern warfare. Then I bethought me how a war could be carried on with fewer men. and I devised a gun that would do the work of a hundred men. One man might go to the war and work the gun, and the other ninety-nine could stay at home and carry on the arts of peace. This was the real incentive I had, so you see I was not such a bloodthirsty creature as might be imagined; for I was trying to save as many as I could of those scenes of distress and despair that were so deeply graven on my mind at Indianapolis. The machine-gun ought not to increase the carnage of war, but rather to decrease it. The tactics of armies have been changed to correspond with the new appliances, and machine-guns and smokeless powder have done much to preserve the peace, by making wars almost impossible, or, at least, by giving them such a forbidding aspect that few nations would engage in one until the last possibility of an amicable adjustment of differences, by arbitration, diplomacy or otherwise, had been exhausted."

A Ridiculous Joke.

"Two men boarded the train at Osage City, and took a seat in the smoker, just in front of me," said a traveler to a *Globe-Democrat* reporter. "It was evident from their conversation, which was carried on in quite a loud tone, that they were, both of them, in hard luck, and were going to Topeka in search of employment. One of them placed his ticket on the seat, while he lit a very inferior cigar, and his companion quickly picked it up and put it in his pocket. A few minutes later the man missed his ticket, and went through the usual pantomime of turning out all his pockets and looking in his hat lining. Knowing the conductor would be round in a moment, and also that he had not enough money in his pocket to pay his fare again, he began asking the advice of his friend, who suggested gravely that he crawl under the seat and try to escape notice that way. There seemed no other alternative for the unfortunate man, who cramped himself under the seat as suggested. When the conductor came along the practical joker handed him two tickets, and was, of course, asked who the second one was for. He replied that it was for his friend, who preferred riding under the seat, whereupon the victim of the joke crawled out, and amid general laughter knocked the dust off his clothes and promised to break in his friend's head on the first opportunity."

It is said that a telegram from New York to Auckland traverses a length of line of 19,123 miles, nearly three fourths of which is submarine cable. It has to be repeated or rewritten 15 times. The longest cable is between America and Europe, say 2,800 miles, and the longest land line is across Australia, from Port Darwin to Adelaide, 2,150 miles.

On Jan. 1, 1894, the official statistics show that the total length of the railroads in France was 36,002 kilometers. That of the concessions already granted on the same date and to be built was 43,488 kilometers. The length of the tramways in operation was 1,664 kilometers, and of those to be built, according to concessions already granted, 2,715 kilometers.

The London depot of the Great Eastern Railway, the Liverpool street station, has just been enlarged, and is now the largest railway station in the United Kingdom. It occupies an area of 14¼ acres, and has 18 separate platforms under four parallel and one transverse space of glazed roofing. The platform space for the accommodation and easy circulation of passengers is notably large. Three hundred and seventy-six signaling levers are required to control the movements of the trains, 240 operated from one tower and 136 from another.

Cast Iron Bricks.

In Germany a form of brick has been used which in shape and size resembles our ordinary bricks, but they are composed of cast iron, and hollow. The shell is so thin that the brick weighs less than one made of clay. A wall is built of such material without the use of mortar, and no skilled labor is required in laying them. The upper and lower sides of the bricks are provided with grooves and projecting ribs, which fit into each other easily and perfectly and form a wall of great strength. There are also two large circular openings in the upper side of each brick arranged so as to receive projections on the lower side of the brick that is to be placed above it. One of the projections is hook-shaped, which secures a solid hold. A wall of these bricks is put together very quickly. After the wall is built it is covered with paint. This closes all the cracks, rendering the wall air-tight, and prevents the bricks from rusting.

"Can any little boy here," asked the visitor, "give me an example of the expansion of substances by heat?" "I can," said Tommy; "our dog's tongue is twicet as long now as it was last winter."

All's quiet in the Pullman car—
Sweet Peace holds sway once more;
The only men who fret us are
Those same old friends who snore.

Ruined by Scabs.--"Yas, I used ter rob passengers an' hold up trains," said the Missouri colonel, "until the business got so low down 'onery frum scab robbers that a decent man couldn't afford ter be caught at it."—*Cleveland Plaindealer.*

The fees of Mr. Thomas C. Platt and Mr. Marsden J. Perry, as Receivers for the New York & New England Railroad Company, have been fixed by the United States Court at $1,000 a month each. They were appointed Receivers last December.

It is reported from Mexico that within two years a railroad line will be in operation between the cities of Campeche and Merida. The Peninsular Company of Railways is pushing the work actively, and has ready at hand all the necessary elements, financial and material, to complete the road within the time mentioned.

The question of Sunday traction is still troubling the people of Toronto, though they voted against Sunday street cars last year. Recently an omnibus line has been running on Sunday. On the first Sunday, when the Mayor heard it, he went to the office of the company to stop the desecration; but as he hired a cab to take him to the office, the people who believe in no Sunday travel are pained and grieved at him.

A motorman on an electric car line in Spokane is quoted in the Seattle *Telegraph* as telling this story: "My 'boss'," referring to the president of the street car company, "is a first-class financier, he is. Why, do you know that every Sunday he advertises for a servant, and Monday twenty or thirty girls ride out to his house near the end of the line to get the place, but find madam can't see them; so they ride back and repeat the journey several times before they are finally told that the old girl has decided to stay awhile. Now that's financiering; 50 cents paid out for advertisements and $8 or $9 taken in for car fares to swell the annual dividends of the boss' company."

The management of the Pennsylvania Railroad claims the credit of being the pioneer in the following achievements: Introduction of vestibule trains; the introduction of stenographers, electric lights, baths, barbers, libraries, ladies' maids and movable easy chairs; the introduction in the United States of interlocking switches and the block signal system; the introduction of the method whereby engines can be supplied with water while running; the establishment of a personally conducted tourist system for the benefit of the pleasure-seeking public; the introduction of chaperons in connection with personally conducted tours and excursions, for the benefit of ladies traveling without escort, and the introduction of the system of elevated stations and double-decked ferryboats.

"What's the fare from here to Detroit now?" he asked of the ticket agent of Court street depot, says the Minneapolis *Journal.*

"Same as always," was the reply.

"The same as before the panic?"

"Yes, sir.'

"But I don't see into it. I've had my wages cut down on account of hard times."

"Can't help that, sir."

"And the fare to Detroit ought to be cut down."

"But it hasn't been."

"Hasn't eh? Then there must be a good reason for it."

"Yes there is. The oil for the engines cost just as much as ever it did."

"Oh-h-h! I see! Nothing off on oil, eh?"

"Nothing off."

"Wall, that makes it all right. I thought there must be some reasonable explanation for keeping the fare up. If oil goes down the fare goes down. If oil stays up the fare stays up. I see. Gimme a full-fledged ticket to Detroit."

The Master Mechanics' Convention.

(*Continued from page* 111, National Car and Locomotive Builder *for July.*)

Cracking of Back Tube Sheets.

At the opening of the second day's session the discussion of the report on the cracking of back tube sheets was continued.

Mr. Johann: In the matter of radial stay boilers, I have given the matter very considerable attention, and arrived at the conclusion that in practice the radial stay boiler was decidedly preferable to crown bar boilers. As the older members will recall, in 1879 I presented drawings of a radial stay boiler. That particular boiler was put in service on the Wabash road in October, 1879. I retired from the road in May, 1885, and at that time the firebox and radial stays and every part of it were in perfect condition. The boiler is still in operation there now, being a total of over 14 years. About three months ago I inquired about the boiler and was told that everything was still in order; that about a year ago they were getting somewhat anxious to know the condition of the stay bolts and drilled out three, and found them to be perfectly sound. They put in three new ones and the balance are still in. The further I go into the radial stay system, the more I am convinced it is in the right direction.

Mr. Wm. Smith: We have a few radial stay boilers, but they have not been in service long enough to develop any of the defects. I wish to say that I have seen all the defects in crown bar boilers that I have heard spoken of in the radial stay boiler, with the exception of the cracking of the flange in the flue sheet at the top. I have not seen anything of that kind in the crown bar boilers. I see one good reason why they should put sling stays in the front and not in the back so much; in the back, the back sheet and back head are connected together, and when the water commences to warm up expansion acts in both of them, whereas in the front flue sheet there is nothing to convey the heat to the forward end of the wagon top, and expansion does not set in there until after the steam commences to rise; consequently something has to go, as the firebox expands with the heat before the forward end of the wagon top does. There is one thing that should be done in the radial stay boilers, and that is a splash-board or something should be put in to stop the wash of the water forward. We make the stop on one brake application. We may be carrying about three-quarters of a glass of water, and when the brake application is made the water will disappear from the glass. The fire is very intense, and though it is but a few seconds during which the water leaves the crown sheet something has got to suffer. If there is any grease in the water, when the grease comes back it will first catch the crown sheet, and that does no good. I would recommend putting on a crown bar, or splasher, in front of the firebox. think a couple of crown bars in front would serve the purpose.

The report of the Committee on "Oiling Devices for Long Runs" was read by the Chairman, Mr. Barnett.

Oiling Devices for Long Runs.

The committee received 58 replies to its circular asking what devices can be provided for locomotives to supply lubrication on long runs. Most of these reported short runs or that nothing special in either oil or cups was used. The locomotive superintendents of Great Britain contributed information and drawings of value because of their wide experience in long fast runs.

The characteristic broadly marking their practice is the use of oil reservoirs at high level, that can, if necessary, be filled while engine is running. They are of brass, square in plan, with hinged top lid, internally divided into sections in correspondence with the number of small tail-pipes leading from them; in the case of axle-boxes, usually one to journal and one to each jaw face. Worsted siphon trimming is common, also horizontal plug-cocks for each pipe, so that oil may not be wasted when engine is standing between trips.

Mr. G. W. Rhodes (C., B. & Q.) uses a three-pocket high-level reservoir in cab for each journal of rear axle of moguls. A good feature in its construction is that a strainer is soldered in each pocket. In addition to such reservoirs and tail-pipes from running-board level, Mr. K. Barnum (U. P.) and Mr. G. W. Stevens (L. S. & M. S.) equip their passenger engines with hose, so that, in case of need, cold water may be played on any axle of engine or tender. Mr. W. D. Holland (G. N.) somewhat similarly equips, but can flush with either oil or water from a tank located on tender.

It is only Mr. L. B. Paxson (P. & R.) that advises us of any practical acquaintance with Cory's force-feed lubricator, a device situated at the base of a gallon oil tank, so arranged that, at will, air or steam pressure delivers one-eighth of a pint of oil through any of 16 small tail pipes as desired, and he says that the use of one for a year on a compound showed about 25 per cent. saving over the old way of oiling. He used it to deliver oil to all axle-boxes, eccentrics and links. No pumps or other forms of intermittent oil feed, as occasionally found in marine and stationary practice, are reported in use on any locomotive.

Mr. W. Cross (C. P.), dating from Manitoba, says self-oiling from cab has no prospect of success in that cold climate, where ordinary supply often freezes, hence his practice is not to put an engine on fast or long runs until it has had a few months in other service, to make all journals and motion-pin surfaces large, and provide not only oil grooves in the bushes, but also to flatten top of pins opposite groove in all case-hardened work. The motion links have oil cavities and small worsted trimmers.

Mr. G. W. West (N. Y., O. & W.) emphasizes the fact that modern locomotives with large wearing surfaces do not give trouble up to 100 mile runs, and that heating is more often due to small bearings than insufficient oil.

Mr. G. W. Stevens (L. S. & M. S.) supplied oiling pipes from foot-board to all axle journals on locomotives drawing the Exposition Flyer, 135 miles continuous run, with the result that the entire service of these trains was performed without a single hot box, and the oil used per unit of service did not show a marked increase over engines having more frequent opportunities of oiling. These ½-inch pipes simply have a copper funnel mouth and hinged lid at their upper ends, so that all oil put in is at once delivered on crown of axle-box.

Mr. A. E Mitchell (N. Y., L. E. & W.), having a run of 140 miles, equips each axle-journal with a very large special fount about frame, provided inside with a threaded spindle feed, and a short tail-pipe to axle-box. The feed is set before the engine leaves the terminal and is not shut off until end of run, and delivering the oil regularly in fixed quantity prevents journals becoming dry at any time. The cheapest freight car oil thoroughly strained is used; it is however in winter thinned with kerosene to cause it to flow freely. He proposes using an axle-box with three deep recesses in the crown, the larger center recess with four oil holes to the journal brass, and the two side recesses each with two holes for oiling jaw faces.

Mr. F. W. Webb (L. & N. W.), sends a drawing of his axle box practice, used since he patented the device in 1891, and showing the actual equipment of his compound "Queen Empress," exhibited at last year's fair. The driving axle-boxes have small rollers let into recesses in the side top of the journal brass. They are of hard wood, ⅝-inch diameter by 7¼ inches long, covered with tubular wicking, and are kept soaked with oil by the continuous dropping from the high level reservoirs. The rollers, lying loose on top of axle, are continuously revolving when engine is in motion, and the whole surface is thus well lubricated. In the oil-cellar a pad bears up against under side of journal, providing additional lubrication. The high level reservoirs are fitted with vertical plug-cocks, and ribs cast on under side of lid engage with their handles, insuring their being open and shut—as required when lid is down. The "Queen Empress" was never in steam until at Chicago, and ran but a trial trip of one mile on siding before handling an exposition train from Chicago to New York, keeping cool the whole of the journey.

It is one of the points distinguishing European from American practice that the former commonly cover such recesses as are provided in crown of axle-box with a plate $\frac{3}{16}$ to ¼ inch thick, either hinged or secured by stud bolts; and, as an example of carefulness and thoroughness, attention is called to the drawing sent by J. Cambie (C. R.), showing that his engines have 46 reservoirs or cups, with 58 tail-pipes or siphon pipes for trimmings, besides the minor oil grooves (and these are apparently machined out). Another point illustrating thoroughness in this matter is seen in Mr. Adams' (L. & S. W.) drawing, where to make clear runway for oil from iron rod to its contained brass, the hole in the brass is countersunk, and that in the iron (above it) is externally counter-bored or externally recessed, leaving a proper drip ridge directly opposite the countersunk hole. Also, it is European practice to invariably provide for the lubrication of the truck center. In one case three oil-pipes are shown as leading to its frictional surfaces. Another point is that they show a preference for two or more oil holes through brasses.

In oil cups for rods there is a wide variety in practice. Mr. J. Hickey (N. P.) uses a combined oil and tallow cup in one casting having a controllable collared jumper feed for oil, and a direct feed for the tallow, when it melts. This cup is secured to rod not only by a gland-shaped flange having two ⅛-inch bolts, but also by a central screwed steel shank, 1 inch in diameter, soldered into cup, and we infer such cups are not often thrown or lost. The solid lubricant in the annulus surrounding the central oil cup is formed of one part beeswax to five parts tallow.

The most notable point in the replies as to oil cups is the rapidly growing practice of forging them solid with all rods, not that this is cheaper in first cost, but it is cheaper eventually, as cup and rod have equally long life. The best practice makes the siphon pipe in the center of the cup solid with the rod. The brass caps for these cups often have a ⅛-inch or ⅝-inch central hole for receiving nose of oil-can, and this hole is sealed against entry of dust by an internal round button, kept up to the cap by an inside coiled brass spring, or the hole is threaded and a wooden plug inserted. There is a general conviction that rod cups are quite sufficient for continuous runs of 100 to 150 miles.

We infer from the replies that little attention has been given to eccentric oiling. However, Mr. A. Cooke (C. & E. I.) reports casting a large cavity in the butt end of strap, into which three or four inches of 1-in. gaspipe is screwed. This is capped with a brass cover, screwing on outside of pipe. Cavity and pipe together give an oil cup of large capacity. This cavity is cast in both top and bottom of butt-strap, so that the single pattern suits right and left hand strap, and similar smaller cavities are cast in cap half of strap, making four cavities (one cup and three cellars) for each sheave.

For cylinders, slide-valves and air pumps some form of lubrication by condensation displacement feed is every-day practice; but in Great Britain it is common to use in addition Furness lubricators—one for each cylinder—that come into operation only when engine is running with steam shut off. Mr. I. Holden (G. E.) remarks that the Vacuum company's sight feed has been superseding the Roscoe, because the latter did not readily displace the heavier and thicker oils, but that the Vacuum has the defect of increasing the speed almost double when the steam is shut off. He has tried the De Limon double-acting sight feed, and this has such large capacity, works so economically and regularly with throttle open or shut—and with all densities of oil—that he is trying a dozen of them, the first cost of one of De Limon's being less than the combined cost of one Vacuum and two Furness, and there being a saving of two pints of oil in a run of 243 miles as compared with the use of one Roscoe and two Furness lubricators.

The only special point in the few replies mentioning tender oiling is the use of spring pads or cotton-seed hulls to continuously lubricate the under side of journals.

To briefly summarize, the replies and drawings show that modern practice for high-speed lubrication is an endeavor to deliver a small amount of oil continuously over the whole length of bearing surface. Bearing surfaces are much larger (we have yet to hear of an engine with too much wearing surface at any point). It is not judicious to trust to one oil hole where two are possible. Cups or oil pockets are solid (cavities in the metal) rather than separate. Grooves are liberal in number and size. The cheapest of oil is then admissible. Strainers and covers over all oil pockets are desirable.

J. Davis Barnett, John D. Campbell, Geo. W. Stevens, Geo. W. West, C. E. Smart, George H. Baker, Committee.

An appendix accompanied the report which showed several specifications for car, locomotive and machinery lubricating oils. These show that the use of Galena or other mineral oil, graduated so as to be as limpid in winter as in summer, is common American practice, whereas in Great Britain there is a marked inclination to the use of vegetable oils.

Mr. Barnett: In British practice it is to be noted that they often use tail pipes to the swabs at the piston and valve stem glands, and it is said that this is found the more useful as the use of metallic gland packing increases. Since sending in the report we have received from Mr. McIntosh a communication, showing his oil cellar as applied to engine trucks, a light iron shell casting held up by springs readily taken out and adjusted. Spines cast inside it prevent the packing of waste used from rolling or lunging. The oil cup used to feed the journal brass is ingenious and cheap. It has an eccentric slide cover, screwed spindle feed, and the cup can turn in the socket so that it becomes a sight feed and the engineer can see that the proper adjustment of feed is made, and then giving the cup a quarter turn back, the sight is closed, and no oil can be blown away.

Mr. Mitchell: Since giving this information to the committee we have abandoned the use of these special founts from the journals and lubricate our engines successfully from the present journal box. We have also decided not to use the three-recess journal box, as the present journal box is perfectly satisfactory.

The report on boiler steel specifications was then read by Mr. G. R. Henderson, the chairman of the committee on that subject.

Boiler Steel Specifications.

In proposing a specification for boiler and firebox steel, it may be well to outline in advance the object of such specifications, and the governing reasons for assuming limits, both for physical and chemical qualities. Briefly stated, the specifications should be such as to secure thoroughly good and reliable material; excluding that of inferior quality. It should be sufficiently broad to allow any reputable maker to comply with its requirements. Finally the limits should not be so severe as to unnecessarily increase the cost, which can easily be done without corresponding increase in value. In other words, the ideal steel which we might wish to have, is not that which we are likely to get, and concessions must be made from the ideal to make a workable specification. In response to call, all members of the committee, with the exception of Mr. Crossman and Mr. Forsyth, which latter was represented, met in Altoona and outlined the proposed specifications. Several of the members presented specifications either current or proposed, and all were in full accord that both chemical and physical requirements were desirable, especially for firebox steel. There was a very decided difference as to the quality of the firebox steel, some of the members favoring a soft steel with ultimate strength ranging from 50,000 pounds to 58,000 pounds, while the majority preferred a harder quality with ultimate strength of 55,000 pounds to 65,000 pounds, and in each case there was a difference in the chemistry.

The specifications presented for discussion are shown below.

FIREBOX STEEL, CHEMICAL COMPOSITION OF.

	No. 1.		No. 2.		No. 3.	
	Desired, not over.	Will reject over.	Desired.	Will reject over.	Desired.	Will reject.
Phosphorus	0.02	0.035	.....	.03	.03	.04
Sulphur	0.02	0.045	.....	.03	.02	.05
Manganese	0.5	0.50	.....	.35	.04	.55
Silicon	0.02	0.035	.....	.03	.02	.04
Copper	.....	.....	.....	.04	.03	.05
Carbon	.....	.....	Low as p'ssible		.18	Less than .15 over .25
Tensile	.....	50,000	.....	50,000	.....	55,000
Strength	.....	58,000	.....	60,000	.....	65.000
Elongation	.....	.....	.....	.....	.....	.....

Dr. C. B. Dudley, Chemist, P. R. R., gave the following reasons why it was inadvisable to reduce the metalloids to the lowest limits shown in some of the specifications, illustrating his remarks by the results of physical tests and chemical analysis of sheets of old fireboxes whose performance was known. The phosphorus limit could be set as low as .02, and could be worked to by the basic process, and by one or more makers of acid steel; it was, he considered, unwise to set the limit so low; moreover it was shown that many of the fireboxes in the list which gave the highest mileage had phosphorous as high as .07. It therefore appeared unwise to insist upon the lowest possible limit when no compensating gain was apparent. Moreover even a small increase in the amounts of phosphorus has a very marked effect in lowering the melting point of the steel during casting, and thus is a distinct gain to the maker. As regards sulphur, it should be remembered that this is largely a question of the fuel; where coal is used, the sulphur will run higher than where natural gas is the fuel. As this would discriminate in favor of the localities using natural gas, the limit was placed at .05 as a maximum, with .02 desired. Manganese and carbon should be considered together, both being hardeners. The hardness can be obtained by either of these elements, but if the tensile strength and the amount of one of these elements be fixed, the amount of the other will also be limited. There is conflict among the steelmakers as to the amount of manganese desired; from the user's standpoint we think it preferable to obtain the hardness from carbon, and therefore fix it within limits, which from our experience we find to exist in many of the longest lived fireboxes. Silicon is believed to have the effect of insuring solidity in ingots, although not much is known as to the condition in which it exists. It is believed, however, that it is more readily oxidized than is iron at high temperatures, and from this cause the steel is more liable to disintegrate. He advised that moderate specification, giving steelmakers as wide limits as were consistent with the quality of steel desired would be in the end far more satisfactory, and that under such a specification, the steel would be delivered promptly, whereas, with narrow limits, there would be in the end an increased cost of material, while it is by no means certain that the performance will be so much better as to warrant it

The committee endeavored to get positive information concerning the performance of hard and soft firebox sheets, having at its disposal the tensile test results of several hundred worn fireboxes, together with the mileages and, as far as it could be obtained, the character of the water used. It had also the tensile tests of specimens taken from sheets, both before and after service, from which latter analyses were made. The tensile strengths varied from 77,000 pounds down to a little over 50,000 pounds, while the mileages varied from a little under 500,000 to a little over 50,000 miles, and the worn fireboxes represented all classes of engines and many different brands of steel. The results of examination were quite conflicting, but when it is remembered that the treatment of the fireboxes on the road has probably more effect upon the life than has the original quality, it was what might have been expected. It was soon seen that both hard and soft steel might be found in both the long and short lived boxes and sometimes in the same firebox. The weight of evidence, however, was toward steel in the neighborhood of 60,000 pounds tensile strength, giving the best results.

The tensile tests of sheets, of which there was a record, both before and after service, indicated very strongly a lower strength in the old than in the new sheets, from which we infer that steel of which the rest of the old sheets was made was originally harder than the results appear to show. We are aware that there is in many quarters a prejudice against hard steel as more liable to crack, but offer the suggestion that improved methods of boiler-making, such as machine flanging and more intelligent methods of boiler washing, are removing many of the earlier difficulties, and we think that, once flanged, the probability is that steel of 60,000 pounds tensile strength will give better service than that of 50,000 pounds or 55,000 pounds. For several reasons the harder steel has decided advantages, namely, in better holding threads and less bagging between stay-bolts. Where bagging occurs the tendency is for the holes to open on the water side and thus lessen the hold upon the bolt.

The reason for recommending a parallel sided section or that produced by longitudinal milling, in preference to the shouldered section usually prepared by shaping or cross milling, is that the first mentioned forms show a higher elongation and one which we believe represents more truly the real elongation of the sheet than does the shouldered form in which the wide ends appear to brace or stiffen the adjacent parallel section for some distance. This point was clearly demonstrated in a series of tests in which sheets were cut up into test pieces, alternate ones being prepared to the different sections mentioned. It was found that in specimens not less

than 8 inches long in tested section, there was little difference in the tensile strength, but the elongation in pieces prepared by shaping or cross milling was markedly less than that of the other forms which gave practically similar results.

The reasons for choosing dimensions of coupon, namely, 36 inches by two inches in rough, at which a section of at least 8 inches between grips is to be prepared 1½ inches wide, were that such length of coupon will make two test specimens if check testing is desired, or it will furnish one tensile test specimen and one for bending and quenching tests. A specimen finished 1½ inches wide and of the thickest sheets used in locomotive boilers will be within the capacity of a 100,000 pounds test machine, and a 50,000 pounds machine will serve for nearly all that are used. Your committee satisfied itself by tests that specimens 1½ inches wide prepared from coupons 2 inches wide and of thickness of ½ inch do not appear to be affected by shear hardening.

The results were as below:

TEST OF ONE-HALF-INCH BOILER STEEL SHEARED TO DIFFERENT WIDTHS AND PREPARED TO SECTION 1½ INCHES WIDE.

No.	Rough width.	Finished width.	Tensile strength.	Elongation in 8 inches.
1	1¾ inches	1.522 inches	56,900	24
2	2 "	1.522 "	56,400	26
3	2¼ "	1.522 "	56,300	29
4	2½ "	1.522 "	56,100	26.5

The heating and quenching test is introduced because many users of steel have no other available method of investigating the quality of steel used, and it is to be noted that in nearly all marine boiler specifications, both in this country and abroad, this clause is embodied, but modified, by requiring that the sheet shall bend to a radius bearing a certain ratio to thickness of sheet, this ratio varying from 1 to 1½ inches.

Limit of Thickness.—Under this head is a clause fixing a limit below which sheets thiuner than those ordered must not go. There is provided also a limit of weight over that corresponding to the dimensions of sheet which is to be paid for. This allowance is made because in rolling sheets there is always a spring of the rolls, causing sheets to be thicker in the middle, and the larger the sheets the greater will this excess be. Whether this allowance will be sufficient with the still larger sheets of the future, time will show; but we suggest that if wider limits become needful they shall be made by allowing greater overweight, rather than by allowing greater thinning at the edges, where the seams, the weakest part of the structure, are located.

With the subject of inspecting and sampling sheets, the committee considered that the specifications need not deal, as each road would have its own preferred methods. The question of establishing the identity of the test specimen with the sheet that it purports to represent, is a perplexing one. Various plans have been adopted, one requiring the sheet and test piece to be attached, and another having the test pieces sheared at the mill, usually in presence of inspector, marked and numbered, so that it can be matched with plate and shipped apart from plate.

Of these plans the first is, we think, to be preferred, while it has the disadvantage: 1st. That there is some chance of the partly sheared test piece being damaged in handling. 2d. That it requires the sheet when received to go to shears for final removal of test piece; and finally, because the test cannot be made in advance of arrival of sheets; it has the great advantage of assuring the positive identity of sheet and test and it does away with the necessity of having an inspector at the mill. The reason of course is that there is much less expense in both time and material where one coupon is allowed to represent more than one sheet, but even then we think that, with the exception of butt strips, this method is not to be recommended.

It will at times happen that the test coupon is too much warped to be prepared without some straightening. In such cases it is necessary that the manipulation shall not cause hardening of the piece. In such case we recommend squeezing cold in a press or between the anvil and steam hammer; but it should never be done by hammering, nor should the coupon be subject to any heat treatment before testing.

Homogeneity.—No better method has been proposed of detecting lack of homogeneity in fire sheets, than that of nicking test piece on edges and bending. Laminations are thus shown, when careful examination of edges does not reveal them.

SPECIFICATIONS.

General Requirements.—Under head of ordering, inspecting at mill, marking and shipping, no recommendations are made, for reasons that no general rule suitable for all roads can be formulated, and it is not essential for uniformity that such rule be made.

Test Pieces.—Test pieces, one from each plate, shall be in rough 2 inches and 36 inches long, and as nearly straight and free from twist as possible, and in no case must be annealed. Each plate shall bear maker's name, either rolled or stamped. The heat number and in addition such identification marks as may be specified by the ordering road, shall be put on each plate and test piece. When inspectors are present at mills, butt strips may be cut from any plate, provided such sheets are respresented by test coupons. Where inspectors are not at mills they must as far as possible be cut from a single sheet as rolled, and each sheet cut into butt strips will be represented by a test strip. All butt strips as well as test strips shall bear the heat number.

Shear Marks.—Each sheet shall be accompanied by test coupon, 2 inches by 36 inches long, attached at one end to sheet. To facilitate future matching, should it be necessary, both sheet and coupon shall be stamped twice across division line with a shear mark, either round, oval, or of other agreed form; which mark should be not less than three inches across. In cases where one large plate is cut into several smaller ones, all represented by one test piece, the same shear mark shall be stamped across each division line in two places before shearing, so that subsequent identification may be readily performed.

Dimensions.—Plates must be of shape and dimensions ordered. Any excess in weight over that corresponding to the dimensions in the order, greater than that specified in table below, will not be paid for. In computing weight of plate from dimensions, one cubic inch will be taken as weighing 0.2836 of a pound.

ALLOWANCE FOR OVERWEIGHT OVER THAT CORRESPONDING TO DIMENSIONS.

For plates ¼ inch thick,							
"	"	5/16	"	"	8	"	"
"	"	3/8	"	"	7	"	"
"	"	7/16	"	"	6	"	"
"	"	½	"	"	5	"	"
"	"	9/16	"	"	4½	"	"
"	"	5/8	"	"	4	"	"

Plates measuring 1-100 of an inch less in thinnest part than that ordered, and all plates which show seams or cracks at the sheared edges, or which have cracks, slivers or depressions in the surface, or which develop defects in working, will be rejected. Rejection on account of thinness is to be made only after measurement of the actual sheet. Test pieces being prepared from the edge of sheet are liable to be thinner than the main sheet.

Test pieces when finished will be 1½ inches wide in test section, and of full thickness of plate, and may be either parallel sided or of reduced section, and prepared either by longitudinal planing or milling. Where a reduced section is adopted, the distance between bottom of fillets shall be not less than 9 inches, and radius of fillets shall be not less than ½ inch and preferably more. Elongation will be measured between tram punch marks originally 8 inches apart, and on reduced sections placed approximately equidistant between fillets. In parallel sided sections, the tram punch may be applied at more than one point to insure breakage occurring between the marks.

Special Requirements for Shell Steel.—Tensile strength, 55,000 pounds to 65,000 pounds. Elongation not less than 20 per cent. in 8 inches. Test piece having rough edges removed by filing, grinding or machining, shall without annealing, bend over on itself, both while cold and after being heated to a cherry red, and dipped in water at 80 degrees Fahrenheit, without showing cracks or flaws on outside edge. No chemical requirements.

Special Requirements for Firebox Steel.—The majority of the committee favored specifications reading as follows:

Metal is to have tensile strength of 55,000 pounds to 65,000 pounds, with 60,000 pounds desired and 28 per cent. elongation preferred.

The chemistry desired is: Carbon, .18; phosphorus, not above .03; manganese, not above .40; sulphur, not above .02; silicon, not above .02.

Plates will be rejected having: 1. Tensile strength less than 55,000 pounds. 2. Tensile strength over 65,000 pounds. 3. Elongation less than 22 per cent. in 8 inches and in ¼-inch plates not less than 20 per cent. in 8 inches. 4. Failure to stand bending and quenching test, as for shell steel. 5. Any seam or cavity more than ¼ inch long in any of the fractures of homogeneity test.

Chemical.—Carbon, over 0.25; carbon, below 0.15; phosphorus, over 0.035; manganese, over 0.45; silicon, over 0.03; sulphur, over 0.45.

Homogeneity test is made in the following manner: A portion of the broken test piece is nicked with chisel on opposite sides alternately, nicks being about one inch apart Test piece is then firmly held in vise and broken by a number of light blows, bending away from the nicks.

Laminations more than ¼ of an inch long will condemn.

The object of this is to open and reveal seams, due to failure to weld up, or to foreign interposed matter, or cavities due to bubbles in the ingots.

The above specification is intended to be liberal in its provisions and does not differ greatly from others that have been used, and the committee believes that it will be satisfactory.

A. W. GIBBS, WM. FORSYTH, T. A. LAWES, G. R. HENDERSON, E. M. ROBERTS, Committee.

Minority Report on Boiler and Firebox Steel Specifications.

We agree to all the items of this proposed specification, except the tensile limits of firebox steel.

Believing that this material should be kept soft and that a hard steel is objectionable on account of its liability to crack in service, we recommend that the minimum ultimate strength be 50,000 pounds, and the maximum ultimate strength 58,000 pounds, per square inch. Some of the members of the committee urged the plea that, as the working pressure of boilers had been increased from 30 to 50 per cent. over previous pressures, and as it was unwise to thicken the firebox sheets, a stronger material should be used. We, however, think that an increase of strength in the steel of 10 per cent. will go but a very short way toward making up the increase in pressure of 30 or 50 per cent., especially when the risk of cracked sheets and use of a harder steel are the penalties.

We, therefore, propose to the association that the tensile limits of firebox steel in the new specification be altered to read from 50,000 to 58,000 pounds per square inch, respectively, and that the carbon be reduced to from 0.10 to 0.20 per cent., the elongation being 20 per cent. for ¼-inch plates and 24 per cent. for 5/16-inch thick and upward in 8 inches of length.

G. R. HENDERSON, E. M. ROBERTS.

Mr. Henderson: I would like to say that the idea of the committee in introducing the minority report was that the association could come to some decision. We did not expect that both reports would be accepted, and the idea was that, after the discussion had been completed, there might be a vote taken on the question: and one or the other of the specifications for firebox steel should be decided upon, so that one grade of steel only would appear for that purpose.

Mr. Vauclain: This is a matter of great interest. I consider this report one of the best reports upon this subject that have ever been brought to our attention. The introductory portion of the report I agree with entirely. The remarks of Dr. Dudley should receive careful consideration from the members of this association. The percentage of phosphorus in firebox steel has been kept down to a very low limit. The idea is to approach as nearly as possible .03 in the specification. It has been shown by the committee that fireboxes having as high as .07 of phosphorus have given excellent results. Our specification for firebox steel is limited to .03, and .05 on boiler steel. After reading the report carefully it seems to me, if the specification was reversed, .05 for firebox and .03 for boiler metal, we might get as good results, and even a little better. The amount of sulphur in boiler steel is limited by Dr. Dudley to .05, which I think is all right, and it is a very difficult matter for manufacturers of steel to reduce the sulphur, on account of the amount of sulphur contained in the fuel. The report recommends a tensile strength ranging from 55,000 to 65,000 pounds of steel for boiler purposes. We have put firebox steel in locomotives down as low as 45,000. We had a specification from one railroad that called for firebox steel between 45 and 50, none over 50; and we had a time, I can assure you, to get material for that specification. Probably not more than one sheet out of ten that we would test would show a perfectly solid fracture, but there would be a fibrous condition in the test piece which suggested laminations, and, by examining the test piece and plate also, we found there were minute laminations all through the plate, that were due to the bubbles that were in the ingots rolled out in a longitudinal direction, which produced what the steelmakers called fibrous steel. There is no such thing as fibrous steel, in my opinion, and these test pieces that showed a fibrous nature were simply test pieces cut from sheets very much laminated, although the laminations were small. On the other hand, when a firebox steel of 65,000 pounds tensile strength is tested, there is an absence of that appearance of laminations, and you are more likely to get a thoroughly sound plate than with the 50,000 pounds.

In regard to the thickness of sheets. The thin plates are always used in the firebox, and these plates as they come from the rolls would necessarily be harder than a thick plate. The thick plate would retain more heat to the amount of surface, and cool less quickly. We would necessarily look for a higher tensile strength in sheets made from the same material as the outside sheets, on account of the extra rolling to reduce it to the thinness desired. We do not care to have the steelmakers anneal the plates. We prefer to take them as they come from the roll and test them accordingly. I have thoroughly examined the specification in every way in regard to the chemical composition of the steel. The report says: Carbon, .18; phosphorus not above .03; manganese, not above .40; sulphur, not above .02; silicon, not above .02.

The chemical composition upon which steel would be rejected is shown immediately below. The sulphur is placed as 0.045, which is pretty hard on the steelmakers. I see no reason why the phosphorus should not be put at 0.035, and even a little higher. I would say as this report evidently intends, that the outside boiler plate shall be of the same nature as the firebox. In regard to manganese, it is desirable to keep the manganese down, I think 40 per cent. is a very fair figure for manganese, but it is best to do the hardening with carbon. I think we would get better service if the plates were hardened with carbon. Sheets as high as .065 in manganese and as low as .012 in carbon do not give as good results as the plates made from the chemical composition here mentioned.

The minority report perhaps contains the ideas of quite a number of people in the business, but I think personally it is a mistake. The report as submitted by the majority of the committee should be adopted unanimously. In case we adopt this, we have a valuable specification. I think the suggestion of the committee to have the test piece attached to the plate when it arrives at the works is a very proper one. We have considerable trouble to match pieces sometimes. I find another thing in the receipt of boiler plate; that is in regard to the thickness. We specify a plate ⅛ inch thick, and you are liable to get it ⅛ inch thick on the edge and 7/16 in the center. This is due to the springing of the rolls, and in order to guard against that as much as possible the proper thing to do is to buy your plate from manufacturers who have rolls big enough and heavy enough to roll plates of the size you order without undue springing in the center. I hope this majority report will be adopted without any change whatever.

Mr. Barnes: This report is a very good one; and a little hard work this morning will enable us to adopt a specification which will have for its purpose the assisting of the manufacturers to make the steel and put it in stock. It will also help in regard to impurities and chemical composition. I think that everything but carbon in the steel is an impurity; but we cannot make steel without these impurities. We ought to take action on this report so that the manufacturers will make the steel and put it in stock.

Mr. McConnell: We have used in the last year in the neighborhood of six hundred thousand pounds of boiler steel. We have a record extending over some ten years, and the average life of the fireboxes does not exceed with us five years. In some cases the fireboxes have been worn out in two years. Our specification has been heretofore from sixty to sixty-five thousand pounds, but we believe that is too high. I do not think the same specifications for steel will answer equally well in bad water and good water. We have reduced the tensile strength of steel down to from fifty to fifty-seven thousand, and the carbon down to not less than .13 nor above .18. We think we get better results there. The character of the water has a good deal to do with the hardness of the steel that you can use. Our water is largely an alkaline water. We have a chemist, and of every sheet of steel that comes to us we make a chemical analysis as well as a mechanical test. The largest sheets we use are 235 inches long, 109 inches wide and 9-16 inch thick. That is used with the side sheet and wagon top. The sheet on some of the boilers is 114 inches wide by 186 to 196 inches long. I think it would be a mistake to have any general recommendation for steel for fireboxes for the whole country.

Mr. Dean: I would like to ask the members of the committee why they have ignored the elastic limit in steel. I have labored under the impression that the elastic limit, coupled with elongation or reduction of area, was about the most important quality that steel has. If the elastic limit is exceeded the steel is useless. There is always the tensile strength. I have had some experience as an inspector, and I find that steel varies very much in thickness in different places, and I think a good many of the steelmakers allow their rolls to run too long before turning.

Mr. A. Gibbs: The reason we did not specify anything on the subject of elastic limit was, first, we use very little of it; and, secondly, all the strain the boilers are designed for is somewhere near 14,000 pounds per square inch, and that strain is so much below the elastic limit of any steel we know of that we did not consider it necessary to touch upon it. The determination of the elastic limit is a much more troublesome matter than that of the other qualities; it is necessary to put micrometers on the piece and measure each pull and the stretch, and go on that way until the stretch begins to increase faster than the strain. There is a good deal more work in it than the ordinary test. As to making the test longitudinally and crosswise, we found only one specification where that was referred to. In that case there was no difference in the tensile strength of the sheet either way. They called for an elongation of 25 per cent. pulled lengthwise and 25 per cent. pulled crosswise. We made a little test, and got about the same result—two per cent. difference. On the matter referred to by Mr. McConnell, the tensile strength, of course we haven't got any water east of the Mississippi River that is as bad as the water he uses. We tabulated the results of 255 boxes, and got as many as possible of the fireboxes west of the mountains, where they run in a limestone country, and as far as we have gone there is nothing to show anything inconsistent with the highset return in sheets having the highest tensile strength.

Mr. Lewis: It strikes me that in the chemical composition there is one inconsistency—in all the discussions we have had on the subject, it is claimed that steelmakers could not make a sufficiently good steel, sufficiently low in sulphur and phosphorus. Mr. Samson Fox, one of the oldest steelmakers in England, said that if proper rules were observed,

(*Continued on page 124.*)

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THE MASTER MECHANICS' CONVENTION.

We continue in this issue the report of the proceedings of the Master Mechanics' Convention, begun in our last issue. The Committee on Oiling Devices for Long Runs had to draw most of its information from foreign, notably English practice, as it seems that on the roads in Great Britain more attention has been paid to such devices than on the roads here; and as showing the improved results following such attention cases are cited of the new *Queen-Empress* handling successfully a passenger train from Chicago to New York after having run a trial trip of but one mile before the start, and of the *Exposition Flyer* locomotives on the Lake Shore & Michigan Southern daily making continuous runs of 135 miles without having a single hot box during the season (summer) that this fast train was run. As a contrast to these performances comes the report of a road in Manitoba where new engines are required to run several months on slow trains before they are permitted on long fast runs. The reason given for this is that in the cold climate there the oil freezes, but it would seem that if oil judiciously thinned with kerosene was used there would be no trouble from freezing. The report recommends liberal bearing surfaces, and oil holes and grooves liberal in size and number; and it indorses the growing practice of forging rod cups on rods, and expresses the opinion that rod cups are sufficient for continuous runs of 100 to 150 miles.

The report of the Committee on Boiler Steel Specifications excited unusual interest. There were two reports on this subject, one by the majority recommending firebox steel having a tensil strength of 60,000 pounds per square inch, with allowable variations of 5,000 pounds either way; and a report by the minority recommending softer metal with a minimum ultimate strength of 50,000 pounds and a maximum ultimate strength of 58,000 pounds per square inch. The recommendations of the majority report contained proposed standard specifications for shell and firebox steel and were adopted for a period of two years. As a result of this, boiler plate manufacturers will be enabled to make and lay in stock plates of the standard specifications. This should cheapen the price of plates while maintaining a standard excellence of quality. There is little doubt that this move will eventually give general satisfaction to the users and makers of locomotive boiler plates and that it will improve the quality and decrease the cost of the same. Two years of experience with the specifications adopted will probably suggest some modifications, but we believe that the advantages of having standard boiler steel specifications will be made so evident that the association will not be willing to abandon them.

Locomotive fire kindlers furnished a subject for an interesting report by a committee headed by the president of the association. The advantages of oil (when properly controlled) over wood for kindling fires in locomotives are made so plain in the report that it is probable there will follow a rather extended movement toward the adoption of a safe oil fire-kindling device. The committee was continued for another year, but it is probable that it will learn little to contradict the views expressed in the present report.

The Committee on Exhaust Nozzles and Steam Passages proved itself equal to any emergency and rendered the most interesting report on the subject it had in hand that has been presented so far. The results of its experiments show that, with other conditions equal, the greatest smokebox vacuum is obtained when the exhaust nozzle is below the center line of the boiler. This was emphasized during the discussion of the report by the related experiences of different members, the opinion being expressed by some that the lower the nozzle could be got, the larger could be made the area of its opening. Referring to the partition in single exhaust pipes, it was found that with the top of the partition placed 20 inches below the nozzle, the back pressure was considerably increased at slow speeds and late cut-offs, due to interference of the exhaust jets with one another; but at high speeds it made no practical difference what relative distance the partition occupied to the nozzle.

The report on Tire Treatment handles a matter of much permanent importance to the members in a concise and instructive manner. It recommends that for shrinking tires on large wheel centers the Association's standard of $\frac{1}{8}\frac{1}{0}$ inch or $\frac{1}{1}\frac{1}{0}\frac{1}{0}$ inch per foot of diameter be used, and in addition that retaining rings be used on all wheel centers over 62 inches in diameter. The proper minimum thickness that tires can be worn to for the last turning is named as $1\frac{1}{2}$ inches for passenger service and $1\frac{1}{4}$ inches for freight and switching service. It suggests that, if the business of the road will permit, tires should be turned when worn $\frac{1}{4}$ inch on road engines and $\frac{3}{8}$ inch on yard engines; and that flanges should not exceed $1\frac{1}{2}$ inches in depth on road engines and $1\frac{3}{8}$ inches on yard engines. In connection with this matter, the suggestion of the Committee on the Cost of Maintaining Locomotives to the effect that turned tires should be kept on hand is pertinent. By doing this, engines can be given new tires without removing the wheels from beneath the engine, and the engine can be turned out in about 10 hours. A number of different gages designed by members of the association for measuring the wear of tire treads and depth of flanges accompanies the report, and a few of these are reproduced in our publication of it.

Those useful money savers, special shop tools, received in the report of the committee on this subject the attention that has long been due them. The merits of portable drilling devices are properly set forth in the report, as are also those of small lathe tools and expanding lathe mandrels, and the advantages of having air hoists to handle the material at heavy machine tools. The advantages of electricity as a motive power for cranes, turn and transfer tables, and for illuminating shops and yards, as well as for brazing, welding, etc., are commended to those contemplating new shops or large extensions of old ones. Such members are also advised to make liberal inquiries respecting special shop tools, and not to try to procure from one or two manufacturers all the tools required. The possibilities of heavy turret lathes, milling and punching machines are also commended to the consideration of master mechanics, as are also emery and tannite grinders to supplant the old style grindstone. It is insisted that any shop having over a dozen men should have a toolroom, with a careful man in charge to care for and sharpen all small tools. This very valuable report is concluded by giving a long list of special tools that are in use in some of the large railroad shops in America.

The report on the cost of maintaining locomotives expressed the conclusion that locomotives built in contract shops cost more to maintain during the first few years of service than do engines built in railroad shops. The cause of this is attributed to difference in workmanship, it being suggested that workmen in contract shops are not as careful to do their work properly on engines which they probably will never see or hear tell of again, as are workmen in railroad shops who know that any careless work will be traced home. The report shows that the frequently noticed apparent difference in the cost of maintaining locomotives on different roads is frequently only an *apparent* difference due largely to different methods of accounting and charging expenses, and that where the difference is not due to such causes it is generally due to the difference in the physical characteristics of different railroads, or to differences in the speed or kinds of engines. The importance of centralizing the work of doing heavy repairs in one or more large shops on any system is expatiated on in the report, and the growing practice of "forestalling the day of heavy repairs by doing beforehand such work as can be performed with certainty and profit" is earnestly recommended.

The report on sanding devices furnishes considerable interesting information, and recommends the use of improved devices for supplying sand to the rails in an even and easily controlled amount. Several such devices are named, and it is recommended that the expenses attending the procuring and preparing of sand for locomotive use should be charged to the locomotive account, the same as fuel and other supplies. The opinion is expressed that if this is done it will result in economy.

A POST-MORTEM EXAMINATION.

The American Railway Union and its offspring, the Pullman boycott, are as dead as the proverbial door nail, and about the only reminders left of them are injuries of a more or less serious character that have been sustained by nearly every person and interest in the United States. Thousands of railroad men who a month ago had good jobs are to-day out of work, but as thousands of other railroad men who a month ago were out of work now have the good jobs, this in itself is no evil. Indeed it may accomplish much good, for it will teach a needed lesson to those who have lost their employment and to those who have supplanted them. The lesson will be one on the Liberty of Labor, a subject that is destined to receive in the near future more consideration than the so-called Rights of Labor—that cloak under which countless assaults have been made on the best interests and real rights of labor, the first of which is liberty, liberty to work for satisfactory remuneration. The understanding and observance of this principle will eventually cause the end of strikes, because, with liberty to work and protection from insult and violence guaranteed, a successful strike of workers in any occupation in any civilized country would be almost impossible, so little is any particular man or set of men needed for the work of the world.

The worst suffers in consequence of the "late war" of this lawless labor organizatian against not only the railroads but the people and the government of the country, are those who have had to submit to an interruption of their business, their means of travel and communication, and to the miscarriage of their matured plans of procedure. The loss, misery and disappointment caused these are widespread and will never be measured or known. Others who have dared to insist on their right to work are in new made graves, and others who were active in lawlessness are in prison cells. It is a great satisfaction to know that among the latter are counted the prime movers in the conspiracy that for a while almost paralyzed railroad traffic and the business and industrial activities depending on it, and it is to be hoped that the terms of their incarceration will be sufficiently long and severe to impress upon them, and upon others by the example, the fact that the laws of this country, state and national, are made by all the people, for all the people, and for the protection of the legitimate rights and interests of all against unjust, unreasonable or unlawful interference by selfishly disposed individuals or collections of individuals.

Probably no labor union ever organized started out under as fair promises of reform as did the American Railway Union, or sooner met a miserable fiasco in consequence of contradicting by its actions the principles it professed. This organization has been a lie and a cheat from its inception. Under the false declaration that its objects were "*the education of its members, the abolition of strikes and the maintenance of harmonious relations between employers and employees,*" it gained toleration and indorsement. The education of its members has been in the direction of anarchy and of open war on the law and the government. Instead of abolishing strikes, it has caused a greater number of them in the brief year of its existence than all the other labor unions in the country have in the past five years. Instead of promoting harmonious relations between employers and employees, it has striven to engender enmity and animosity between them. The ambition of its leaders has plainly been to inaugurate a reign of terror in this country which in cruelty, vindictiveness and general destruction of life and property would have surpassed the French Revolution. That they did not succeed was simply due to the fact that the American people as a whole are prosperous, patriotic and contented. This is a nation of working people, and there are fewer drones in proportion to the workers in it than in any other nation. Property is more widely distributed among individuals here than anywhere else on this round world, and so are the necessities of life and a larger proportion of luxuries.

We have said before that six feet of earth should make train wreckers all of one size, whether their attempts were successful or not. The same applies with greater force to those leaders of the American Railway Union whose counsel and example have led to the many wrecks of trains and losses of life in consequence in numerous sections, and who have tried to wreck the peace of our country. Some of their followers have met and others will probably meet this specification, for there were some shot dead while attempting to destroy bridges, and others are in jail awaiting trial for murder in some States and for train wrecking in others, the hangman's noose being a certainty for each upon conviction.

The post-mortem examination of this dead labor union and its strikes reveals a shameful blot on the escutcheon of organized labor, the effect of which will be to alienate for a long time much sympathy with its cause. It also reveals the fact that in this country no labor union or federation of such unions can dictate unjust or unreasonable terms of employment or remuneration, or for any considerable length of time embarrass the activities of industry and commerce.

This is a great nation of intelligent workers, only a small proportion of whom chose to join unions whose objects are antagonistic to the interests they serve and from which they receive fair remuneration. While the vast majority of our workers are contented and do not affiliate with labor unions, they are disposed to be liberally tolerant of

those who are discontented and seek to redress their real or imagined grievances through unions; but when such unions undertake to paralyze industry and abridge the liberty of the whole nation, they simply invite sure disaster, which will be swift in coming and overwhelming in its force.

CHARITY.

During the Master Car Builders' and Master Mechanics conventions at Saratoga, in June, a sacred concert was given for the benefit of the New York *Tribune* and Chicago *Daily News* fresh-air funds. An admission fee was charged those attending the concert, and $174.23 was realized. The sum was distributed equally between the two papers named. Mr. F. W. Coolbaugh was chairman of the committee having the matter in hand, and the letters of acknowledgment he has received from those in charge of the *Tribune* and *Daily News* funds, respectively, are touching in the extreme. The Rev. Willard Parsons, in charge of the *Tribune* fund, says:

The *Tribune* Fresh Air Fund relies entirely upon voluntary subscriptions with which to carry on its work of sending poor children from the overcrowded tenements to the country for two weeks. The average expense per child for that period is about $3, though last year it was much less. It will thus be seen that this handsome contribution will accomplish as great, if not greater results than the most exacting could expect. Surely the members of the two associations named will have cause for rejoicing with us since they have aided so materially in making such possible.

Mr. Charles M. Faye, manager of the *Daily News* fund, says:

In behalf of those who cannot speak for themselvse, permit me to thank you for the check for $87.11, being half of the proceeds of the sacred concert at the June conventions of the Master Car Builders' and the Master Mechanics' associations at Saratoga. It is more welcome than I can tell, because of the great need of help this season. The Sanitarium opened on Monday, June 11, and for the 29 days since the record is: Sick babies, 3,354; mothers, 4,730; children, 8,974. It must be understood that every organized charity in Chicago is shut down during the spring and summer months, and that the *Daily News* Fresh-Air Fund is the only living help to the poor and sick at this time.

We are sure that those who attended the concert and contributed to its worthy object have just cause to be glad they did so. The summer is a trying season for the poor in large cities, and it is made more so by the closing of charities that contribute to their comfort in winter. It is generally supposed that in summer they have no need of assistance, but while they do not need fuel and food as in winter, they do need fresh air in sickness, and this can only be obtained by leaving their crowded quarters in the city.

A most discouraging feature of the recent lawless interference with railroad traffic was the encouragement given the lawbreakers by officers high in municipal and State authority. The mayors of Chicago and Springfield, Ill., openly countenanced the lawless strikers, as did also the governors of Colorado, North Dakota and Illinois. The Attorney-General of North Dakota acted most disgracefully. The Mayor of Chicago disgraced himself and his city. Respecting the latter, the *Railway Review*, of Chicago, says:

It is undeniable that the personal attitude of Mayor Hopkins in the early days of the strike was the greatest obstacle to the maintenance of law and order. His office was the headquarters of the various movements against the Pullman company; it was the gathering place of the agitators, and it is positively asserted on both sides that the mayor advised the boycott of Pullman cars. In the midst of the worst rioting and disorder the mayor for some time wore the white ribbon of the strike sympathizers. And not until the combined influence of prominent citizens of Chicago and the administration at Washington thoroughly alarmed him, did he take any active measures to restore order.

Of course these demagogues were bidding for future votes, and it is to be hoped that voters, the vast majority of whom are law-abiding men, will remember them and their conduct on election day.

Those who attended the Saratoga Convention in June and met the familiar and kindly face of William T. Small, will learn with a shock of surprise and regret of his sudden death at Rochester, N. Y., on July 6. Mr. Small was one of the best known and most highly respected American railway master mechanics, and since February, 1893, was Superintendent of Motive Power of the Buffalo, Rochester & Pittsburgh Railroad. Mr. Small commenced his railroad career in Chicago in 1864, on the Chicago & Northwestern. From there he went to Parsons, Kan., on the M., K. & T. R. R. as general foreman of the locomotive shops, and was afterward promoted to be Master Mechanic of the entire line. From there he went to the Northern Pacific as Assistant Superintendent of Motive Power of the western divisions, and was promoted to be Superintendent of Motive Power of the entire line in 1889. He resigned that position in 1892. He leaves a widow and four children. He was a brother of Mr. Henry J. Small, who has for a number of years been Superintendent of Motive Power and Machinery of the Southern Pacific Railroad.

The efforts of several candidates to secure the secretaryship of the Master Mechanics' Association at the June convention has been characterized by one of the railroad papers as "an unseemly scramble," and the methods adopted as "those of the ward politician." The criticism is just. The peace and dignity of the Association are of too much value to be jeopardized in this way. Probably none of the members realize this more than those to whom the above criticism applies.

Literature.

The Mexican Investor. Monthly, in English. One dollar per year. A. P. Crowe, Editor and Manager. Calle Santa Isabel, No. 10, City of Mexico.

The first number of this new publication has been received. It will treat of the resources of Mexico, and of the possibilities of safe investment in the country. The first issue contains articles on mining stocks, coffee culture and an article on the State of Colima, written by Mr. Francisco Palencia, the member of the Mexican Congress from that State. It is expected that other members of Congress will contribute articles on their respective States. General Porfirio Diaz, President of Mexico, warmly indorses the publication.

American Street Railway Investments, a supplement to the *Street Railway Journal*, Havemeyer Building, Cortlandt street, New York.

The first number of this publication has appeared. It is to be an annual publication, and the future numbers will, as the present number does, give all desirable information respecting street railways in the different cities of the United States. Those interested in street railways will find this book full of interesting information.

The Official Railway List, 1894. The Railway Purchasing Agent Company, Rookery Building, Chicago. Price, cloth, $2.00; flexible leather, $3.00.

This is the 13th edition of this very useful list of American railway officers. It has been carefully corrected up to the date of issue. The book contains, as usual, much matter aside from the list of officers that is useful for railroad men, and the list embraces officers of every degree from presidents to foremen of repairs.

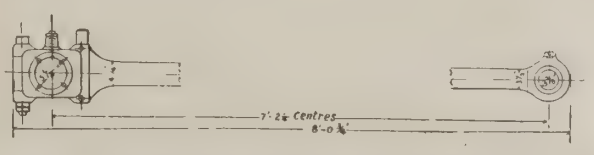
Communications.

Main Rods on West Shore Locomotives.

[Referring to the design of main rod described in Mr. Heffernan's article on Repairing Locomotives in this issue (see page 117), and said to have given excellent satisfaction on the West Shore Railroad, we requested of Mr. Boon, the Assistant Superintendent of M. P. and R. S., some further information respecting it. His letter follows:]

Editor National Car and Locomotive Builder:

Referring to main rods on West Shore engines, would advise that we have about 200 locomotives with the main rod such as you describe. I herewith send a drawing of the rod on our passenger engines. It is possible the rod would change adjustment as the key is driven, but as all our brasses are fitted to the pin with a key solid and bearing tight, when it is necessary to ease the brasses, in order to take up the lost motion, liners are put in and the rod is adjusted to the proper length. After 10 years' experience we have found no objections to this rod.



The recesses referred to in the back end of main rod, originally were made to hold a sponge. This did not work well and was replaced with pine blocks wrapped with cotton wicking. These also failed to give satisfaction and were replaced with babbitt; all these brasses are now running with babbitt.

The front end, or crosshead end of main rod, has no keys or means of adjustment of any kind; being an eye with a solid brass bushing. This arrangement has also given excellent results. JAMES M. BOON.

In repainting heavy coach work in which window frames have to be painted, it is an economical plan to thoroughly smear the glass over with whiting mixed to a spreading consistency in turpentine. This method is a straight shoulder hit at the wasteful expenditure of time spent in cleaning the glass in car windows also. In running the sash of windows it takes an amazingly skillful brush hand to avoid daubing the glass more or less with color, with varnish, and the various other substances which enter into the process of painting and finishing. The use of whiting enables the painter, when the job is finished, to wipe off any of the accumulated material in a quarter of the time required to scrape and wash with wood-alcohol. The whiting washes off readily, and carries with it all the liquid and solid matter lodged thereon. It is such little floating atoms of economy as the above which comprise the sum total of an amount which the painter should keep a keen and penetrating eye upon.—*Painting and Decorating.*

Personal.

Mr. Winfield J. Taylor, of Baltimore, Md., has been appointed Receiver of the Washington & Chesapeake Beach road.

General Manager W. H. Baldwin, of the Flint & Pere Marquette has resigned, to take the vice presidency of the Southern Railway Company.

Mr. W. W. Mayberry has resigned as General Superintendent of the Mexico, Cuernavaca & Pacific, and is succeeded by Mr. W. T. Sprague.

Mr. R. Finney, Jr., has been appointed Purchasing Agent of the Pittsburgh & Western, in place of Mr. J. J. Saint. Headquarters, Allegheny, Pa.

Mr. C. M. Ward, General Manager of the South Carolina & Georgia Railroad, has resigned, and is succeeded by Mr. L. A. Emerson, with office at Charleston, S. C.

Mr. Homer T. Dick, formerly Assistant to the General Manager, has been appointed Superintendent of the Ohio Southern, with headquarters at Springfield, O.

Mr. E. M. Herr, formerly Superintendent of the Grant Locomotive Works, has, it is reported, become Manager of the Gibbs Electric Company, of Milwaukee, Wis.

Mr. Samuel Griffith, Division Master Mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, at Kankakee, Ill., died at North Bend, O., June 25, at the age of 72 years.

Mr. George Preston, Master Mechanic of the Canadian Pacific at Toronto Junction, has been transferred to the Eastern division, and is succeeded by Mr. George MacKinnon.

Mr. C. W. Bogart has been appointed General Foreman of the Erie & Wyoming Valley shops at Dunmore Pa. He was formerly Assistant General Foreman of the Erie shops at Port Jervis.

Mr. A. L. Mohler has been appointed General Manager of the Minneapolis & St. Louis. Mr. Mohler was formerly General Manager of the Great Northern and resigned that position several months ago.

Mr. L. M. Martin, late General Manager of the Des Moines, Northern & Western, has been appointed General Manager of the Iowa Central, with headquarters at Marshalltown, Ia., to succeed Mr. E. McNeil.

Mr. N. Monsarrat, late Vice-President and General Manager of the Cleveland, Akron & Columbus, has been appointed Receiver of the Valley Railway, with office at Cleveland, O., to succeed Mr. J. K. Bole, deceased.

Mr. Samuel Spencer, ex-President of the Baltimore & Ohio, and one of the Receivers of the Richmond & Danville, has been chosen President of the Southern Railway Company, under which name the Richmond & Danville has been recently reorganized.

Mr. W. S Jones, formerly Superintendent of the Rome, Watertown & Ogdensburg, and afterward Superintendent of the Central Division of the New York & New England, has been appointed General Superintendent of the South Carolina & Georgia, with headquarters at Charleston, S. C.

The following appointments took effect July 15 on the Seaboard Air Line: Mr. James Maglenn, Superintendent Motive Power, with office at Raleigh, N. C.; Mr. S. B. Shaw, Master Mechanic, with office at Raleigh, N. C., Mr. D. W. Ballentine, Master Car Builder, with office at Portsmouth, Va.

Mr. P. E. Burwell has resigned as General Superintendent of the Cumberland & Pennsylvania, the resignation took effect July 30. He will be succeeded by Mr. Lewis M. Hamilton, who has been Assistant Superintendent for a number of years. Mr. Burwell will remain in the employ of the company as Consulting Engineer.

Mr. W. H. Trainham, Master Car Builder of the Richmond, Fredericksburgh & Potomac Railroad, died recently, and his death was announced as follows by General Superintendent E. T. D. Myers: "It is with great distress that the death of W. H. Trainham, for many years the Master Car Builder of this company, is announced. He was a thorough workman and an exemplary man, whose record is untarnished. His death is a great loss to us."

The *Maine Central*, a paper published by the Maine Central Railroad, gives in its latest issue a portrait of Mr. Charles H. Kenison, the Master Car Builder of that road, together with the following biographical sketch of his career: Mr. Kenison was born in Concord, N. H., April 15, 1830. He learned the millwright's trade and continued in that business until May, 1858. He was on locomotive and passenger car work from May, 1858, to May, 1864, for the Old Colony Railroad. His connection with the Portland & Kennebec and Maine Central railroads dates from May 12, 1864. He was appointed Master Car Builder of the Maine Central Railroad in October, 1881.

The Master Mechanics' Convention.

(*Continued from page* 121.)

there was no trouble in getting phosphorus and sulphur as low as .04 and .05. The claim has been made that we cannot get sulphur and phosphorus so low on account of our fuel, except in the natural gas regions. They do not have natural gas in England, where Mr. Fox produced these effects. It would seem to me, in this respect, the action of the committee would seek to undo what we have heretofore done in establishing a proper limit for sulphur and phosphorus.

Mr. Barnes: I have examined a case of an exploded locomotive boiler this year. The shell sheet was so brittle crosswise of the grain that it would not bend as much as five degrees. Lengthwise of the sheet, or rolling, it would bend nearly double. The tensile strength of the steel was 65,000 pounds per square inch, from actual test. The elongation lengthwise would fill this requirement, in some cases. The boiler exploded because the steel was so hard and so brittle that when the sheet was rolled to make the double riveted lap, it was hammered in the rolls with an iron hammer and cracked.

Mr. Forsyth: I am in favor of the 65,000-pound limit for fireboxes, and after listening to the discussion I do not think there have been any sound objections put forward to it. I think the tendency is to think if a firebox sheet cracks that the steel is high strength and high carboned. But I think the results of a great many tests have shown that soft metal, low strength metal, is about as liable to crack as high strength steel. Mr. Pitkin brought up an important point yesterday in considering firebox steel, and that is the overheating of the sheets. These sheets sometimes get nearly red hot, and then they begin to pocket, and after a sheet has pocketed the strains in it are such that almost any steel will eventually crack.

Mr. Gentry: I feel satisfied that the report will suit the majority. It establishes a safe limit for those who have not had an opportunity of making laboratory tests. To such members as have laborotories, and can make tests, they are not going to be governed entirely by the report, but will be governed by their particular circumstances.

Mr. Barnes: Does the committee think that a steel is good to use that contains the outside limit of all these chemical ingredients?

Mr. Gibbs: I do not know enough about it personally; we endeavored to provide a sliding scale for the different elements.

Mr. McConnell: As there appears to be such a wide difference of opinion on this subject, I move that the committee be continued for another year, to make a report at the next meeting.

Mr. Gibbs: The committee has done a good deal of work on this subject. We could not get much additional data to enable us to report much progress next year. I think it would be better to let the subject go over for a year or two, and let the members make trials, and see if there are such obstacles as are supposed.

On motion of Mr. Gentry, amended by Mr. Mitchell, it was decided that the majority report should be adopted, that the condemning point of sulphur should be changed from .045 to .035, and that with this exception the recommendations of the committee should be adopted as the practice of the association for two years.

The report of the Committee on Locomotive Fire Kindlers was next read by Mr. John A. Hill, one of the committee.

Locomotive Fire Kindlers.

In considering the subject of kindling locomotive fires with any other material than wood, the first consideration must be cost, and the second fire risks. It is now the custom in this country to use from about one-eighth to three-fourths of a cord of wood to kindle a fire, the latter amount being required to kindle hard coal; this calls for the purchase, hauling, handling, storage and cutting of many thousands of cords of wood on every large railroad. In Europe, where wood is scarce and expensive, banked fires of coal are kept in large furnaces and a gang of men employed to carry live fire to engines. Oil as a kindler has often been tried and as often abandoned. Insurance companies absolutely refuse to risk any house where oil is stored, or where it can flow by gravity into a building, or be kept under continuous pressure. Devices for burning it have been crude and too clumsy to handle in every-day service. Oil has always been cheaper than wood for fire kindling, but it has always been more dangerous. The conditions under which it could be successfully used seem to have been simmered down to the following:

1. There must be no oil stored in the building.
2. There must be no gravity flow toward a building, under any circumstances.
3. Only so much oil must be brought into a building as will kindle the fire or fires needed, the surplus, if any, immediately removed.
4. A burner easy to handle.
5. No possibility of leaving the supply of oil on by accident or carelessness.
6. A system of fire kindling cheaper and better than that in use.

Several of our members have been working on this problem for some years with more or less success, and all the conditions seem to have been met in the device now in use at the Chicago roundhouse of the Chicago, Rock Island & Pacific, the Cedar Rapids shops of the Burlington, Cedar Rapids & Northern, and other cities in the Middle States, and known as the Leslie fire kindler.

The report here described the Leslie locomotive fire kindling plant at the Chicago roundhouse of the C., R. I. P.& R. R. As the plant was very fully described on page 112 of the NATIONAL CAR AND LOCOMOTIVE BUILDER for July, we omit this portion of the report. Continuing, it says:

A number of tests have been made to determine the difference in time required to get up a given pressure of steam with wood and oil kindled fires. The oil-kindled fire always got up steam first, but the difference in time was inconsiderable in a few instances, but 20 to 30 per cent. in favor of oil when steam was raised to a working pressure.

The saving of oil over wood does not end with the difference in cost of fuel per fire. A 6,000 gallon tank of oil is one carload for the company to haul, insure and run risks on. The equivalent in wood would be 500 cords, or 71 carloads; 71 cars to load, transport and unload, and the lading to store and cut up, to say nothing of the risk of fires, cost of handling, etc. When wood is green or wet more is used; expensive lubricating or illuminating oils are wasted to help it, and some wood is always stolen. Weather has no influence on the quality or the quantity of oil fuel for a fire; it requires no storage room, no handling, no push cars, no opening of doors, no smoking of cabs and no danger from fire.

If a railroad now keeping in repair and running 71 cars to transport 500 cords of wood in a given time, would haul 71 cars of oil, for fire kindling, it would equal 5,041 carloads of wood. Besides its usefulness as a fire kindler, this system of handling liquid fuel may be employed in taking off and putting on tires, welding or straightening bent or broken frames or front braces, heating up sagged crown sheets and for similar purposes. The advantages of the oil system of fire kindling seem to be many. It has proved itself cheaper, easier and better than wood, decreasing the fire risk, storage room and labor in handling.

JOHN HICKEY, J. O. PATTEE, GEO. B. BROOK, W. T. REED, JOHN A. HILL, Committee.

Mr. Hill: Since this report was written the committee has received several communications on the subject, each bringing up a point not touched on in the paper. One point raised is as follows:

"In most of the statements there seems to be no mention made of the expense of pumping air for the purpose of forcing the oil through pipes. As you are probably aware, at most points where engines are housed, there are no air plants at present provided, as there is little or no use for compressed air. In such cases the entire expense of compressing the air will be chargeable to the kindling of fires, and it will be found that the compressing of this air costs something which cannot be ignored in making a true statement."

Certainly the air compressed for fire kindling costs money, and the inference is that at a point where there is no air used for other purposes this would be quite an expense. Mr. Leslie has informed your committee that they have had perfect success with plants at isolated places where the entire equipment, aside from the regular piping, consisted of a large air drum and a hose connection. When an engine comes into the house her train line hose is coupled into the storage tank hose and the pressure pumped up; this has been found sufficient to kindle a number of fires and at practically no expense, as the steam in the boiler is wasted any way.

Another point brought out is stated as follows:

"Where air is compressed for other purposes, such as testing brakes, or operating pneumatic machinery in roundhouses, the proportion of the cost chargeable to kindling fires would be small. Another point in regard to statements: I have seen wherein it is assumed that 1½ gallons of oil have practically the same amount of heating power as ⅛ of a cord of good hard wood. In our experience we have demonstrated that it takes practically twice as much coal considered with oil to produce the same results as are produced with the ⅛ cord of wood. In general the proportions of each would be for each kindling 400 pounds of coal and 1½ gallons of oil; two hundred pounds of coal and ⅛ of a cord of wood."

Personally I cannot understand how this is possible, as after the fire is kindled the wood is gone and there is but 200 pounds of coal burning in the box, while with the oil kindled fire there is 400 pounds of burning fuel. It may be possible that the heat units given off by the two fires are not far different, but it seems to me that the oil kindled fire is in the best condition.

Mr. Bushnell: We have had the device in use only a short time. The length of time required to start the fire depends somewhat upon the condition of the coal, as to whether it is dry or moist.

Mr. Gentry moved that, as the subject was somewhat new, the committee should be continued for one year. Carried.

The report of the committee on exhaust nozzles and steam passages was read by the Chairman, Mr. Quayle.

Exhaust Nozzles and Steam Passages.

In contemplating the necessities of the work of investigating this subject the commitee decided that shop tests were necessary to secure uniform conditions, and arrangements were made to conduct such tests at Purdue University, but the destruction by fire of the engineering laboratory at Purdue necessitated different arrangements.

The committee forthwith designed a truck for the purpose of carrying a locomotive—the power being absorbed by brake-shoes, and the pressure on the brake-shoes being controlled by water instead of air. It was agreed to fit up a special exhaust pipe having a partition plate that would have a vertical lift of five inches. The object of this was to increase or decrease the area of the exhaust pipe at the combining point, where the steam is exhausted from the double nozzle into the single pipe, to learn if by raising or lowering this it would have an effect upon the back pressure. It was also arranged with a telescope pipe that had a vertical movement of 5⅝ inches. This was to obtain, if possible, a fixed relative position between the top of the exhaust tip and the stack. The plan of work agreed upon in addition to that was to apply a vacuum indicator for showing the vacuum in the smoke-box. We found that this indicator worked very successfully at the slower speeds, but when the higher speeds were attained the spring was not sufficiently active, and would not respond to the faster pulsations in the smoke-box due to the exhaust. The use of the vacuum indicator was therefore abandoned, and the water column alone was used. An air-chamber was used to give a steady movement to the water in the glass. A Boyer speed recorder was placed immediately to the front of the forward driving-wheel under the running board, so that accurate readings of the speed could be taken during the test. An indicator was used on the cylinder to obtain the amount of back pressure and exhaust pressure in the cylinder.

The following series of tests were made:

First Series.—To ascertain the position of the exhaust nozzle, the position of the partition in the exhaust pipe and the diameter and shape of the stack that would give the best draft with the least back pressure in the cylinder. The speeds were varied from 20 to 40 miles an hour and the cut-off from 5⅝ to 14⅝ inches. The length of the stroke was 24 inches. The results of this series of tests are given in Tables I. to V., inclusive, showing the effect of changing the position of the exhaust nozzle and the position of the partition in the exhaust pipe.

TABLE I. (AVERAGE RESULTS.)

Type of smokestack, 13 inches straight. Exhaust nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
24⅝	5-0	6.6	5.7	8.0	8.1	4.3	
20¼	5-0	6.0	5.6	7.3	8.1	4.3	
16	5-0	6.6	5.2	7.6	7.8	4.4	

TABLE II. (AVERAGE RESULTS.)

Type of smokestack, 14 inches straight. Exhaust nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
24⅝	5-0	8.3	6.9	9.8	8.3	4 9	
20¼	5-0	8.7	6.8	9 7	8.8	4.9	
16	5-0	8.4	6.9	9.5	8.6	4.3	

TABLE III. (AVERAGE RESULTS.)

Type of smokestack, 16 inches straight. Exhaust nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
24⅝	5-0	7.9	7.1	9.3	8.5	4.7	
20¼	5-0	6.9	7.0	9.6	7.6	4.7	
16	5-0	7.9	6.8	8.1	7.7	4.9	

TABLE IV. (AVERAGE RESULTS.)

Type of smokestack, taper. Exhaust Nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
24⅝	5 to 0	9.2	7.9	9.57	8.8	5.1	
20¼	5 to 0	8.45	7.4	9.7	8.07	5.2	
16	5 to 0	8.05	7.1	7.57	7.0	5.33	

TABLE V.

Tyne of smokestack, taper. Exhaust nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
24⅝	0	8 7	9.5		9.5	5.8	
28⅝	0	10.0	9.2	8.8	10.4	5.5	

Second Series.—To ascertain the effect on the vacuum of of changing the position of the stroke in the smokestack.

The position of the choke was varied from 6 inches to 20 inches above the base of the smokestack at the top of the smokebox.

The results are given in Table VI.

TABLE VI.

Type of smokebox, straight with choke. Exhaust nozzle, 4½ inches. Length of smokebox, 59 inches.

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
							Position of choke "A."
28⅝	0	9.8	.....	8.8	9.8	.....	20 inches.
28⅝	0	.....	7.3	10.3	9.6	5.9	17 "
28⅝	0	8.6	7.1	9.8	9.2	.....	14 "
28⅝	0	.....	8.1	10 6	10.0	5.8	11 "
28⅝	0	8.7	7.2	10.0	9.8	5.9	8 "
24⅝	0	*9.3	7.6	10.7	9.0	5.2	6 "
16 (M)	0	†	6.11	9.79	6.8	4.5	6 "

* Telescope raised four inches for this reading .11 inch.
† Steam jet struck above choke in stack.

Third Series.—To ascertain the effect on the vacuum of changing the length of the smokebox.

Two lengths of the smokebox were used, viz: 59 inches and 38 inches from the tube sheet.

The results are given in Table VII.

TABLE VII.

Type of smokestack, taper. Exhaust nozzle, 4½ inches. Length of smokebox, 59 and 38 inches

Position of exhaust nozzle, "B."	Position of the partition in the exhaust pipe, "C."	Vacuum in inches of water.					
		14 5/16	9	11 11/16	9	5⅝	Cut-off.
		105	158	158	211	211	Revs. per min.
		20	30	30	40	40	Miles per hour.
28⅝	0						
Length of smokebox 59 inches.		10	9.9	11.7	11.8	6.4	
Length of smokebox 38 "		13	10.1	13.0	13.5	8.5	

NOTE.—The above tests are comparable with each other, but not with other tables, owing to the difference in location of vacuum pipe.

CONCLUSIONS FROM THE TESTS.

First. The results show that within the limits of these experiments the vacuum is greater when the nozzle is below the center of the boiler than when above it. The extreme limits of variation of the height of the nozzle in these tests was from 1⅝ below the center of the boiler to 11 inches above, which corresponds to a variation from 28⅝ inches from the base of the stack, at the top of the smoke arch, to 16 inches from the same point. The results are given in Tables I. to V., inclusive.

Second. It was found that the back pressure line on the indicator cards was raised considerably when the partition in the exhaust pipe was at the lowest position, and when the speed was low, especially for long cut-offs. This is due to the interference of one exhaust jet with the other. It is evident that for passenger engines the position of the partition is immaterial, as there was no rise of the back pressure line on the indicator cards at high speed for any position of the partition. The variation of the position of the partition from the top of the exhaust nozzle was from 20 inches to 15⅝ inches, and the variation of one opening of the exhaust pipe at the partition was 65 to 123 per cent. of the

area of the exhaust nozzle. The results are given in Tables I. to V., inclusive.

Third. After experimenting with 13, 14 and 16-inch straight stacks and a 13-inch tapered stack, it would appear that the maximum draft can be obtained under all conditions by using a tapered stack having easy approach at the bottom and a tapered part at the top, having a total angle of about 10 degrees. Fig. 14 shows the general shape of such a stack. It is important that the contracted portion of the stack and the exhaust nozzle be so located that the steam will strike the stack at or below the contracted portion. The results are given in Tables I. to VI., inclusive.

Fourth. With this engine a 14-inch straight stack gave a greater vacuum than a 13-inch and a 16-inch. The results are given in Tables I. to IV., inclusive.

Fifth. It was found that a variation in the position of the choke in a straight stack did not materially alter the vacuum when the steam jet struck the stack below the choke. See Table VI. But when the exhaust nozzle was raised and the choke lowered so that the steam jet struck the stack above the choke, the vacuum was materially reduced.

Sixth. This test shows that an increase of the length of the smokebox over and above that necessary to get in a cinder pocket in front of the cylinder saddle is unnecessary and undesirable, as the long smokebox greatly decreases the vacuum. Sufficient area of netting can be put into a smokebox which is long enough to give room for a cinder pocket in front of the cylinder saddle.

ROBERT QUAYLE, WM. FORSYTH, JAMES MCNAUGHTON, JAS. W. HILL, W. S. MORRIS D. L. BARNES, Committee.

Mr. Forsyth: The question of what the real angle of exhaust steam from a locomotive is has not been determined carefully by any experiment, and in trying to get what the angle was we found a great difference of opinion. It would be a creditable thing for a committee to make careful experiments and determine what this is, because it is of great assistance in designing locomotive stacks. If you have the angle it is an easy thing to get the stack pretty nearly right.

Mr. Barnes: Regarding the conclusions, it is noticeable, more than anything else, that this report is quite against the long smokeboxes and decidedly in favor of the short smokeboxes. Zerah Colburn many years ago found a short smokebox gave more vacuum than a long one. This test corroborates it. In the first conclusion we were not able to lower the exhaust nozzle enough past the lower limit, while we were able to raise it so high that the vacuum was decreased; but with the apparatus we could not get low enough where the vacuum decreased on the lower side. If the nozzle were lowered eight inches more, we would get a greater vacuum than given in the tables.

Mr. McConnell: We are using the diamond stack on the Union Pacific. Our cylinders are constructed on a very liberal plan. On our 18-inch cylinders the exhaust is 8 inches in diameter. On the 19 and 20 inch cylinders the exhaust is 8½. We have a consolidation engine with 3⅝ double exhaust nozzle, with a diamond stack. The boiler is 66 inches in diameter, and is so high that we cannot get a stack to exceed 4½ feet in length. On our passenger engines, 18 × 26 cylinder, our exhaust nozzle is 3½ inches, double nozzle. We are running that up in the mountain where the air is light, and it is supposed you have to run a smaller nozzle in light air than in a lower altitude. The result of the diamond stack in dollars and cents to our company has been that in 1890 we hauled 254 loaded freight cars one mile with a ton of fuel; in 1893 we hauled 260 cars with a ton of fuel; in passenger service, 1890, 119; 1893, 145 passenger cars one mile with a ton of fuel; in 1890, 2,590 tons one mile; 1893, 2,757 tons of freight one mile with one ton of coal; in 1890 our engines were all equipped with the extension front and straight back; in 1893, all equipped with diamond stack. In 1890 expense of handling cars, including expense of motive power and car department, was 3.17; in 1893, reduced to 2.79; 1890, the passenger service was five cars to a train; 1893, 5.96. The freight service has also increased—15.86 cars in a train in 1890, 17.12 in 1893. Tonnage has increased and we have saved in one year $87,000 worth of coal by our diamond stack. Our flues were worn out faster with the extension front end. Our experience has been, it is more economical and we get better results from the diamond stack than extension front end.

Mr. Quayle: I would like to know whether the increase in economy is due to the diamond stack as compared with the straight stack, or short front end and long front end; question of stack or extension. It is pretty well concluded that the long front end is not in it with the short front end.

Mr. Gailbraith: I do not think it is so much in the stack as in the length of the front end. We have increased our mileage on coal from 19 to 33 miles to the ton on the same section. I am very much in favor of the short front end.

Mr. Mitchell: I think the combination of the front end and the stack is what decides the question. I have engines on our road with short front end, extension of 18, 24, 30 and 36 inches; they were originally 36 inches, but we have gradually been cutting them down. I think we get the best results with the 18-inch extension. These engines originally had a tapering stack, five feet long. We have made a series of experiments by putting in various sizes of liners until we have obtained the best results with 13¾ at the throat and 16 inches at the top, 54 inches long.

Mr. Roberts: I would like to ask Mr. McConnell what height nozzle he uses with the diamond stack?

Mr. McConnell: We make them as short as we can get them; not to exceed 4½ inches.

Mr. Roberts: I think the height of the nozzle has more to do with the economy of fuel and the steaming qualities of the engines, using the extension front end and straight stack, than the length of the front end.

Mr. Tongue: I have a great many engines with the diamond stack, and they make excellent records. On one of these engines I put the front end on, and the engineer was much annoyed lest the steaming qualities would be reduced. It was not decreased; it was not improved; and there is where we stand.

Mr. Graham: I have engines with extension front ends and straight stacks. Two engines, both the same size and run, one has extension front, and the other short front; both straight stacks. I find with the extension smokebox I can run with a double nozzle ⅛ inch larger than the other, and, so far as the consumption of coal goes, the one with the extension front end makes a little better mileage.

Mr. Peck: I find in the front end engine a great deal depends on the deflector plate; I have better results placing it behind the nozzles than in front of them.

Mr. Cromwell: We have over eight hundred engines with the extension front; they are from 18 to 44 inches. We never saw any material difference in their steaming qualities, so long as we kept them air tight. There is no question about the nozzle, the stack and those things entering into the steaming quality of the engine.

Mr. George Gibbs: My experience coincides with the committee, except that I would lay less stress on the difference between the tapering and straight stack than they do. I do not think there is much difference in practice between the two.

Mr. Benson: I have found very little difference in the shape of the stack, with the exception that a choker stack, in burning hard coal, would chop your fire out. I have that impression very strongly. Twenty-three inches down from the base of a 16-inch stack is the proper place for a nozzle.

Mr. Mitchell moved that the committee be continued for another year, and that it continue the experiments on the line followed, and take up the question of the diamond stack, and see what stack will give the best results. Carried.

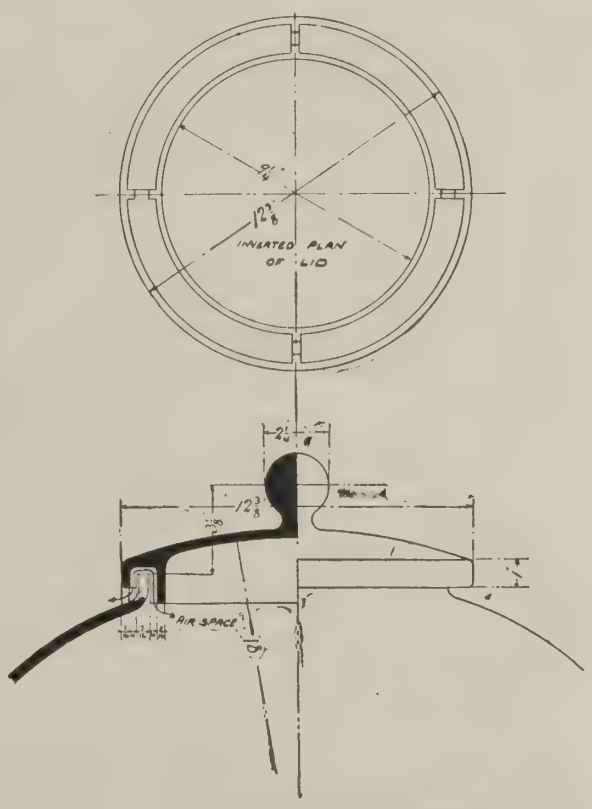
The report of the Committee on Sanding Devices was read by the chairman, Mr. O. Stewart.

Sanding Devices.

The use of sand upon the rails to prevent slipping of locomotive driving wheels seems to be at times a necessary evil. It is conceded that the injudicious use of sand increases the wear of tires, rails, ties, tender and car wheels, and also the resistance to trains.

The method generally used to distribute sand upon the track is not capable of fine adjustment, and has only been retained in the absence of something better. Within a comparatively short time several so-called improved sanding devices have been designed, calculated to sand the track reliably, evenly and economically.

The report here goes on at considerable length to relate the questions asked in its circular of inquiry, and the answers received thereto. These show that a majority of members considered the ordinary sanding arrangement unsatisfactory. Many have improved devices in use, one using a jet of hot water back of the drivers to clean the track. Leach's device is used by 25 members answering, as compared with six members using other devices. The general opinion expressed was to the effect that these devices



PLAN FOR VENTILATING SANDBOX.

effected a saving of from 30 to 50 per cent. in sand, and that the improved distribution of sand on the rails increases the hauling capacity of locomotives and saves fuel, also reduces the liability of breakage of crank pins and rods, with their usual disasterous results.

The cost of sand per ton in the sandbox is variously reported from 20 cents to $2.47, averaging $1.13 per ton; the weight of a boxful varying from 450 to 1,050 pounds, averaging 730 pounds. Estimates place the amount of sand used by a locomotive in a year at from 9 tons to 88 tons, the average of all estimates given being 46 tons. Continuing the report says:

All of the improved sanding devices reported upon use a current of air, controlled by a valve in the cab, to carry the sand to the pipes, and the reports indicate that this method is found to be more economical and satisfactory than the sand lever arrangement. In regard to the amount of this saving in sand, the reports show a marked difference. It is evident that reports of a saving of 65 to 80 per cent. are not based upon actual tests, but they may be regarded as forcible expressions of a considerable saving. Probably 35 to 50 per cent. is more nearly correct, and is a very satisfactory showing. It cannot be questioned that a saving of this amount of sand, especially upon heavy grades, reduces the resistance to trains, but no data are at hand to determine the amount of this saving. It would seem that any device which reduces the amount of sand used must effect a saving in tire wear. If, however, a device is so easily operated that it is used without necessity, then, instead of a saving in sand, the opposite might be the result, and some check on the amount used would be desirable. Again, pneumatic devices may be so constructed that they do not indicate in the cab when they are in operation, and the feed valve may be left open longer than necessary through the forgetfulness of the engineer, when waste of sand and unnecessary wear of tires would be the result. Your committee, therefore, recommend that all improved devices have some telltale arrangement in the cab, as a reminder to the engineer. It is too often the custom of engineers to "catch" driving wheels that are slipping by a liberal use of sand, instead of partly closing the throttle. No one will deny that this practice often results in broken rods and crank pins. Any device, therefore, which feeds a limited and continuous stream of sand at a time when the conditions are favorable for slipping, must have the effect of reducing the liability of breakage of crank pins and rods.

According to the reports, the cost of sand in the box varies from 20 cents to $2.47, and averages $1.13 per ton. In cases where the cost is given as low as 20 cents per ton we can hardly believe that the cost of loading and transportation has been taken into account. However, taking the average cost per ton, and the average amount used by each engine, as given in the reports, and figuring a saving with improved devices of one-third, which we believe to be a conservative estimate, we have a saving in value of sand alone of $17.32 a year. Adding to this the reduced wear of tires, machinery, tender and car wheels, rails and ties, and also the lessened resistance to trains, the result is strongly in favor of this method of sanding.

To show the difference of opinions of members of the Association in regard to the matter of automatic operation, we quote from the replies made by the superintendents of motive power of two prominent roads. Each speaks favorably of the pneumatic principle. One says: "The principal features of the sanding device should be that of ready application without change or disturbance of the sandbox as usually constructed, and the device should be made operative in connection with the engineer's brake valve." The other says: "No; neither do I approve of the automatic feature in connection with the air brake, as there are places on our system where the use of sand is forbidden, such as interlocking switches, etc."

Your committee believes that the proper drying and screening of sand for locomotive use and the ventilation of sand boxes are of sufficient importance to warrant a few remarks. Sand is too often put into a box in a damp condition, and the heat from the boiler has a tendency to bake and prevent its free delivery. Improper screens are often used, being either too coarse or continued in use when worn out, and the men who do the screening become careless in their work. Either or both of these causes allow stones to get into the box, and when they become lodged in the passages or obstruct the movement of the valves not only cause much annoyance but often considerable delay and expense in removing them. A netting not coarser than four meshes to the inch each way, or perforated sheet steel with openings not over ⅛ inch wide, should be used to screen sand for pneumatic devices, as the current of air has a tendency in light feeding to blow out only the finer sand, the coarser material accumulating and in time requiring to be cleaned out by a stronger blast through openings provided for that purpose.

Sandbox covers are often made without any adequate provision for a circulation of air. We all know what a common practice it is for enginemen during pleasant weather to remove the sandbox covers for ventilation to prevent sweating. We believe that a similar plan to the one shown in the accompanying drawing should be made for all sandboxes.

Judging from the reports received, the whole expense of procuring and preparing sand for locomotive use is not generally charged to the engine performance. Many of the reports do not give any data as to the cost of sand. This matter is not generally given the attention that the importance of the subject demands. Why should not sand expense be charged to locomotive account the same as fuel, oil and other supplies? If this were done your Committee believes that it would greatly reduce the amount of sand used by either the pneumatic or the old sand-lever arrangement.

O. STEWART, F. M. TWOMBLY, C. E. FULLER, JR., L. M. BUTLER, J. MEDWAY, Committee.

Tire Treatment.

In making our report, your committee for this year labor under the same difficulty as the committee of last year, so far as the question of retaining rings for large centers is concerned, in that nearly all of the replies are based on personal views or opinions, instead of practical experience, on account of the members not having locomotives with large wheel centers running over the roads with which they are connected. This feature of our subject being therefore in such an embryonic condition, we can only give a consensus of the opinions expressed, which may show in a measure the probable direction, or field, which the railroad mechanical officers will first enter in equipping locomotives with large driving wheels, so far as increased safety of the tires is concerned, and enable each one of us to have the benefit of the judgment and opinions expressed, both in the report and in the discussion, should we be required to design large driving wheels for a locomotive in the near future.

The different phases of the subject will be taken up in the order they appeared on the circular of inquiry; the views of the replying members will be given as concisely as possible, after which will follow the recommendations of your committee.

QUESTION: *What shrinkage do you use per foot in diameter of each size wheel center above fifty-six (56) inches?*

Your committee, from the answers received, find the majority of the members are using either the master-mechanics' standard 1-80 or 1-100 inch per foot in diameter of center for shrinkage, and would recommend that these allowances be followed on the larger centers, when future experience will demonstrate the proper shrinkage to use, and the association will be in a position to recommend the correct amount of shrinkage for all diameters.

QUESTION: *Do you consider an increased shrinkage necessary on account of the application of the driver brakes?*

Over 66 per cent. of the members replying do not consider any increase in shrinkage necessary. It is the opinion of the committee that increased shrinkage is not necessary on account of the application of the driver brakes.

QUESTION: *For tires of the large diameters mentioned (66 inches and above), do you consider retaining rings necessary for increased safety?*

Two railroads are using retaining rings on wheel centers less than 62 inches in diameter (the adoption of retaining rings on one of these roads was probably due to the result of legal complications), and it has been the practice of railroad companies and locomotive builders of late years to put retaining rings on all wheel centers of 66 inches and upward. The committee consider that retaining rings are necessary on all wheel centers above 62 inches in diameter.

Your committee would recommend the same shrinkage as used for each size of wheel center without retaining rings, for the reason that if retaining rings are used they have been applied to give increased safety.

QUESTION: *What is the minimum thickness of tires you consider safe to run without retaining rings in?*

Concerning the thickness that tires should be considered safe at last turning, your committee find the recommendations vary from 1¼ to 1¾ inches for passenger service, from 1¼ to 1⅝ inches for freight service, and from 1 inch to ⅞ inches for switching service. After a careful consideration of this subject we would recommend the limit on passenger tire be placed at 1½ inches for last turning, and the limit on freight and switching tires be placed at 1¼ inches for last turning. The weight on drivers not to be considered, and no distinction made between engines equipped with driver brake and those that are not.

QUESTION: *What is the greatest permissible depth of wear on tread of driving wheels you consider?*

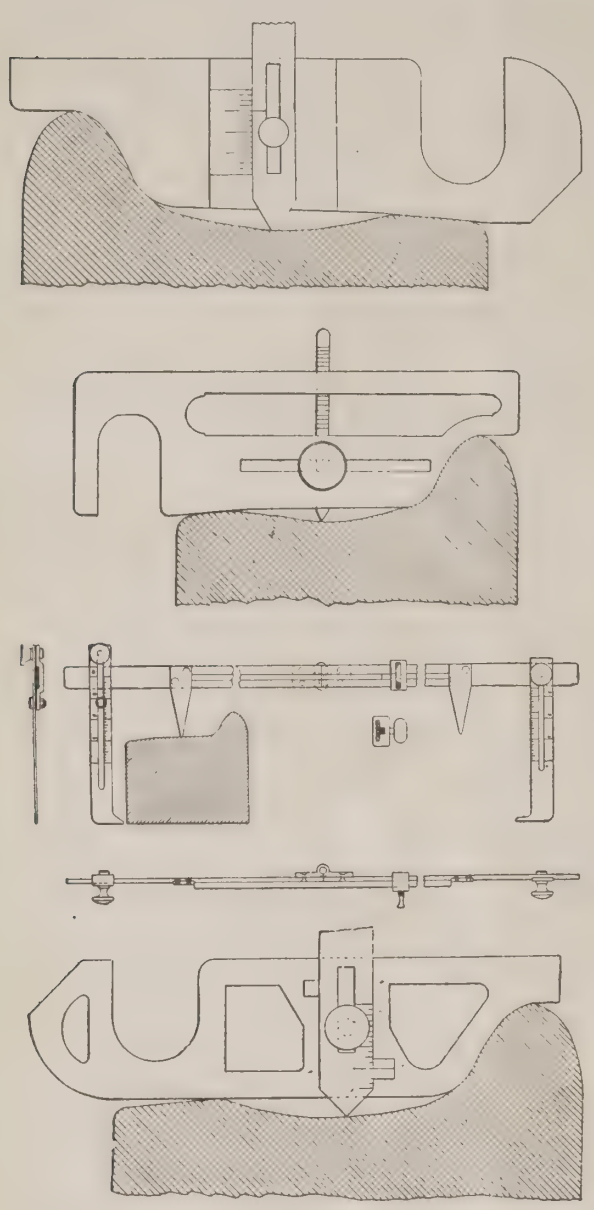
Your committee believe the wear on tires should not exceed ¼ inch in depth before turning on road engines, and ⅜ inch in depth for switch engines. We believe the conditions of traffic on railroads govern, in a great measure, the depth tires are worn; for instance, if power is badly needed,

engines are often run when the tires should be turned. While we recommend and believe the above limits are good practice, we do not believe an arbitrary rule could be carried out at all times, as the business on a road regulates the number of engines that can be spared from service for tire turning. We believe if above practice was carried out, it would be equally advantageous to the engine and the track.

Question: *What is the greatest permissible depth of flange of tires you consider safe to run?*

Your committee would recommend the depth of flangs permissible on road engines 1½ inches, and on switch enginee 1⅝ inches.

Among the several gages submitted for measuring depth



Gages for Measuring the Wear of Treads and Depth of Flanges of Tires.

of wear of tread, and depth of flange on tires with worn tread, the committee submit those shown in the accompanying engravings for the information of the association.

A. E. Mitchell, Geo. W. West, Thos. Millen, J. H. McConnell, A. J. Cromwell, John Y. Smith, Committee.

Special Shop Tools.

We find much attention has been paid to the working of portable universal drilling and boring machines; they are, in fact, indispensable in the larger shops, and in any shop that handles even a few modern engines a month they can be made to pay largely. Some of our members have apparatus made by them, but there are on the markets several excellent portable drilling devices, some operated by power from the shop shafting, in shape of ropes, sheave pulleys, flexible shafts, etc., others driven by steam or compressed air. It is found that new locomotive cylinders can be drilled and reamed in the floor near where they are to be applied faster and more accurately with a good portable device than with most radial drill presses, and the heavy castings do not have to be moved as often as if under the drill press; and all the heavy reaming for repairs, drilling out and renewing staybolts, tapping staybolt holes, and many other jobs formerly done by hand. The means of conveying power to these drilling machines can also be utilized for cylinder bores, valve seats, planers, etc., and where ropes and sheaves are used in connection with suitable snatch blocks or "turn abouts" the power can be conveyed to any desired point. Your committee recommend their adoption as a labor and time saving device, and find that they are not as generally known, and used, as their merits demand. We strongly recommend the introduction of cheap and reliable hoists for general use at heavy machine tools, and members can get all necessary information from our list in regard to those in use in railroad shops, and we find there are quite a number of such appliances manufactured by the well-known makers of pneumatic, hydraulic and other forms of cranes and hoists, and there are several builders of machine tools and railroad shop specialties that make a cheap and reliable hoist. Members desiring to get full capacity of their machine tools and reduce liability of accidents to employees and save wages of helpers and laborers, should give this important item in shop practice the fullest consideration.

Your committee find that very little progress has been made in utilizing electricity in locomotive repair shops, and they are of the opinion that various causes will combine to prevent much being accomplished in this direction for quite a while yet; however, they feel that, in view of the rapid strides made in applying this powerful element to heavy cranes and for other purposes in the large building shops, more than a passing notice should be given it by members contemplating the erection of new shops or an extension on a large scale of present shops. The possibilities of a good electric plant in connection with large locomotive and car shops are, in our opinion, very great; in addition to its use as a motive power for cranes, transfer tables, turn-tables, etc., it may be considered as a means of lighting buildings and yards, welding, brazing, and perhaps other uses suggesting themselves as necessity occurs.

Among special shop tools that are not very generally used, mostly because their value is either underestimated or their better qualities little understood, are the best designs of patented small lathe tools. We refer to those tools so made, tempered and set in stocks or holders as to prevent the necessity of dressing and shaping, but that always present a proper cutting edge by grinding the dulled point only. Such tools are cheap compared to the immense quantities of high-priced tool steel cut up monthly for small lathes, those for threading, cutting off and light inside boring being especially handy and economical and insuring good work, while the more substantial, such as diamond points, round nose, square, etc., save time at light machines; this is particularly true of small lathes in toolrooms. We do not recommend these tools for heavy work on any class of machines.

Another class of shop tools that can be gotten up in any shop, but which we find are not generally in use, are the holding bars, or stocks, made to fit tool posts of large engine lathes, and even wheel lathes, as well as planers, slotters, etc., and so arranged with suitable slots and set screws for taking short bits or tools of square tool steel of proper size for work in hand; in this way the very best quality of tool steel may be used at a small cost, and the tools are more handy and can be kept in better shape with less work than if dressed on large pieces of heavy steel. These holding bars or stocks can be bent or set at any desired angle and easily arranged so bits or tools can be worked up to points required, and when necessary the bits themselves can be offset or bent. For heavy inside boring and many jobs of turning, they are more steady and work better than solid heavy tools. Where the slot in the tool post of heavy lathes is small it is best to have a special tool post with a large slot for the tool-holding bars. A tool holder of this kind is used to great advantage in upright slotting machines, and can be provided with clearance for the up-stroke by a simple spring arrangement, thus saving the cutting tool from being broken or worn on the point. The shank or stock of such bars is round, and held between two half-round clamps in the tool post, and can be turned in any direction desired in the post, so as to allow a rounded diamond-point tool to do almost any kind of work. Our list shows that these tools are extensively used in a number of shops, which can furnish desired information. A feature of this particular bar is that it allows the very shortest of worn-out tools of best grades of steel from lathes to be made into a first-class slotting tool, instead of the very heavy tools generally used.

We find the matter of convenient and accurate lathe mandrels has not received the attention it should in most repair shops, and instead of the gradual introduction of good "expanding" mandrels a majority of shops are still depending on the old solid mandrel in its most temporary form, and some shops have a ton of them which, if put at their actual cost, would purchase a full set of the best expanding mandrels, and if sold for No. 1 wrought scrap would go far toward the cost of enough of them to take the place of about all their old mandrels. Since a number of our members have called attention to an expanding lathe mandrel in daily use by them and recommend it so highly, and from the fact that a reliable tool of this kind is difficult to obtain at reasonable prices, and many of our members having experience with some very poor devices of this sort, your Committee have decided to mention the "Nicholson expanding lathe mandrel" as probably the best of which they have knowledge, and as having been mentioned by all members who touched on this subject in their contributions.

We desire to impress upon our members the advantages to be obtained in looking carefully around and corresponding with fellow members when they are selecting shop tools, with a view of getting what are really "special shop tools." There are several builders of good heavy shop tools that make few if any specialties, and at the same time there are many parties making strictly special tools who make few if any regular heavy machine tools. Some of the very best special shop tools are made by parties not as well known as the old standard machine tool makers; this is particularly applicable to turret lathes, universal and plain milling machines, grinding and polishing machines, bolt-heading and threading machines, punching machines, tube or flue welding machines and many others that should be specially selected, and not included in contracts for shop plants, with a view of trying to procure from one or even two parties all the machine tools required.

Among the most useful of the special tools above mentioned, we would suggest that the possibilities of well designed heavy turret lathes and heavy universal milling machines and punching machines, designed to meet the requirements of heavy locomotive shop repairs, make them the most important special machine tools to be considered in equipping a shop. We mention the punching machine particularly from the fact that we find it is not as generally used as it should be in repair shops; with a proper punch and accurate templates, about two-thirds of the rough drilling in car repair, and about all in tender and tank work, and very much bridge, roadway and miscellaneous work now drilled in many shops, can be punched at great saving in time and allow use of drill presses for needed work that cannot be punched.

The rapid introduction of self or air hardening tool steel has caused the retirement of the old-style grindstone as a means of sharpening large machine tool cutters, etc., and the substitution of heavy tannite and emery grinders has proved, wherever tried, a paying investment, those styles of grinders designed to use water plentifully on the wheel have shown their superiority over the dry wheels.

There is a very convenient double form of these grinders with one coarse and one fine grained wheel set in same frame, and it is found that the smallest tools can be finely ground without injury to temper. We suggest to those of our members who have never used them to inquire into their merits as compared to old-style grindstones.

In conclusion, your Committee want to forcibly impress each member with the importance of a "toolroom" and tool keeper. In our opinion, no shop, however small, can afford to be without a toolroom, if it is nothing but a corner railed off in the shop and looked after by the foreman. We find most shops of consequence have toolrooms, many of them very elaborate arrangements, for making, repairing and caring for tools. We find that any shop employing as many as a dozen machinists can well afford to establish a toolroom and select a good man who has qualifications for this work, whose duty it should be to look after and keep small tools in order, and keep all drills, cutters, reams, etc., ground ready for immediate use; such tools should not be altered or even sharpened outside of the toolroom. Members wanting information in regard to toolrooms and methods of checking for tools, etc., can get the same from most any member whose name is given on the list accompanying this report.

T. W. Gentry, Geo. L. Potter, H. D. Gordon, G. R. Joughins, Wm. Swanston, F. B. Miles, Committee.

List of Special Shop Tools, giving Names of Tools and Special Service Designed to be Met, with Names and Address of Members who can furnish Prints and Information in regard to them.

P. Leeds, Louisville & Nashville, Louisville, Ky.:

Chuck and boring bar for eccentrics. Cylinder chuck, 54 inch planer. Cylinder chuck, 60 inch planer. Boring bar for tube sheets. Dies for heavy punching under steam hammer. Expanding mandrel for turning and finishing dead or bull rings. Reamer for patch bolt holes (special). Method of slotting links in slotting machines. Drill press attachment for links. Portable horizontal and vertical drill. Portable drilling and reaming machine. Universal joint for portable machines. Adjusting arrangement, portable machine. Expanding mandrel for turning and finishing cylinder packing rings.

Allen Cook, Chicago & Eastern Illinois R. R., Danville, Ill.:

Applying connections to airbrake hose. Jig for drilling eccentrics. Tool bar or tool holder for slotter. Injector seat reamers. Device for making wrought spring saddles for driving boxes. Die or tool for forging wrenches.

J. E. Keegan, Grand Rapids & Indiana R. R., Grand Rapids, Mich.:

Pneumatic hoist. Pneumatic press for copper and tin shop. Application of air to wheel press. Air-tank used with Wells' tire heater. Grinding attachment for lathes. Center rest for wheel lathe. Hydraulic bushing press. Flue cutter. Grinding attachment for planers

F. B. Smith, New York, Pennsylvania & Ohio Railroad, Meadville, Pa.:

Removing and applying gaskets to airbrake connections. Lathe attachments for turning tumbling shaft bearings. Lathe attachments for turning eccentrics. Transfer jack for drop pit. Safety or locking hook for handling tires. Counterboring and foxing tool combined.

J. H. McConnell, Union Pacific Railway, Omaha, Neb.:

Staybolt drilling machine. Radial crane. Pneumatic press for boiler shop. Automatic nut tapper. Ten-inch pneumatic hoist. Rod polishing machine. Link grinding and polishing machine. Lathe center. Nut mandrel. Bolt centering machine. Pneumatic press for driving-box bearings. Device for coupling driving springs. Moffat portable drilling engine, operated by air. Mandrel for turning driving bearings. Pneumatic flue roller. Reamer for piston fit crosshead. Drill press boring bar. Pneumatic device for air hose couplings, etc. Lathe boring bar. Bolt fitting device.

Geo. W. Stevens, L. S. & M. S. Ry., Cleveland, O.:

Arrangement for stretching, clamping and lacing very heavy belts. Machine for rolling and forming coping for locomotive tanks. Machine for turning wrist pins for cross heads. Attachment to foot or tail stock of lathe for brass work. Reamer grinding machine.

W. Smith, C. & N. W. Ry., Chicago, Ill.:

Arrangement for planing locomotive links and quadrants. Attachment to lathe for turning tumbling shaft bearings. Turret head for ordinary lathe. Locomotive hoist. Flue hole cutter. Flue scarfing machine.

E. C. Williamson, M., St. Paul & Sault Ste. Marie Railway, Minneapolis, Minn.:

Arrangement for heating tires with gasoline.

A. E. Mitchell, New York, Lake Erie & Western R. R, New York City:

Device for removing worn gaskets. air hose. Device for handling tires in setting them. Flexible shafts. Expanding mandrels. Automatic saw sharpener. Hydraulic bushing press. Device for applying air hose connections. Swinging emery grinder. Overhead trolley for erecting shop. Truck for carrying cylinders, etc. Oil pump for filling squirt cans. Arrangement for transferring oil from barrels to oil tanks. Locomotive link grinding machine. Arrangement for cleaning car seats, cushions, etc., by compressed air. Milling machine for valve seat ports. Swing boring mill.

John Hickey, Northern Pacific Railway, St. Paul, Minn.:

Hydraulic lift for drop pit. Quartering square for driving wheels. Pneumatic hoists. Hydraulic press for removing piston rods from cross-heads. Chuck for piston packing rings. Arrangement for reaming check valve seats, etc. Steam and air gage hand remover. Tube sheet cutters. Hand pumps for drop pits. Driver and truck drop pit. Device for gaging worn tires. Thirteen-inch pneumatic jack. Flue expander and spring former.

R. C. Blackall, D. & H. C. Co. Ry., Albany, N. Y.:

Hydraulic lift or jack for car shop, wheel crane, jack for car work, locomotive lift, crane for oil storage, press for driving bearings, crank pin press, wheel press, crane, 5-ton capstan for car shop.

C. T. McElvaney, M., K. & T. R. R., Dennison, Texas:

Lift for drop pit. Pneumatic crane. Pneumatic device for handling wheels. Swivel joints, connections for blowing off pressure on boilers.

G. B. Hazelhurst, Baltimore & Ohio Ry., Baltimore, Md.:

Tapping gig. Eccentric rod gages. Tire boring gages. Eccentric strap gages. Eccentric block gages. Wheel center gages. Split eccentric. Flue testing apparatus. Pneumatic hoists. Suspended emery grinder. Outfit for lead lining journal bearings. Many other useful and handy devices for shopwork on application.

G. W. Rhodes, C., B. & Q. R. R., Aurora, Ill.:

Arrangement for removing and setting tires with gas. Arrangement for using oil fuel in bolt, spring and other furnaces. Arrangements for utilizing compressed air in hoists, riveting machines and portable engines for drill borers, reaming, tapping, etc. Roller for tightening side rod bushings. Countersinking ratchet. Special tools, dies, etc., for use under steam hammer in forging rocker arms, etc Many other useful devices in shopwork on application.

R. D. Wade, Richmond & Danville R. R., Washington, D. C.:

Tool holding bars for heavy lathes and slotters. Apparatus for removing and setting tires by gas generated at shop. Mandrel for turning driving bearings. Molds and methods of making rings for metallic stuffing box packings. Flue sheet cutter. Special reamers and cutters. Boring bars and attachments for horizontal boring machine for crossheads, rods, boxes, eccentrics, straps, etc. Hand punch and gage for engine jackets and thin sheet metal work. Chucks and attachments for handling special work in lathes. Planers and milling machines. Flexible shafts. Portable drills. Reamers for reseating valves in injectors, air pumps, checks, globe valves, etc. Pneumatic oil lift or siphon for taking oils from barrels to storage tanks. System of toolroom management.

W. A. Brown, Atlantic & Danville Railroad, Portsmouth, Va.:

Drop pit for shop or engine house. Lathe attachment for eccentrics. Lathe attachments for tumbling shafts.

R. H. Soule, Norfolk & Western Railway, Roanoke, Va.:

Very general use of the Moffat motor and drill for following purposes:

Drilling and tapping staybolts. Turning tires of locomotives while wheels are under engine. Setting locomotive valves. Many other ways of utilizing this power will suggest themselves.

Cost of Maintaining Locomotives.

The committee on this subject rendered a report on the comparative cost for repairs of locomotives built in contract shops and those built in railroad shops. The committee found wide diversity in the practice of different roads in charging the various items of expenditure for the maintenance of locomotives, due to lack of uniformity of opinions in the accounting departments of the roads. Performance sheets as usually arranged were considered by the committee as entirely unreliable, and unfit for comparison "without an intimate knowledge of all the circumstances and conditions existing during the period covered by the statements." Necessity for retrenchment sometimes reduces repairing expenses for a while, "only to swell them to unusual figures at a later period." The kind of engines, methods of operation and physical characteristics of different roads were considered by the committee as being important factors in the cost of repairs, this being always larger for mogul, 10-wheel or consolidation engines than for 8 wheel engines. The character of fuel and water, and the effects of sharp curves and heavy grades, also affect the cost of repairs. Higher average speeds were found to cause higher average cost of repairs, the 8-wheel engines in fast passenger service

costing more to keep up than the 10-wheel engines in freight service on the same road.

Referring to the comparative cost of repairs required on engines built in contract shops and those built in railroad shops, the committee received in reply to its circular of inquiry "many opinions and few figures," the consensus of opinion being that engines built in railroad shops were less expensive to maintain, but no opinions or figures were received which would show that in a single case contract built engines had proved less expensive to maintain than those built in railroad shops. Actual figures were furnished only by members of the committee. Mr. J. N. Barr, of the Chicago, Milwaukee & St. Paul, contributed the following:

I give you herewith the average cost of repairs for the first fifteen months of eight of our class "B" eight-wheeled engines, built in a contract shop, and six of the same class of engines put in service at the same time and built in our shops. The average cost of repairs for the eight contract-built engines was 2.028 cents, and the average cost of repairs for the six engines of the same class built in our own shops was 1.155 cents. The only other comparison we can make between engines on equal footing is the case of one of our Class "C" engines, which is a six-wheeled switcher that has been in service two and a half years. The average cost of repairs during that time has been 2.29 cents; nine contract engines of the same class bought at that time have cost on the average 3.45 cents. I have no hesitation in saying that the cost of repairs for the first three years of engines built in our own shops is much less than for engines built in contract shops.

Mr. William Smith, of the C. & N. W. R. R., was not able to furnish figures giving a direct comparison of two lots of engines, but gave the expense of maintaining five contract built engines for the first three years of their existence, and also for the second three years, the idea being that the engines having passed through the shops and been thoroughly overhauled, in a measure they became railroad built engines after that time. The statement showed very little comparative difference. Mr. Smith said:

There is no reason why a builder cannot build just as good engines as any railroad company can, providing they wish to do so. But the builder's engines seldom give as good satisfaction as they do after we have given them general repairs. They are generally fitted up more loosely when we receive them, and the engines do not seem to work as well when new as after they have once been through the shops. I do not see why this should be, unless we are a little more particular with them than the builders are.

Mr. G. W. Rhodes, of the C., B. & Q., said: Our experience is that when a railroad company furnishes drawings, specifications and competent inspectors, there will be found little difference between the cost of maintaining engines built at railroad company shops and those turned out of the shops of locomotive builders. The question is one principally of facilities and supervision. The figures from the C., B. & Q. are given in three tables. The first table shows that the repairs of nine Class "H" moguls built by the railroad company averaged for thirteen months 5.26 cents per mile, and that nine engines of the same class built by contract averaged 5.47 cents for an equal period of time, the difference of .21 cent per mile being in favor of the engines built in the railroad shops. The second table records the expense of repairs on six contract built Class "G" switching engines and five railroad built engines of the same class, the former averaging 2.25 cents per mile for 22 months and the latter at 2.32 cents per mile for an average of $31\frac{3}{12}$ months, the difference in this case being in favor of the contract built engines. However, the figures for the railroad built engines cover a longer period, and the expense of repairs during the latter part of the period must have been greater than in previous months, so that if the figures had covered the same or equal periods of time the result of the comparison might have been different.

The third table is shown herewith, and shows the cost to the railroad company of engines built in their own shops as compared with those purchased from builders.

The table shows the cost of repairs is slightly in favor of the railroad built engines, the 12 averaging 3.59 cents per mile for $25\frac{11}{12}$ months, and the contract built engines averaging 3.62 cents per mile for $11\frac{1}{12}$ months.

COST OF REPAIRS ON C., B. & Q. MOGUL ENGINES, CLASS H.

Engines Built by Contractors.

Maker.	Engine No.	No. of mos.	Mileage.	Amount expended for repairs.	Cost per mile.	Cost each.
Rogers	35	7	31,982	$943.52	2.95	$10,600 00
"	37	11	51,039	1,424.64	2.79	10,600.00
"	43	8	44,804	806.59	1.80	10,600.00
"	47	8	41,775	981.30	2.34	10,600.00
"	51	8	41,850	927.09	2.21	10,600.00
"	99	11	43,952	2,149.27	4.88	10,600.00
"	107	10	48,366	1,068.71	2.20	10,600.00
"	131	8	47,657	693.87	1.45	10,600.00
Baldwin	179	22	95,111	4,975.56	5.23	10,105.00
Rogers	208	8	31,457	1,856.46	5.90	10,600.00
"	398	10	47,735	1,119.44	2.34	10,600.00
Baldwin	414	22	91,720	5,414.89	5.90	10,105.00
	12	$11\frac{1}{12}$	617,448	$22,361.34	3.62	
Per engine bas. on 12 mo'ths.			55,704	$2,017.56	Ave. cost,	$10,567.50

Engines Built by C., B. & Q. R. R.

Engine No.	No. of months.	Mileage.	Amount expended for repairs.	Cost per mile.	Cost each.
48	27	157,546	$6,650.46	4.22	$9,644.15
75	32	172,705	7,297.55	4.22	9,776.05
134	26	87,638	3,841.67	4.38	9,492.04
144	29	184,495	6,543.97	3.54	9,776.05
164	24	127,370	3,401.89	2.67	9,644.15
203	17	81,566	1,279.35	1.56	9,557.34
232	21	85,164	2,292.98	2.69	9,624 73
243	26	128,393	4,051.44	3.15	9,492.04
254	19	83,704	2,909.96	3.47	9,557.34
304	32	116,035	4,479.50	3.86	9,776.05
312	31	114,956	5,787.50	5.03	9,776.05
408	27	125,614	4,090.69	3.27	9,492.04
12	$25\frac{11}{12}$	1,464,586	$52.623 96	3.59	.....
Per engine based on 12 months		56,508	$2,030.52	Av. cost...	$9,634.00

In reference to the foregoing, the report says: It is apparent from the figures obtainable and from the experience of the members who have given us no exact figures, that the cost of maintaining contract built engines for the first few years of service is always greater than for those engines built in the railroad shops, the amount of difference varying with circumstances. Before making an investigation, some of the members of your committee were of the opinion that there was practically no difference, providing the engines were in both cases built under specifications and careful and intelligent inspection, and there appears to be no reason why a builder with his plant properly equipped cannot turn out as good work as a railroad company. Builders, however, labor under certain disadvantages which should not be overlooked in such a comparison. Workmen in a railroad shop know that the engines on which they work stay with the road, and to be repaired will, in all probability, return to the very shops in which they are built. Bad work on their part will, therefore, sooner or later come to light and be traced to them. In a contract shop, the men who are inclined to slight their work feel that once out of the shops they may never hear of it again, and they cover up bad work in spite of careful inspection and supervision. Then, again, less will be heard of bad work coming out of a railroad shop because of the natural disposition of every man to quietly cover up his own mistakes or carelessness.

On this question of the relative expense of maintaining contract and railroad built engines your committee is, therefore, of the opinion that on the average the workmanship in the railroad shops is better than in contract shops, and that, consequently, the repairs of railroad built engines are less for the first few years of their existence than the repairs of those turned out of contract shops, even when the latter are built under thorough inspection.

The following table was presented in the report to illustrate the diversity of practice of different roads in charging certain items to locomotive repairs.

In reference to this table, the report says: "It illustrates very forcibly some of the causes which produce low and high repair expenses, and that its effect can be traced in the performance sheet is clear from the last column of the table."

SHOWING WHAT IS CHARGED TO THE ACCOUNT OF LOCOMOTIVE REPAIRS ON THE PERFORMANCE SHEETS OF VARIOUS ROADS.

Roads with More than Five Hundred Locomotives.

No. of road.	Mileage of road.	Material and labor for regular locomotive repairs.	Material and labor, repair wrecked locomotives.	Repairs foreign locomotives wrecked on road.	Rebuilding to fill vacant numbers.	Engines bought to fill vacant numbers.	Cost of new shop tools bought outside.	Cost of new shop tools built in shop.	Repairs of shop machinery and tools.	Heating and lighting shops, shop supplies, etc.	Salaries of M. M., clerks, foremen, etc.	Wages of watchmen, laborers, etc.	Laboratory expenses.	Drafting-room expenses.	Rental of engines.	Cost of engine repairs.
1	1,473	Yes	Yes	Yes	Yes	Yes	No	No	No	No	P*	No	No	P*	Yes	6.37
2	1,704	"	"	No	"	"	"	"	"	"	No	"	"	No	No	4.89
3	2,175	"	"	"	"	"	?	Yes	Yes	Yes	P*	P*	½	P*	"	4.59
4	3,323	"	No	"	"	No	No	No	No	No	"	?	P*	"	?	4.16
5	5,703	"	Yes	Yes	"	Yes	"	"	"	Rep'irs	"	Yes	½	½	Yes	3.98
6	2,290	"	"	"	"	"	P*	P*	P*	P*	"	P*	P*	P*	"	3.94
7	4,438	"	"	"	"	"	No	No	No	Yes	Yes	Yes	?	Yes	No	3.86
8	4,258	"	"	"	"	"	"	"	"	No	*	P*	P*	½	Yes	3.59
8	1,445	"	"	"	"	"	"	"	"	"	"	No	?	Yes	No	3.53
10	898	"	"	No	No	No	"	"	"	"	?	"	?	?	?	3.25
11	1,340	"	"	"	"	"	"	"	"	"	No	"	No	No	No	2.06

Roads with from One Hundred to Five Hundred Locomotives.

12	819	Yes	Yes	Yes	Yes	Yes	P*	P*	P*	P*	P*	P*	.....	P*	?	7.07
13	1,556	"	"	No	"	"	No	No	No	No	No	No	No	No	No	6.36
14	477	"	"	Yes	"	"	"	"	"	"	?	?	.....	?	Yes	6.16
15	1,499	"	"	"	"	.....	?	?	"	"	P*	P*	.....	P*	No	5.19
16	1,223	"	"	.....	.....	.....	No	No	"	"	No	"	.....	"	.....	4.20
17	1,321	"	"	No	Yes	Yes	"	"	"	"	"	"	No	"	No	4.19
18	1,134	"	"	.....	"	"	"	"	"	"	P*	No	.....	"	.....	4 12
19	1,810	"	"	Yes	"	No	"	"	"	"	"	P*	.....	.....	.....	4 07
20	1,192	"	"	No	"	Yes	"	"	"	"	"	"	.....	No	No	3.92
21	634	"	"	"	"	"	"	"	"	"	"	"	.....	?	Yes	3.68
22	809	"	"	"	.....	.....	"	"	"	P*	"	"	No	P*	No	3.51
23	1,986	"	"	"	No	No	"	"	"	No	No	No	"	No	"	3.42
24	761	"	"	.....	Yes	Yes	"	"	"	P*	P*	"	.....	P*	"	3.30
25	821	"	"	Yes	No	No	"	"	"	"	No	"	.....	"	"	2.99

Roads with Less than One Hundred Locomotives.

26	259	Yes	Yes	.....	Yes	No	No	No	No	No	No	No	.....	P*	No	4.33
27	980	"	No	Yes	In part	"	"	"	"	"	P*	P*	.....	.....	.....	4.05
28	200	"	Yes	"	Yes	Yes	"	"	"	"	No	No	.....	.....	No	3.56
29	583	"	"	"	"	No	"	"	"	"	P*	P*	.....	P*	"	3.42
30	257	"	"	.....	No	"	"	"	"	"	"	No	.....	"	.....	2.79
31	304	"	"	Yes	Yes	Yes	"	"	"	"	"	?	.....	"	No	2.42
32	20	"	"	No	"	"	Yes	Yes	Yes	"	No	No	.....	"	"	2.01

* Prorated.

Continuing, the report says:

By examining the figures for such roads as show an exceptionally high expense for repairs, some of the reasons therefor will be noticed. For instance, the repairs on road No. 1 cost 6.37 cents, but that road has 221 consolidation engines and 161 other engines having more than two pairs of drivers; all legitimate repairs expenses appear in its account; and, further, this road is scrapping many small engines, and filling the vacant numbers with much larger engines, whose cost is charged to locomotive repairs. The figures for road No. 12 illustrate another point we have already alluded to—fluctuation in expenses. Its cost of repairs is high, because during the last fiscal year a large amount of money was spent in rebuilding old engines, giving them new and larger boilers in each case. The Superintendent of Motive Power of this road says that fully one-half of the repair work at the main shops for that year was boiler work.

It may be profitable, in connection with this subject, to turn attention to some of the means by which the cost of repairs may be reduced. The importance of centralizing the work of heavy repairs in one or more large shops on the system, well equipped for doing such work economically, should not be lost sight of. Heavy repairs conducted in small and imperfectly equipped shops, not only cost more than at the main shops, but require more time and keep the engine out of service for a longer period than are necessary. This is a serious matter when there is sufficient business to keep all the motive power moving. The only circumstances under which repairs made at small shops would be cheaper than at the main shops would be when there was a large difference in the rate of wages in favor of the small shop. Certain work, however, can be done economically and quickly in the small shop, when the latter is supplied from the main shops with those finished parts for which it has no facilities. Unless unusual conditions exist a second plant for heavy repairs should not be considered until the first has become large enough to warrant the installation within it of first-class tools, and every convenience by which the cost of the work will be reduced. This having been achieved, and a greater output being desired, it is a question, depending for answer upon local conditions, whether the increased capacity be obtained by enlarging the plant or building a second one, with the expectation that in a short time it will also be large enough to warrant the installation of a large amount of labor-saving machinery.

Continuing, the report said that formerly little was done toward repairing an engine before it entered the shops, but that now many parts were kept on hand in a partly or wholly finished condition, thus facilitating repairs and shortening the necessary time for the same. These parts being finished at the convenience of the shop also reduces the cost of the work. The habit of doing a lot of unnecessary work on engines that go to the shop for tire turning was commented on, and it was suggested that to avoid this and reduce the time of an engine's absence from service it is good practice to keep turned tires on hand for each class of engines, so that when one comes in for new tires the old ones are replaced with new ones without removing the wheels from under the engine. The cast-off tires can be turned at convenience and held for use. In this way engines have been given a new set of tires and turned out of the shop in 10 hours. Some roads carry this policy out to the extent of keeping extra boilers on hand for certain classes of engines.

If it is the settled policy of the mechanical department to forestall the day of heavy repairs, by doing beforehand such work as can be performed with certainty and profit, it will result in keeping the shops more uniformly employed, and in reducing the cost of heavy repairs. A limit to this method of working is reached when the interest on the capital locked up in the repair parts awaiting use becomes so great as to counteract the saving effected, but this will never occur when the repair work is judiciously managed. Those making repairs should be instructed not to substitute new standard parts when it is possible to refit or repair to advantage the old parts, even if they are no longer standard, true economy in repairs being the ruling idea rather than the pushing of certain standards.

Running repairs are frequently not conducted economically, because of the absence of facilities at small outlying points, and the lack of care in keeping such places stocked with the supplies and stores they require, and only those. Thousands of dollars are locked up in supplies at these and larger points, that have gradually accumulated and for which there is seldom any demand. The stock at each place should be kept as low as possible, and yet it should be of such a character as will fully meet the demands at that point.

The tools required for running repairs at outlying points where the number of locomotives cared for is about twenty-five, are as follows:

One boiler and engine, 1 lathe, planer, drill press, bolt cutter, blacksmith's forge, grindstone and 1 complete set of hand tools.

G. W. RHODES, JACOB JOHANN, W. SMITH, J. N. BARR, WM. GARSTANG, W. H. MARSHALL, Committee.

The report of the committee to name subjects for investigation by the Association during the coming year then made its report, which was adopted.

Report of Committee on Subjects.

1. Stacks, Smokeboxes and Exhaust Nozzles.
2. Locomotive Fire Kindlers.
3. Shop Tests of Locomotives.
4. A Decimal System of Gages for thickness of sheet metal, tubes and wire—the committee to confer with manufacturers and others, and to submit a practicable system for adoption by the association.
5. The Utilization of Railway Scrap Material, and best method of handling the same.
6. Causes of Bulging in Firebox Sheets.
7. Best Materials for Boiler Tubes and specifications for the same.
8. Piston and Piston Rod Fastenings with special reference to pistons of large diameter and light weight.
9. To Submit a Set of Proportions for Riveted Joints representing approved practice.
10. Wear of Driving Wheel Tires as affected by Weight upon the same.
11. Pneumatic and Electric Transmission of Power in Railway Shops.

The officers elected for the ensuing year were: William Garstang, President; R. C. Blackall, First Vice-President; R. H. Soule, Second Vice-President; Angus Sinclair, Secretary; and O. Stewart, Treasurer. Two votes were necessary to elect a second vice-president.

The vote for secretary being announced Mr. Angus Sinclair was found to have received 77 votes out of a total of 122. On motion of Mr. Setchel the election of Mr. Sinclair was made unanimous.

The Master Car Builders' Convention.

(*Continued from page* 109, National Car and Locomotive Builder *for July.*)

After the discussion of the rules of interchange ended, during the last session of the convention, the president announced that the report of the Committee on Automatic Coupler Standards and Limits would be read. This was done by Mr. Wallis, the chairman of the committee.

Automatic Coupler Standards and Limits.

All the manufacturers of M. C. B. couplers were invited to participate in the test; fifteen accepted, four declined, and about seventeen did not respond; eight not invited sent couplers. Twenty-one complete sets and four incomplete sets of couplers were tested, and of this number fourteen were made of malleable iron and eleven of steel, all couplers being equipped with steel knuckles.

The results obtained in the striking tests show 16 per cent. of the shanks cracked and broken behind the head; 26 per cent. cracked and broken in the head, and 44 per cent. of knuckles broken. The results of these tests should be considered as furnishing independent information from the drop tests made on a solid foundation. In the tests of 1893 the entire shock was transmitted through the shank and barrel of the coupler, whereas in the tests of 1894 the larger part of the shock was transmitted through the horn, as in service. Your committee believes that the latter tests will furnish more useful information than those of the previous year, for should couplers be redesigned on the strength of tests of 1893 alone, there would be a tendency to strengthen parts of shanks which both the tests of 1894 as well as observations of service show do not fail. Where strength is really needed is directly back of the head, and we are without any reliable data showing that other parts of barrels need be any stronger.

ler manufacturers, and to-day the guard arm has been strengthened, and the percentage of failures at this point is diminished and will continue to diminish with the more extensive application of the M. C. B. coupler.

Couplers which were not fractured in the general tests were subjected to an extra guard arm test, which was to destruction. It will be noticed that of these, 33, or 86 per cent., failed from broken shanks, and only one, or 2.6 per cent., from broken guard arms. In six, or 15 per cent., the guard arms were so much bent as to preclude further test.

Your committee would, therefore, indorsing the recommendations made in the report of 1892, call attention to the necessity of a revision of the dimensions of the shank immediately behind the head, and while larger fillets would accomplish good results, at the same time it believes that a more satisfactory design would be the widening of the shank for a short distance, together with the introduction of larger fillets.

Your committee would again call attention to the indifference displayed toward the M. C. B. contour lines. Out of 114 couplers presented, representing 25 different kinds, but 20 couplers fully complied with the M. C. B. limit gages.

In regard to locking device your committee is at a loss to recommend anything that would be of value. It has been impossiele to assimilate the many different types presented. This must be the work of future investigation. It has only to say that the results show that locking devices are efficient in proportion to their simplicity.

Your committee has great hesitancy in recommending a material to be used for couplers. The result shows that the strongest coupler, all other things being equal, will no doubt be made of steel. The worst steel bar, however, is not as good as the best malleable iron bar, although the best steel bar is superior to the best malleable iron bar, and the poorest steel bar is better than the poorest coupler made of malleable iron. It does not follow, however, that the use of malleable iron is to be condemned, for the reason that your committee does not believe that strength alone is the all-important item. Few structures, involving expenditure of have given us a mass of information that it will be well for every member of the association to study. They have given us information which will enable us to make tests, and have given the manufacturers information which will enable them to meet the requirements. It is, as a rule, thought that a committee has not completed its work until it has made some recommendations for us to vote on; at the same time, some of the most valuable reports are of a character that it is not necessary to vote upon. I am satisfied that the whole association feels that the knowledge of the members, and their opportunities for knowledge in this matter, have been advanced by the work of this committee.

Mr. Marshall's motion was put and carried.

Mr. E. D. Bronner read the report of the Committee on Air-Brake and Hand-Brake Apparatus on Cars.

Air-Brake and Hand-Brake Apparatus on Cars.

Upon looking over the field which should be covered by its instructions, the committee finds that it is obvious that the brake apparatus upon passenger cars, being so constantly under the supervision of inspectors, and the opportunities for repair and mainienance of the same being so frequent and regular, the standards of efficiency established by the various reports heretofore made to this Association and by the Westinghouse Air-Brake Company, can be easily maintained.

The one point the committee wishes to touch upon in this connection, however, is in relation to the hand brakes upon passenger cars. It finds that on the majority of roads the hand-brake wheel is placed so close to the center line of the car that it will not be effective when the ordinary car with this standard of hand brake gear is coupled to a vestibuled car. It also finds that in nearly all cases the brake chain is attached directly to the brake staff with no method of increasing the power of the brakeman operating the wheel.

M. C. B. Coupler Tests, 1894.—Summary Statement of Results.

Name of coupler.	Material in drawbar.	Average weights: Coupler complete.	Average weights: Knuckle.	Striking test. Coupler No. 1. Blows.	Coupler No. 1. Broken in	Coupler No. 1. Cracked in	Coupler No. 1. Below limit.	Striking test. Coupler No. 2. Blows.	Coupler No. 2. Broken in	Coupler No. 2. Cracked in	Coupler No. 2. Below limit.	Coupler No. 2. Average.	Guard arm test. Coupler No. 3. Blows.	Coupler No. 3. Broken in	Coupler No. 3. Cracked in	Jerk test. Coupler No. 4. Blows.	Coupler No. 4. Broken in	Coupler No. 4. Cracked in	Coupler No. 4. Below limit.	Coupler No. 5. Broken in	Coupler No. 5. Cracked in	Coupler No. 5. Below limit.	Total number of blows received.	Number of couplers damaged in: Shank.	Head.	G. arm.	Knuckle.	Pin.	Lock.
American.	S.	227.6	51.6	5	.....	.....	Yes	4	.....	Knuckle	Yes	4½	16	Shank	.....	4	.....	.....	Yes	.....	.....	Yes	29	1	..	..	10	..	..
Buckeye..	M. I.	220.2	59.8	5	.....	G. arm	Yes	7	Knuckle	.....	.....	6	2	Lock	inoperative	4	Knuckle	.....	.....	Knuckle	.....	.....	18	..	..	1	3	..	1
California.	S.	211.8	33.3	4	Knuckle in	operative	....	4	.....	.....	Yes	4	18	Shank	bent badly	5	.....	.....	Yes	.....	.....	Yes	31	1	..	..	8	..	..
Chicago...	S.	222.2	49.5	8	.....	Knuckle	Yes	9	Knuckle	.....	.....	8½	18	G. Arm & L. inop.	Head	5	.....	.....	Yes	.....	.....	Yes	40	.	1	1	1	..	1
Dickey ...	S.	212.7	44.5	5	.....	.....	Yes	5	.....	.....	.....	4½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..	..	..	..	..
Eureka. ..	S.	238.5	48.0	6	Knuckle	.....	....	3	Knuckle	.....	Yes	5	9	Shank	.....	4	....	.....	Yes	.....	.....	Yes	23	1	..	..	..	2	..
Excelsior..	S.	204.7	50.9	7	.....	.....	Yes	7	... .	Knuckle	Yes	7	9	Lock inoperative	Shank & G. Arm	6	.....	.....	Yes	.....	.....	Yes	29	1	..	1	1	1	1
Gould.	M. I.	213.6	37.5	4	Knuckle in	operative	No	7	Knuckle	.....	.....	5½	4	Shank	.....	5	.....	.....	Yes	.....	.....	Yes	20	1	..	..	2	..	..
Improved Standard	M. I.	215.7	66.1	8	Lock inoperative	Head	No	7	Lock inoperative	Head	No	7½	5	Shank	.....	5	Lock inop	erative	Yes	Lock inop	erative	No	25	2	..	..	..	..	4
Johnston.	M. I.	171.6	36.0	6	Head and shank	.....	....	5	Knuckle and shank	G. arm and head	....	5½	2	G. Arm	.....	1	.....	.....	No	Knuckle	.....	....	14	2	2	2	..	..	..
Kans. City	S.	215.6	61.3	6	Head	.....	....	6	Knuckle	.....	.....	6	9	Shank	.....	3	.....	.....	Yes	.....	.....	No	24	1	1	..	1	..	..
Klinger...	S.	280.25	68.0	5	.....	.....	Yes	5	....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..	..	..	..	..
Lathem...	M. I.	232.5	37.4	4	Knuckle	.....	....	4	.....	Knuckle	Yes	4	4	G. arm	.....	4	Head	.....	....	Head	.....	....	16	..	2	1	2	..	..
Lathem A.	M. I.	233.6	37.9	1	Lock inoperative	Knuckle	No	2	.....	Knuckle	Yes	1½	5	Shank	.....	4	.....	.....	No	Knuckle	.....	....	12	1	..	..	3	..	1
LittleGi'nt Buckeye.	M. I.	195.8	49.4	7	Head	Knuckle	....	7	Knuckle inop.	Head	Yes	7	3	Lock inop	erative	9	Pin & lock	Head	Yes	.....	Head	Yes	26	..	4	..	2	1	2
Park	M. I.	168.75	38.5	3	Knuckle	.....	....	5	Head	.....	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	1	..	1	..	..
Pooley	M. I.	205.4	39.1	4	.....	.....	Yes	4	Knuckle	.....	.....	4	6	G. arm	.....	5	.....	.....	Yes	.....	.....	Yes	19	..	..	1	1	..	..
S. H. and H.....	S.	215.6	50.4	6	.....	Head	Yes	6	.....	Head and shank	Yes	6	5	Shank	.....	4	Knuckle	.....	....	Knuckle	.....	....	21	2	2	..	2	..	..
Smillie....	M. I.	198.4	44.6	5	....	.....	Yes	6	.....	....	Yes	5½	2	Shank	.....	3	Knuckle	....	....	.....	.....	No	16	1	..	..	1	..	..
St. Louis..	S.	212.5	58.6	6	.....	.....	Yes	6	.....	.....	Yes	6	11	Shank	.....	6	Lock in	operative	Yes	Lock inop	erative	Yes	29	1	..	..	..	..	2
Tower.....	M. I	218.4	47.9	7	Shank and thrower	Head	Yes	6	Shank and thrower	Head	Yes	6½	4	Shank	.....	4	Knuckle	.....	....	.....	.....	No	21	3	2	..	1	..	..
Trojan	M. I.	225.5	53.5	8	.....	Shank	Yes	8	.....	Shank and head	Yes	8	7	G. arm	.....	5	Knuckle	.....	....	.....	.. ..	No	28	2	1	1	1	..	..
Van Dorson.....	M. I.	231.6	53.2	4	Knuckle inoperative	Knuckle	No	6	Knuckle	.....	.....	5	4	Shank	.....	2	Knuckle	.....	....	Knuckle	.....	....	16	1	..	..	4	..	..
Van Dorston A...	M. I.	224.0	52.5	2	Pin	Knuckle	No	3	Knuckle	.....	.....	2½	4	Shank	.....	....	....	.....	.....	.....	.....	.....	.....	1	..	..	2	1	..
Williams..	S.	195.7	41.5	7	.....	Knuckle	Yes	7	Shank	.....	.....	7	7	Shank	.....	5	.....	.....	Yes	.....	.....	Yes	26	2	..	..	1	..	..
Totals.	14 Malleable Iron and 11 Steel; 48 of these couplers went below the limit...																							24	16	8	35	3	1

There were 46 bent pivot pins not shown in this table.

The jerk test may be open to criticism as being artificial; but without this, or some similar test, we would have but little information as to the efficiency of locking devices, and the sufficiency of pins, lugs and knuckles under pulling conditions. In the jerk tests the equalizing bar was so shaped at the ends as to bring direct pull upon the knuckles of the pair of couplers under test, with the least possible spreading action. The results of the test show 95-10 per cent. of the couplers broke in the heads, and 26 per cent. of the knuckles broken; the remaining couplers were thrown out on account of distortion beyond the limits of the test by the combined failure of pivot pins, knuckles and locks.

The result of the striking and jerk tests, considered together, show that out of 92 couplers 22.8 per cent. of the knuckles were broken or cracked, and 30.4 per cent. of the couplers broken, either in head or shank; but the breakage in knuckles would probably have been greater had not many of them been thrown out on account of being beyond the limit, before they were broken—52 per cent. of the couplers failing on this account; which goes to show that the pivot pins are generally weak, allowing knuckles to close before any other damage has been done. It will be observed that coupler lug failures are exceedingly few.

Of knuckle failures 70 per cent. are in tongue, 14 per cent. in one or both of the lugs, and the same percentage in pin hole.

The guard arm test may also be criticised as artificial and arbitrary. Service has shown, however, that a very large percentage of coupler failures is due to guard arm breakages, the result, no doubt, of blows from ordinary link and pin couplers glancing from closed knuckles or striking directly upon the guard arms.

The results of the test are 68 per cent. broken shanks, 27 per cent. broken guard arms and 18 per cent. broken locks, some couplers combining two or more failures.

The result of this test conflicts with the observation of service, for whereas in actual service there is a preponderance of guard arm failures, in the test the shank failures are in excess. The probable explanation is that direct blows concentrate the shock on the opposite side of shank, whereas a glancing blow, or one from a broken link and pin coupler, wedges off and breaks the guard arm alone.

It is impossible, of course, without great expense, to provide a machine where guard arm tests, under all conditions, can be made. At the same time, it seems to be reasonably certain that direct blows will break the shank, whereas glancing blows will produce similar results on the guard arm. The latter point has been recognized already by coupmoney, are designed to do more than is required of them with the proper safety factor. A coupler of steel or one of malleable iron may be made so heavy and so large as to be practically indistructible, and at the same time it would be neither cheap in first cost nor satisfactory to use. Future developments would seem to be in the line of making a coupler as light as possible, and sufficiently strong to meet the strains to which it is subjected, of as cheap material as is consistent with the above; and the coupler which will have the highest commercial value will be the one which combines the elements "minimum weight," "minimum first cost," "the greatest average strength," and "the most perfect yet simple action." In addition to this we must consider also the cost of renewals of couplers which have failed in service.

J. M. Wallis, R. D. Wade, S. A. Crone, J. S. Lentz, J. H. McConnell, T. G. Duncan, Committee.

Mr. Marshall: I move that the report be received and the committee discharged, with thanks.

Mr. Rhodes: The information in regard to couplers which has been given to the association during the past two years has been very satisfactory. We simply appoint a committee on these subjects, but we do not always realize the work involved. I presume it has not cost Mr. Wallis' company less than $6,000 or $7,000 to conduct these tests. After such work as this it looks odd that we should accept this report and discharge the committee. We feel the committee has done this association a great service. I believe in this kind of investigation that there is a time when it is well to stop for a while. When you show the direction in which investigations can be made you are assisting all parties concerned. This was the case with the air-brake investigation, when it was continued for two years and dropped for two years, and taken up again.

Mr. Wallis: The machine is at Altoona, and will be there permanently, and is at the disposal of the M. C. B. Association or any manufacturers who wish to use it.

Mr. Barr: I agree with Mr. Rhodes; and I intended to say a few words in connection with this, and that is the committee, while they have not made any recommendations, With the small wheels necessarily used, the question arises whether the full efficiency of the hand-brake can be obtained by this means. On account of the increase of vestibuled cars in service, and what seems to be a lack of power in the hand brakes, it is inclined to think the appointment of a committee to consider this question and make recommendations to the Association would be advisable.

The prevalent idea has been that a systematic and rigid air test of all air brakes, coupled with the necessary repairing, would entail large expense and delay to freight on account of the time required to do the testing and repairing, and the large amount of extra switching which it was assumed would be necessary. We will assume that the shop practice in applying the apparatus to the cars is up to the acknowledged standards, and that cars go on to the road in a complete state of efficiency and properly marked as to oiling, cleaning, etc.; that the shops have all been piped, with all necessary arrangements to couple the air to any car on any track; that all cars passing through the shops for repairs are there thoroughly tested and put in proper condition before they leave.

This practice is of course quite general. The difficulty, however, is to devise a method to maintain the brakes on cars which do not come into the shops except at long intervals—in the majority of cases extending over years. The next development would be to equip all light repair shops and outside repair tracks with a similar air plant, consisting of air compressor, piping, etc., to reach every car coming on to such repair tracks for any cause, and to give them all the necessary test and care. When you consider the immense number of cars placed upon repair tracks for other necessary causes outside of air brake defects, it will be apparent that a very large number of cars will be reached in this way without any extra delay or extra expense on account of switching. After this stage had been reached, the next would be to improve the method of making terminal and interchange inspections. The obvious method would be to substitute for the common inspection by observation or test by engine which, in the former case, is merely superficial, and in the latter is limited and unsatisfactory, a test made by the same methods as on repair tracks. It may be considered that this method will entail delay, but experience with the system in view has demonstrated that this is not the case.

At the particular plant in mind the tracks where trains of interchange freight cars are received and from which the trains are sent out on the line, are supplied with air at the standard pressure and with connections every 36 feet, so that

the train can be reached at any point or at any car. When a train is received the air is applied at once, and the test, inspection and light repairs carried on while the ordinary inspection and light repairs of the other parts of the car are in progress. The time occupied by the ordinary work has been found sufficient to prevent any extra delay on account of air brake work. At this plant large numbers of cars are of course handled. Their inspection and repair of air brakes is very rigid, however, as no car with defective apparatus is permitted to go out on the line. Even with this extreme method, they find that no extra delay is entailed, and very few cars are switched out for these repairs, most of the work being done while the car is in the train. They replace defective hose, take up slack, replace a section of pipe where practicable; and if a triple is not efficient from any cause, replace it entirely; all of which is done in train.

It has been found that a new triple can be applied in less than fifteen minutes ordinarily, and it has been done in seven minutes. This is, therefore, the quickest and surest way of putting a triple in order. The one removed can be put in condition in the shop at the repairer's leisure, a special airbrake room being provided convenient to the testing tracks, where all supplies and parts necessary for the maintenance of the brakes are kept on hand, and which is provided with all necessary tools and appliances for repairing or putting in order defective parts that have been removed from cars, which, when they are again put in efficient condition are placed with the good stock, to be used again when needed.

The simplicity, effectiveness and small cost of this plant, considering its extent, were surprising. Near their steam supply was placed an 8-inch air pump and a locomotive air reservoir; from this was strung a 1-inch wrought-iron pipe, which in the yards was placed alongside of every second track (thus enabling one line of pipe to supply two tracks). The pipe was laid on top of the ties, close to the rail for protection, and was held in place by large-sized staples, driven into the ties so as to permit of a movement of the pipe in expanding and contracting. A branch pipe, 1-inch, 18 inches long, was connected every 36 feet, and on this was fitted a cutout cock and a small length of hose (about 12 inches), to which was fitted a 1-inch airbrake coupling. The hose and coupling are close to the track, in a covered iron box to protect from snow, ice, water and dirt. This method of laying a supply pipe in a freight yard is much cheaper than when laid under ground, and it is also thought that the pipe will last longer. The men who do the airbrake inspecting and repairs are especially trained for the duty; this has been found necessary, and is what will have to be done wherever it is attempted. They carry a hose about 8 or 10 feet long, with double coupling, and are thus enabled to connect the air to any car without inconvenience. It has been found that no extra reservoirs at outside points are necessary, and no trouble was experienced last winter from freezing if the system was drained out every 12 hours, which was done by simply opening a cock at the end of the lines and blowing the water out. Check valves are placed occasionally in the lines to prevent

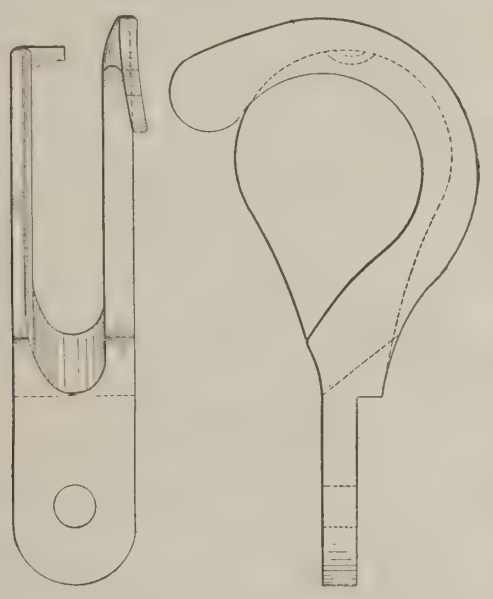


FIG. 1.—PROPOSED MODIFICATION OF DUMMY COUPLING HOOK.

a return current of air if it is desired to use the air back of another point where it is being used. This plant has a total of 8,500 feet of pipe, and it has been demonstrated by practical use that there is sufficient pressure at any point in the system to do the necessary testing for a large yard. At a distance of 2,000 feet from the pump, actual test has determined that the reduction in pressure is but one pound from that indicated at the pump.

The airbrake apparatus is a delicate piece of mechanism which is capable of yielding wonderful results in operation of railroads. To attain these results the various parts must be maintained in proper adjustment; worn-out or damaged parts must be renewed or repaired; screens, triples and cylinders must be kept clear of dirt, gum, etc., and the last two named must be properly oiled at stated intervals. It is not sufficient to equip a car and turn it loose to take care of i self. No hesitation is evinced by railroad companies in taking the necessary time and expending the necessary money to maintain the other parts of the car; and, considering the vast amounts of money already expended and to be spent in applying this apparatus to freight cars, which, with the extra foundation rigging, must be at least 12 per cent. of the value of the car itself, it seems inconsistent that there should be any hesitation in providing the means and appliances to maintain this equipment in an efficient condition. That this is not being done in an efficient manner is beyond question, from the information at hand.

The large number of cars already equipped is being taken advantage of even by those companies that have none of their own, which is shown by the replies to the circular, when 39 out of the 40 companies state that they place all airbrake cars ahead in their trains and operate the brakes. How long this will continue to be an advantage and not a danger will depend upon what is done to maintain them in a proper condition of efficiency. The way to maintain the standard of efficiency is to take care of the brakes.

The committee cannot elaborate a method which would do for all roads under all conditions. The explicit information as to methods, given in the replies to our circular, is very limited, and the little it offers was necessarily obtained by personal visits to plants in operation. After the apparatus has been properly applied to cars, its efficiency can only be maintained by rigid inspection, and repairs at every opportunity, and this can be attained in a satisfactory manner by the introduction of air plants in which a constant and copious supply of air at the standard pressure is maintained by some power and distributed through shops, repair tracks, and inspecting yards, so that it can be conveniently connected to any train or car without any extra switching. If it cannot be extended to the inspecting tracks, it should at least be placed on all repair tracks of any importance at the earliest moment. These tests only, if properly maintained, would insure a rapid improvement, and help to a very large extent in maintaining the brakes. Some companies will not permit any car to leave its yards with defective airbrakes; others, and these, of course, a very large majority, consider that a car in which the hand brakes are effective, even though the airbrakes are inoperative or defective, to be no worse than a car without airbrakes, and permit it to go forward, in many cases in a defective condition, expecting that the defects will be detected and taken care of at terminals. They must "trust to luck," however, that this is done, as but seven roads say that they have any system of indicating to other inspectors that the car is defective, and the lack of facilities for test inspection in yards and at terminals would render the chances of its detection very small before it was again placed in a train. To fill this want, the Western Railway Club has presented a form of airbrake defect card, which appears to your committee to be a good one, and which is hereby submitted for adoption as recommended practice.

THE.....R'Y
AIRBRAKE CARD.
AIRBRAKE CUT OUT.
Applied to Car No....Initials....
Date.... ....at.....
By.....Inspector.
By.....Train No.....
Conductor.

THE R'Y

AIRBRAKE CUT OUT

CAR CAN BE PLACED BETWEEN AIRBRAKE CARS.

Car No.....Initials.....Date.....
Card applied at..... .....for following
Defects.....
By ..... | By.....
Inspector. Conductor.
Train No.....

Repaired at.....
Date.....
By.....
Nature of Repairs.....

THE.....R'Y
DEFECTIVE AIRBRAKE CARD.
Applied to Car No....Initials....
Date.....at.....
By.....Inspector.
By.....Train No.....
Conductor.

THE R'Y

Defective Airbrake.

CAR CANNOT BE PLACED BETWEEN AIRBRAKE CARS.

Car No.....Initials.....Date.....
Cars applied at... .....for followihg
Defects.....
By..... | By.....
Inspeotor. Conductor.
Train No.....

Repaired at.....
Date.....
By.....
Nature of Repairs.....

We find, in looking over a list of defects found at an interchange inspection point, that the number of airbrake coupling gaskets replaced is very large. In an effort to keep the apparatus clean, many companies are endeavoring to enforce the hanging up of the hose; in many cases this is improperly done, and the bent hose becomes a receiving basin for flying dust and cinders, in which case it would be preferable to let the hose hang down. This is not the only evil. The hook on the dummy coupling is inserted inside the gasket very often, and the result is that the usefulness of the gasket is destroyed in a short time. In no other way can we account for the large number of gaskets found defective. The remedy we would suggest is that proposed by the Central Railway Club, consisting of an enlargement of the point of the hook in the present dummy coupler, in accordance with design shown in Fig. 1, which will prevent an improper use of it, and which insures freedom from damaging contact with the gasket, and exclusion of dirt whenever the coupling is hung up.

E. D. BRONNER, PULASKI LEEDS, JAMES MCGEE, WILLIAM MCWOOD, W. P. SIDDONS, Committee.

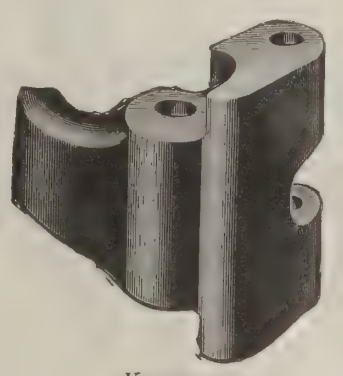
Mr. Waitt moved that the report be received and the committee continued another year to consider the two points they have brought up. Carried.

The Williams All-Steel Coupler.

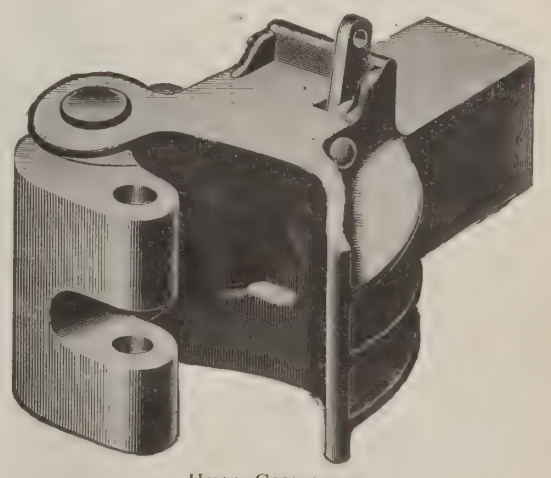
The M. C. B. car coupler illustrated herewith is made entirely of steel and has the liner blocks cast on. It is manufactured by the Chicago Tire and Spring Company, of Chicago, Ill., and weighs but 195 pounds. It is claimed that this weight is from 25 to 50 pounds less than that of any other standard M. C. B. coupler. It is also claimed that the lock in this coupler cannot be bent, broken, displaced or worn out. It has successfully withstood three drops of a 1,640-pound weight from 10 feet, and 12 drops from 15 feet, or 10 extra drops from 15 feet without breaking. A pair of these couplers withstood a pulling test of 179,000 pounds, or 69,000 pounds in excess of M. C. B. requirements. Further desirable information respecting this coupler can be obtained by addressing Mr. Dyer Williams, Grand Pacific Hotel, Chicago.

The Bloomsburg Car Company, of Bloomsburg, Pa., manufacturers of freight, mine and dump cars, has just published a second edition of its illustrated catalogue, in which is added a number of new cuts and illustrations, among others a general view of the company's works at Bloomsburg. These were first erected in 1868, and after being destroyed completely by fire in 1879 were rebuilt. To these, year by year, the company has made improvements and additions, and has introduced new machinery as fast as it was found to be necessary for the thorough equipment of the shops. The plant now covers over four acres of ground, and the shops alone cover two acres. The members of this firm have been in the car building business for the past 25 years, and are thoroughly conversant with every detail of construction of the great variety of cars now in use.

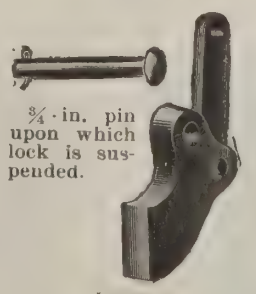
The works of the Brown & Sharpe Manufacturing Company, at Providence, R. I., will be closed, it is announced, from August 6 to 18 inclusive, for repairs.



KNUCKLE.



HEAD COMPLETE.



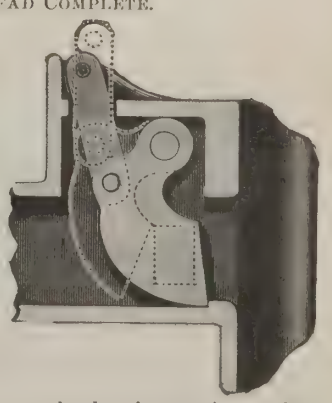
¾-in. pin upon which lock is suspended.

LOCK

KNUCKLE OPENING SPRING.

Made of 5-16 Crucible Steel.

1¼-in. Hinge or Knuckle Pin.



LOCK showing position when locked, also dotted lines showing position when knuckle is open and coupler uncoupled.

THE WILLIAMS ALL-STEEL COUPLER.

The "Reliable" Water Gage.

The accompanying engraving shows a new form of water gage for steam boilers. It is made by the Reliable Water Gauge and Manufacturing Company, of No. 916 South Third street, St. Louis, Mo. Every steam user is aware of the annoyance, expense and damage caused by the frequent breaking of the ordinary round glass water gage. The "Reliable" water gage consists, as shown in the cut, of a handsomely finished brass casing, heavy enough to withstand any boiler pressure. Above and below the view space is the brass connecting pipe, which takes the place and is the size of the ordinary glass tube. The whole instrument can thus be slipped into any gage in exactly the same manner as a glass tube is put in, without any alteration whatever. The face of the casing is milled to a perfectly smooth surface, and then faced with a specially prepared and tempered highly polished flat Scotch glass, $\frac{7}{16}$ of an inch thick, held in place substantially, but yet readily removable. This glass is so prepared as to withstand all changes of temperature without cracking, and it is perfectly safe for very high pressures. An aluminum reflector makes the height of the water more readily noticeable than in the ordinary gage. Some of the advantages of this gage over the round water glass are that it will not break when subjected to high pressure and changing temperature, and the usual expense of purchasing glasses and rubber washers is avoided, as is also the trouble and annoyance of replacing broken glasses.

"P. & B." Paper.

The United States Circuit Court for the District of New Jersey has rendered a decision in the case of the Standard Paint Company vs. Henry J. Bird and James L. Reynolds, in which it is adjudged that the members of the Standard Paint Company were the first persons to produce a paper coated with the solid residuum of petroleum, and combining the characteristics of an odorless, water, acid, alkali and airproof paper, and that the patent under which the Standard Paint Company has hitherto manufactured was valid and had been infringed. The Court held that any paper possessing the same essential characteristics and produced by the coating with any material similar to that employed by this company, by whatever name it may be called, is an infringement of its patent.

A permanent injunction was granted against Messrs. Bird and Reynolds in the action referred to, directing that an accounting be had to determine the damages to the Standard Paint Company. The litigation referred to has covered a period of over four years, and the decision should be a caution against the use of any sheathing or insulating papers which fall within its meaning.

The Standard Brake Company, of 50 Exchange Place, New York, has perfected a device for quickening the application of air brakes. It is called an *accelerator*, and at a recent test made in the presence of a representative of THE NATIONAL CAR AND LOCOMOTIVE BUILDER it did accelerate the application of a Westinghouse quick-action freight brake so that with the device in operation the application was made in .16 of a second, and without it the application was made in .825 of a second, with approximately the same pressure.

The Boston Belting Company, of Boston, Mass., has just issued a new price list in pamphlet form. This company has been engaged since 1828 in the manufacture of India rubber goods for mechanical purposes, and its methods of manufacture have reached a high state of perfection, as shown by the excellent quality of the numerous kinds of rubber goods it makes. It has also invented and perfected most of the machinery for the manufacture of rubber goods.

A Floating Palace.

The Norwich Line placed an elegant new steamer in commission July 10 to run in connection with the steamboat train of the New York & New England Railroad. The new boat is the "City of Lowell." Year by year the imposing and world-famous fleet of floating palaces of white, whose paddles and propellers ceaselessly churn the waters of Long Island Sound by day and night, grows larger in numbers and more magnificent in detail. All that the very best minds in naval architecture and engineering science can bring to bear upon the problems of greater speed and more artistic appointments has been devoted to each succeeding addition to this royal flotilla, and in the "City of Lowell," the newest acquisition to the fleet of the popular Norwich & New York Transportation Company, known more generally as the Norwich Line, the acme of perfection would appear to have been achieved.

The "City of Lowell" was built at the Bath Iron Works, Bath, Me., from which some of the finest vessels in America have been turned out, and was designed by A. Cary Smith, the well-known and successful steamboat and yacht designer of New York. Her hull is constructed entirely of steel, with four complete transverse water-tight bulkheads. She has five decks—lower, main, saloon, gallery, and hurricane; most of the work above the main deck being of wood. Some of her dimensions are as follows: Length of keel, 320 feet; length over all, 336 feet 1 inch; beam, moulded, 49 feet 6½ inches; beam, over guards, 66 feet; draft, loaded, 13 feet; depth, main deck to keel, 20 feet 4 inches; tonnage, 2,400 tons.

Half Universal Radial Drills.

In this issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER is illustrated the half universal radial drill, manufactured by the the Bickford Drill & Tool Company, of Cincinnati, O. This machine is made in two sizes called the styles A and D machines, and the following is a general description of both machines:

The base plate is very heavy and deep, and is ribbed and braced on the under side so as to avoid all spring. The column, with large round base, is bolted to the bottom plate, and over this column, with long bearing on top and bottom, is fitted the outside sleeve, which carries the arm. This arrangement is only found on these tools, and makes them the stiffest machines of their kind on the market today. The sleeve rests on the bottom, on a large flange, and is fitted with three clamping bolts. The rotating arm, fitted over the sleeve, is of a box form, strongly braced and raises and lowers by power. The flange of the sleeve is provided with roller bearings which allow the arm to swing with perfect freedom. The machine is driven by a cone pulley shown on the back of the drill, and by means of miter gears through the inside of column to the top. All sizes are fitted with back gearing. The spindles have a powerful automatic feed, and are fitted with the Bickford patent quick return motion. The box table, together with the countershaft complete, is furnished with each machine. The universal tilting table will be furnished, if desired. The shafts and spindles, likewise the worm and worm rings, together with the main gearing, are made of steel. All gearing is cut from the solid. The head of these machines can be swiveled at any angle upon the arm, but the company also manufactures full universal radial drills, or machines which have rotating heads, and the arm revolves around its own axis, thereby making it possible to drill at any angle and in any direction within the range of the arm.

The style A machine will drill to the center of a 10 foot circle and will receive 4 feet 10 inches over base, and weighs 6,500 pounds. The style D machine will drill to the center of an 11-foot circle and will receive 6 feet 8 inches over base, and weighs 12,000 pounds.

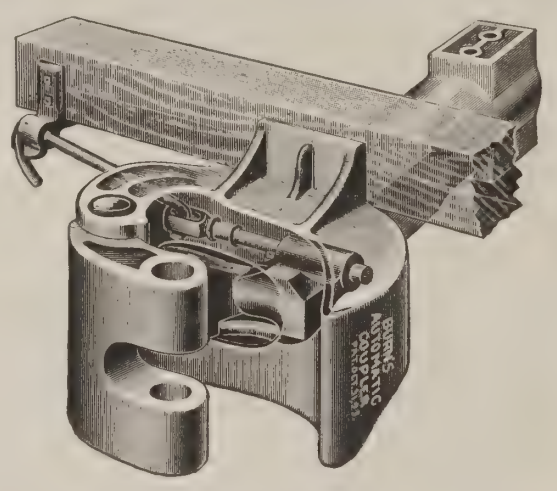
Further information in regard to these machines will be furnished by the manufacturers, the Bickford Drill & Tool Company, Cincinnati, O.

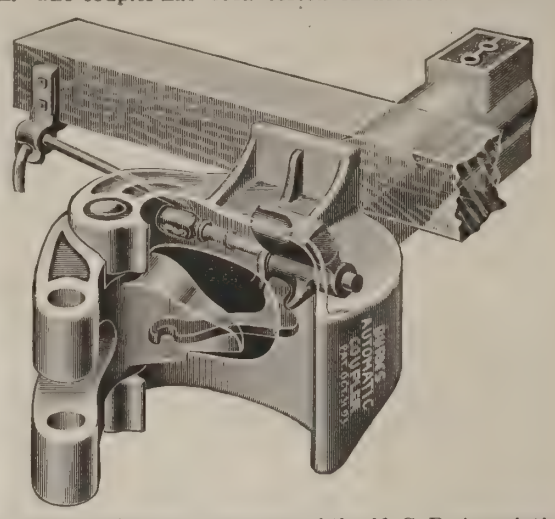
The Burns M. C. B. Coupler.

One of the most interesting exhibits at the Saratoga conventions in June was the Burns automatic car coupler, which is illustrated herewith, and which is made by the Syracuse Malleable Iron Works, at Syracuse, N. Y. The bar of this coupler is made of malleable iron, and all the other parts of cast steel. The construction of the coupler is shown in the accompanying cuts, and it will be noted that it conforms to M. C. B. specifications.

Fig. 1 shows the bar with the knuckle closed, and Fig. 2 with it open. There are five parts of the coupler, as follows: The bar, the knuckle, knuckle pin, lock and the knuckle opener. The lock is operated by a shaft which extends horizontally through the side of the bar back of the pivot pin, and the knuckle is moved by the lock. The lock itself is a heavy casting and in locking falls between the tail of the knuckle and the wall of the bar, forming a solid backing against which the pull on the knuckle is received. The knuckle opening device is positive and is operated by the same motion as the lock.

The locking arrangement opens from the side, and this prevents snow, ice or cinders from getting inside; and it is claimed that the construction of the lock is such that it cannot jump and unlock the knuckle while the train is in motion. The coupler has been tested in accordance with the



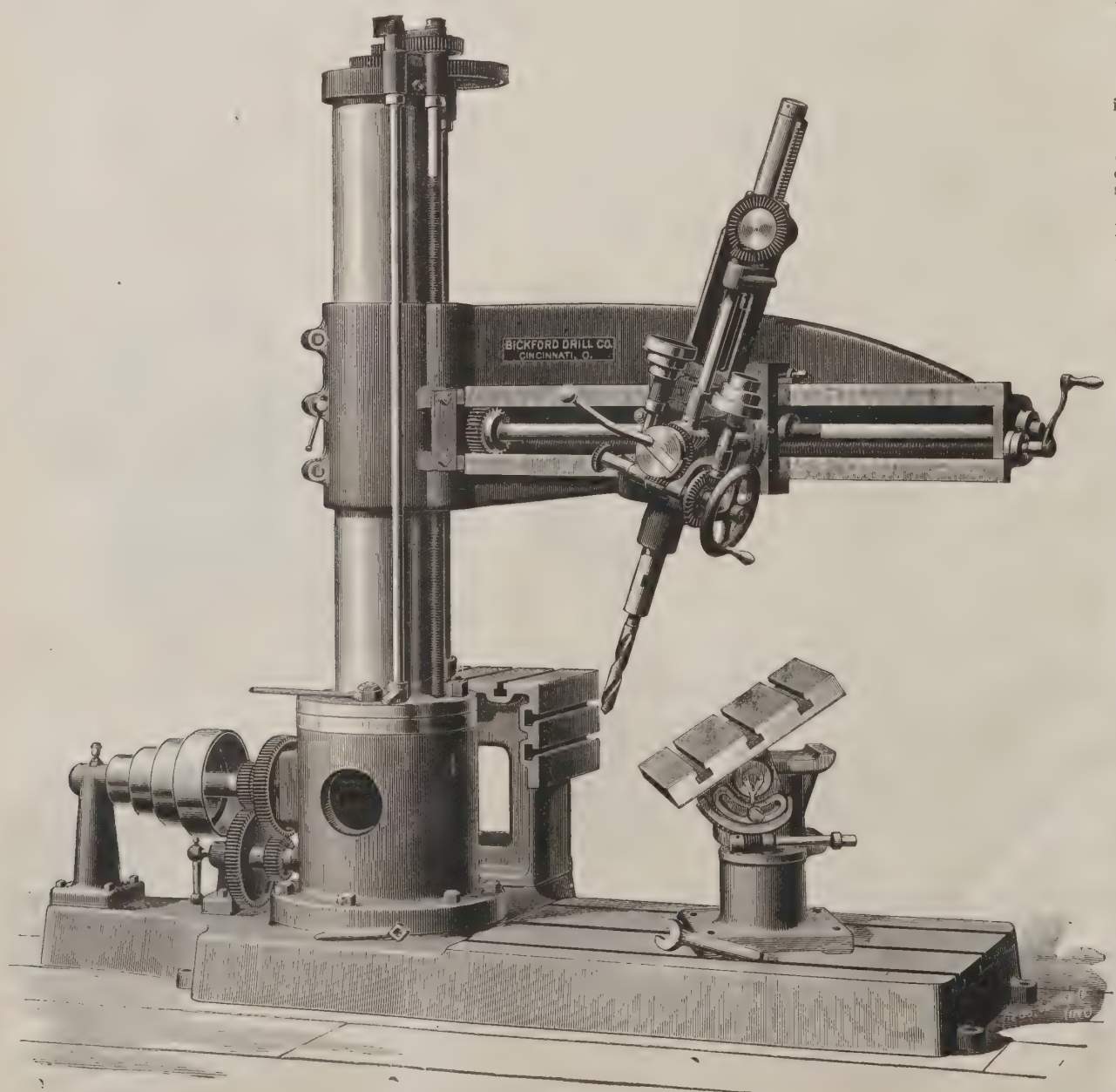


proposed standard requirements of the M. C. B. Association, and has given satisfaction. It has also been subjected to a prolonged service test on the Delaware, Lackawanna & Western R. R., without failing in particular.

The Craig Reynolds Foundry Company, of Dayton, O., is now at work erecting for the Big Four System at Mattoon, Ill., two complete sets of gates protecting street crossings 1,200 feet apart, and connected with and operated from a central tower-house. This is an undertaking that has not been attempted by other manufacturers of crossing gates. The absolute reliability that can be placed in the perfect mechanical features of the Dayton gate enables the makers to perform this contract and guarantee it for a period of five years.

We understand that Messrs. T. Isbester and H. Woodland are very well pleased with their connection with the Star Headlight Company, of Rochester, N. Y. These gentlemen were connected with the Utica Headlight Works for a number of years until recently, and they find that the headlights, lanterns, etc., made by the Star Headlight Company, and the facilities for making the same, are equal in every way to those of the United States Headlight Company. The address of the Messrs. Isbester and Woodland is the Western Union Building, Chicago.

The Sterlingworth Railway Supply Company, of 256 Broadway, New York, has become the exclusive selling agent in the railway field of the Magnolia Metal Company, and will endeavor to establish the same enviable reputation for Magnolia metal in this field that it has attained in marine and stationary engineering. Those who have used Magnolia metal believe that the agents will have little trouble in doing this. Mr. George Royal, Jr., is the Western agent of the company, with office in the Mondadnock Building, Chicago; and Mr. A. B. Bostic is the Southern agent, with headquarters at Atlanta, Ga.



A HALF UNIVERSAL RADIAL DRILL.

Our Directory

OF OFFICIAL CHANGES IN JULY.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Boston & Maine.—H. E. Folsom is appointed superintendent of the Connecticut River & Passumpsic Division, with office at Londonville, Vt. H. F. Sampson is appointed Assistant Superintendent at Springfield Mass.

Buffalo, Rochester & Pittsburgh.—William T. Small, Superintendent of Motive Power, died July 6.

Canadian Pacific.—George Preston, Master Mechanic at Toronto Junction, is transferred to the Eastern Division, and is succeeded by George MacKinnon.

Cumberland & Pennsylvania.—P. E. Burwell, General Superintendent, has resigned, and is succeeded by Lewis M. Hamilton.

Delaware & Hudson.—C. R. Manville, Superintendent Pennsylvania Division, has moved his office to Scranton, Pa.

Flint & Pere Marquette.—W. H. Baldwin, General Manager, has resigned.

Glendon & Gulf Railroad.—Frank D. Jones is appointed Superintendent, with office at Glendon, N. C.

Iowa Central.—L. M. Martin is appointed General Manager, with offices at Marshalltown, Ia.

Mexico Cuernavaca & Pacific.—W. W. Mayberry, General Superintendent, has resigned, and is succeeded by W. T. Sprague.

Minneapolis & St. Louis.—A. L. Mohler is appointed General Manager.

Minnesota Transfer.—Robert Dudgeon is appointed Superintendent, vice D. M. Sullivan, resigned.

New York & New England.—T. W. Kennan is appointed Superintendent of the Central Division, vice G. W. Offutt, resigned.

Ohio Southern.—Homer T. Dick has been appointed Superintendent.

Pennsylvania Railroad.—J. F. Miller, General Superintendent Southwest system, has removed his headquarters to Chicago.

Pittsburgh & Western.—R. Finney, Jr., is appointed Purchasing Agent, with office at Allegheny, Pa., vice J. J. Saint, resigned.

Seaboard Air Line.—James Maglenn is appointed Superintendent of Motive Power, with office at Raleigh, N. C. D. S. Shaw is appointed Master Mechanic at the same place. D. W. Ballentine is appointed Master Car Builder, with office at Portsmouth, Va.

Sedalia, Warsaw & Southern Railroad.—Thos. F. Mitchum is appointed Receiver.

South Carolina & Georgia.—J. M. Turner, Superintendent, has resigned.

South Carolina & Georgia.—C. M. Ward, General Manager, has resigned, and is succeeded by L. A. Emerson, with office at Charleston, S. C. W. S. Jones is appointed General Superintendent, with office at the same place.

Washington & Chesapeake Beach.—Winfield J. Taylor is appointed Receiver.

NATIONAL CAR AND LOCOMOTIVE BUILDER

SEPTEMBER, 1894.

CONTENTS.

It is said that an electric railway, 300 miles long, is to be built, connecting Boise City and Lewiston, Idaho.

The Southwestern Railroad system of Russia is to be purchased by the St. Petersburg government on Jan. 1, 1895.

The Brooks Locomotive Works, of Dunkirk, N. Y., have recently finished two locomotives for the Toledo & Ohio Central.

The Johnson Steel Company has filed in Elyria, O., a $2,000,000 mortgage in favor of the United States Trust Company.

The Harlan & Hollingsworth Company, of Wilmington, Del., has completed two cars for the United States Fish Commission.

The shops of the Reading Railroad Company in Reading are being run on double time to meet the demand for box and gondola cars.

As a result of the order for the elevation of the Lake Shore tracks in Chicago, the company's yards will be removed to Porter, Ind.

The usual output of over 200 new locomotives by the shops of the Pennsylvania Railroad will be reduced to about 100 locomotives this year.

A stage coach was engulfed by a wall of water created by a cloudburst near Berwind, Colo., on Aug. 3, and all the passengers, four in number, and the driver perished.

A broken axle caused the wrecking of 18 cars of an eastbound Pennsylvania Railroad freight train at Chester Valley, 32 miles west of Philadelphia, on Aug. 20.

A freight train on the Wabash Railroad struck a horse near Jonesboro, Mo., Aug. 19. The engine and 19 cars were derailed and the engineer and two tramps were killed.

The Illinois Central road has adopted the "Pullman color" as a standard for all its passenger equipment except the suburban cars in Chicago. These will be painted yellow as heretofore.

The plant of the Grant Locomotive Works at Chicago has been leased to the Siemens-Halske company for $1,000 per month. The electric works of the latter company, at Chicago, were burned Aug. 1.

The Consolidated Coal Company, of Frostburg, Md., has informed all the miners who stuck to their posts during the recent protracted strike that they will each receive nine months' rent and fuel free.

William Burke, a section foreman, Philip Roth, a laborer, and Joseph Corley, aged 15 years, have been arrested at Chicago on the charge of attempting to wreck a train on the Chicago & Great Western Railroad, at Maywood, Ill., on July 6.

The employees of the Oregon Railway and Navigation Company have accepted a reduction of 12½ per cent. in the wages of those receiving upward of $100 per month, and a 10 per cent. reduction for those receiving from $50 to $100 per month.

Figures compiled by railway officials show that more than 7,000 railroad employés who quit work in Chicago during the recent strike are still idle, their places having been filled by new men, many of whom were brought from other cities.

From 11 a. m. on Sunday, July 29, to 8:15 a. m. on Monday, July 30, the Chicago, Burlington & Quincy Railroad received at Chicago 875 cars of live stock on 33 trains. This is said to be the largest shipment of live stock ever received in the same space of time.

The Illinois Central Railroad Company needs a number of new freight cars, and about 500 are soon to be ordered. It is asking for bids on some 50,000 pounds capacity fruit cars, and some 60,000 pounds capacity stock, coal, box, furniture and refrigerator cars.

The Southern Railway Company purchased the Georgia Pacific Railroad Aug. 18. The sum paid was the amount of the road's indebtedness. The road is 633 miles long and runs from Atlanta directly west through Birmingham to Greenville, on the Mississippi River.

The Switchmen's Union, of Kansas City, Mo., was organized on Aug. 12 with 400 members. This, it is believed, is the first step toward forming a national switchmen's union, to take the place of the one recently disbanded. A resolution was adopted against affiliation with the Knights of Labor.

More new industrial establishments have been set on foot within the last three months in the South than were started there in any other quarter since 1892. The number reported is 787, against 662 for the preceding quarter and 436 for the last quarter of 1893. This record has been beaten only two or three times in the whole history of the South.

The journey between Buenos Ayres and Montevideo, along the Rio de la Plata, will soon be made in the shor space of five hours. There are 125 miles separating the two cities. New steamers of the type of those that ply in the English Channel between France and England are to be purchased, having a speed of twenty-five miles an hour.

A report is current that the St. Louis, Chicago & St. Paul is about to place an order with the Cooke Locomotive and Machine Company, of Paterson, N. J., for two 4-wheel coupled locomotives, for delivery by Sept. 15. The report has no foundation in fact. The Cooke Locomotive Works report that they have not received an order for a locomotive this year.

In emptying barrels containing lubricating oils a quantity of the oil adheres to the interior of the barrel, increasing in quantity with the viscosity of the oil. Subjecting the barrels to a steaming in order to remove this oil has been tried in some localities and found to result in considerable saving; and it is recommended as good general practice by those who have tried it.

The shops of the Chicago & Eastern Illinois Railway at Brazil, Ind., are to be moved to Momence, Ill. The move is to be in consequence of the lack of protection the company received during the late strike. The sheriff wore the strikers' white ribbon, and when asked for protection he swore in strikers for deputies who put emery in the oil cans of the locomotives and in other ways endeavored to cripple the company.

A passenger train on the line between Bellegarde and Geneva recently consumed 45 minutes in running two and a half miles. It was following a freight train, one car of which contained cod liver oil. A leak was started in this car that allowed the oil by a curious chance to run exactly on the middle of the rails The well greased track required very liberal sanding in order to make even the slow time above mentioned.

The enormous fruit business handled by the Union Pacific this year is without parallel in the history of the traffic. Shipments over the Wyoming division now average nine or ten trains a day, and the officials think the rush will continue at least a month. Over three hundred special trains of California green fruit have already been shipped over the line to the Eastern markets. Few shipments were made until July 15.

The New York *Evening Sun* says: "It is a matter of industrial history that not one of the great strikes has resulted in success. The reason is manifest on a moment's consideration. Such a movement must break down unless it is complete, and it cannot be complete without the infringement of the laws relating to freedom of contract and personal liberty. Early in the game the strikers of necessity run up against the constitution of the United States, and that is as hopeful a proceeding as butting a stone wall."

On complaint of the Harlan & Hollingsworth Company, car builders, of Wilmington, Del., the South Jersey Railroad was on Aug. 22 placed in the hands of a receiver. Mr. Francis I. Gowen, of Philadelphia, was appointed receiver. The liabilities of the company, exclusive of its bonded indebtedness, amount only to about $35,000, but the immediate ground for the receivership was its inability to pay about $12,000 owing to a force of Italians employed in tracklaying.

During a series of experiments for the English Royal Society's committee on researches upon alloys, Captain Hunt has made a discovery that will probably be utilized in the coinage of money. His alloy consists of 78 parts of gold to 22 of aluminum. These proportions, moreover, are the only ones in which these two metals alloy perfectly. The product, it is said, is of a beautiful purple color, with ruby reflections, and cannot be imitated.

A narrow-gage railroad is in course of construction between Puerto Barrios and Guatune, Guatemala, a distance of 180 miles. Forty miles of this road will soon be in operation. The road is known as the Ferro Carril del Norte, and has at present 150 cars, four locomotives, one steam shovel and a steamboat. Silvanus Miller is the engineer and contractor, Miller A. Smith is the general manager, and W. D. Holland, who sent us the above information, is the master mechanic.

Enormous shipments of California fruit are being made to the East and to Europe. For the last month 100 carloads a week have been sent out of Sacramento, while the San Jose district has contributed 35 cars a week. The fruits going east are mostly peaches, pears, plums and apricots. The shipments will continue until Nov. 30. Reports from various sections of the State say that the fruit crop excels all preceding ones, both as to quality and quantity.

On Sunday, August 26, the Broadway cable cars in New York ran on a schedule 12 minutes shorter per trip than usual. The run from the Battery to Fifty-ninth Street was made in 34 minutes, and the same time was used for the return trips. This equals the time made by the elevated railroad trains. This speed is probably too great for a crowded street like Broadway, but the experiment was considered successful, and it is said that the cars will run at the new speed every night after Broadway is comparatively free of vehicles.

Gen. Wade Hampton, the United States Commissioner of Railroads, speaking recently on the question of the government ownership of railroads in this country, said: "To my mind government ownership is not possible. It would take something like $186,000,000 to purchase the roads known as the government-aided companies. Think of the interest on the bonds necessary to be floated to accomplish this object, and what the people would be taxed to pay the interest on the bonds. I believe government ownership entirely out of the question."

A contract was recently offered for locomotives for the Egyptian State Railroad, in which the tenders were made by weight, a method which will strike American locomotive builders as rather curious. The bids received were as follows: Societe Franco-Belge, 1.025 fr. per kilo.; Neilson & Co., Glasgow, Scotland, 1.043634 fr. per kilo.; Ansoldo & Co., Genoa, Italy, 1.100 fr. per kilo.; Societe John Cockerill, Seraing, Belgium, 1.152 fr. per kilo. The contract was given to the Societe Franco-Belge at its bid. At the rate named the price of a 40-ton locomotive would be a little over $8,000.

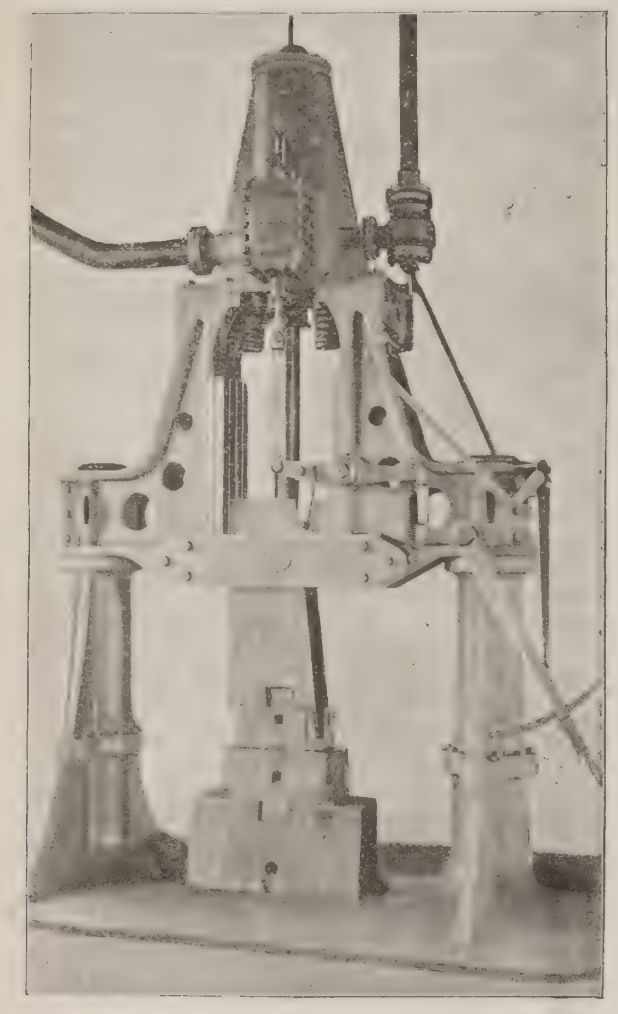
The Department of Public Works of the Argentine Republic is now organizing a technical commission to proceed to the provinces of Salta and La Roja in order to begin studies and surveys for the construction of branches of the Central Northern Railroad. This commission will also study the problem of the entrance of the same railroad to the city of Jupey. The Department is also pushing actively the termination of its portion of the railroad between Buenos Ayres and Valparaiso. Only 20 miles are yet to be constructed, on the top of the Andes Cordilleras, to reach the frontier of Chili, which country is also pushing the work on its own side.

Mr. Charles Margot, preparator at the physical laboratory of the University of Geneva, has recently made a curious discovery concerning aluminum. He has found that if glass be rubbed with a piece of this metal, very brilliant markings will be obtained that no amount of washing will cause to disappear. Mr. Margot has constructed a small aluminum wheel which revolves very rapidly and with which he makes designs upon glass after the manner of ordinary engravers. The designs are metallic, chatoyant and brilliant, and, by burnishing with a steel tool, they may be even made to have the appearance of metallic inlaid work. The adhesion is absolute. But it is necessary to see that the glass as well as the aluminum point is perfectly clean.

The deepest parts of the sea are in all cases very near land. The deepest sounding known was obtained 110 miles outside the Kurile Islands, where there are 4,655 fathoms, or 27,930 feet of water. The next deepest is 4,561 fathoms, 70 miles north of Porto Rico. With these and a few other exceptions, the depth of the oceans, so far as yet known, does not reach 4,000 fathoms, or four sea miles. The ocean with the greatest mean depth appears to be the Pacific, which covers 67 millions of the 188 millions of square miles composing the earth's surface. The Northern Pacific is estimated by Mr. John Murray to have a mean depth of over 2,500 fathoms, while the Southern Pacific is credited with a little under 2,400 fathoms. The Indian Ocean, with an area of 25,000,000 square miles, has a mean depth, according to Mr. Murray, of a little over 2,000 fathoms, while the Atlantic (by far the best sounded ocean) has an area of 31,000,000 square miles, with a mean depth of 2,200 fathoms.

A Home-made 3,000-lb. Steam Hammer.

The drawings and photographic reproduction on this page show the appearance and general construction of a steam hammer designed by Mr. J. B. Barnes, Superintendent of Motive Power and Machinery of the Wabash Railroad, and built at the Springfield (Ill.) shops of that road, where it is used to work into useful stock-bars the many forms of scrap iron that accumulate on that railroad. New iron is made from shop scrap, old bridge iron and old axles and crank pins. All scrap is thoroughly cleaned before being piled. Old crank pins are hammered flat, then piled and worked into stock bars the same as other scrap. The piles are worked into slabs, and the slabs then piled and worked into stock-bars of from 4 to 9 inches in diameter. These bars are converted into axles and crank pins as desired. All driving and engine truck axles, crank pins, piston rods, main and side rods, guide yokes and engine and truck frames for the entire system are made under this hammer.

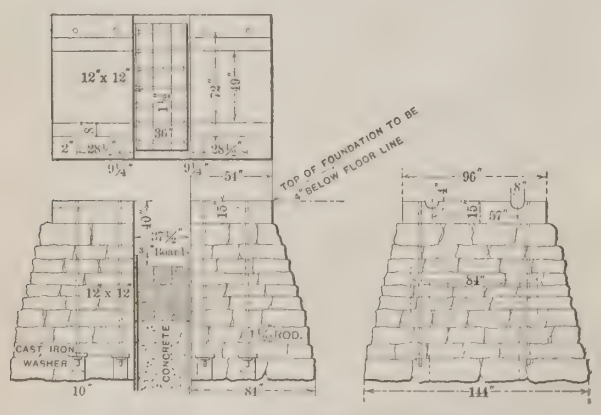


HOME-MADE STEAM HAMMER, SPRINGFIELD SHOPS, WABASH RAILROAD.

The decreased expense over buying these materials has been clearly proved aside from the decreased cost of finishing. Should we take into consideration the surplus weight of materials furnished by outside companies, and the expense of machining this surplus metal into the scrap pile, there would be a still better showing in favor of the home production.

The crank-pin dies are made to close, and the pins have $\frac{3}{16}$-inch surplus metal for finishing. A record is kept of the kind of scrap used in making axles, crank pins, side and main rods and piston rods, and the test pieces are etched with acid to show the physical formation of the iron.

The entire hammer, excepting the valve motion, throttle levers, piston and rod and hammer head, is made of cast iron; the hammer head and piston rod are steel and the other parts mentioned are wrought iron. It will be noticed that the two vertical or supporting columns are made in two pieces each. The joint by which the upper and lower portions of these columns are joined together was made so as to allow of the upper end being swung in a lathe to permit the facing of the joint and the turning of the upper end to fit the cross arms. In fact, in the whole design of the hammer, the scope of the shop tools, and the available facilities for handling such unusual forms of work had to be constantly considered.



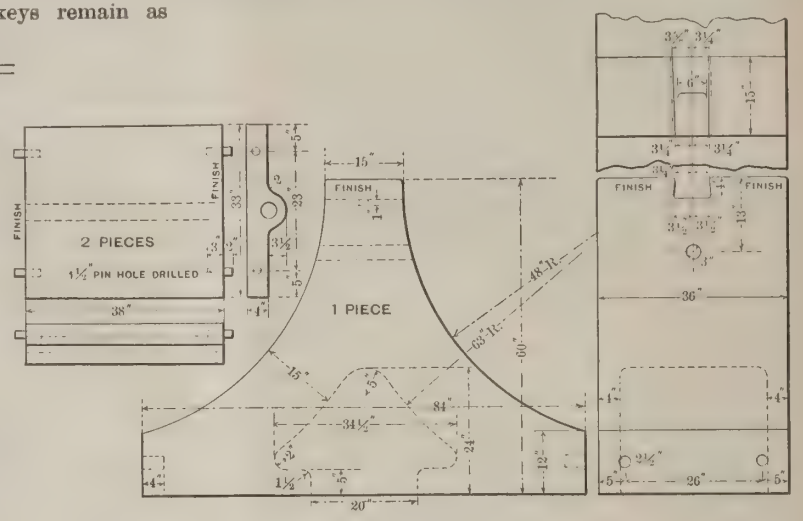
FOUNDATION FOR STEAM HAMMER.

The steam chest is fitted with the Barnes balance valve, the small spring on the reverse lever being there for the purpose of counterbalancing the weight of the valve and valve rod. Any desired rate of speed or application of power may be had by the usual manipulation of the throttle and reverse levers. After a year's constant use, close inspection has failed to show any appreciable wear of any of the working parts, and all bolts, nuts and keys remain as tight as when first put in place.

The Atchison, Topeka & Santa Fe having fallen behind in the payment of wages, Judge Caldwell, of the United States District Court at Topeka, has issued the following order:

Ordered, That the men employed by the receivers in the operation of the road and the conduct of its business shall be paid their monthly wages not later than the 15th of the month following their accrual. If the earnings of the road are not sufficient to pay the wages of the men as here indicated the receivers are hereby authorized and required to borrow from time to time, as occasion may require, a sufficient sum of money for that purpose. The payment of the wages of the men shall not be delayed beyond the time fixed in this order upon any pretense whatever. The obligations of the receivers for money borrowed for this purpose, specified in this order, shall constitute a lien on the property of the trust prior and superior to all liens thereon.

A stage coach line across the Andes Mountains, between Argentine and Chili, now runs from the summit of the Andes to the Argentine terminus of the Trans-Andine Railroad, thus reducing to an hour and a half the formerly long and dreaded mule-back journey between the Argentine and Chili termini of the railroads.

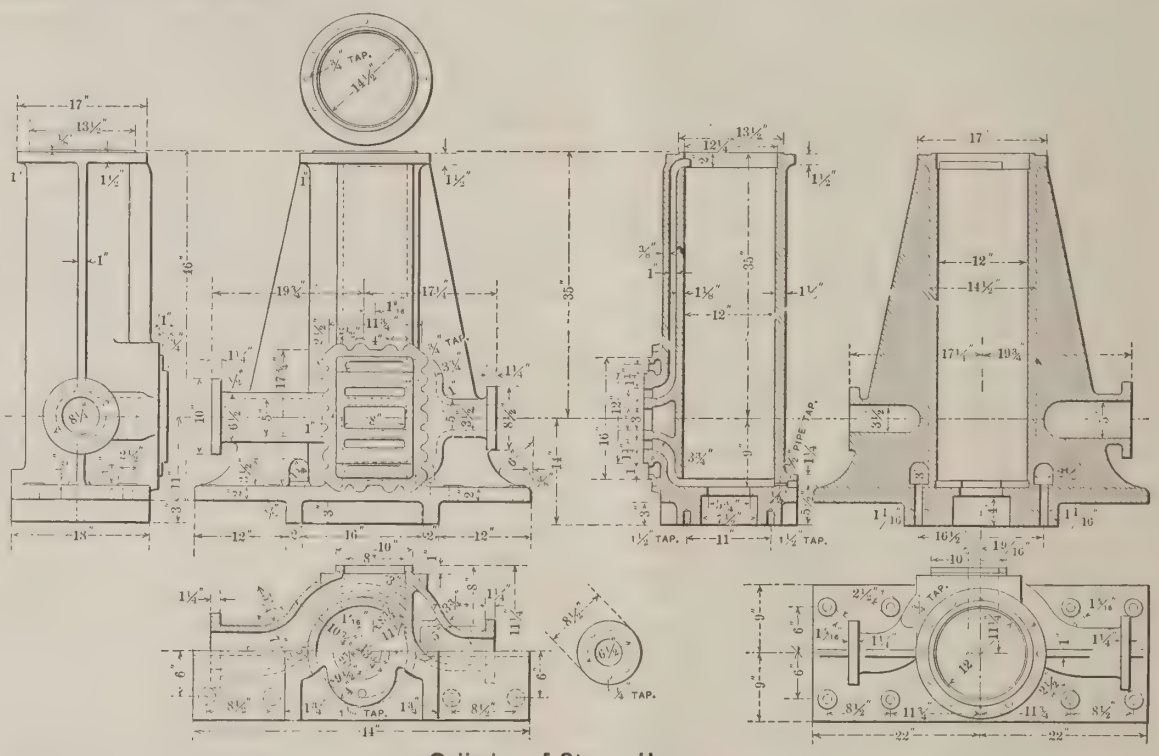


Anvil and Filling Block.

It is estimated that the total production of petroleum in the world last year was about 84,330,809 barrels. Of this the United States produced 48,412,666, or 57 per cent.; Russia produced 33,355,669 barrels, or nearly 40 per cent.; Austria-Hungary is third in point of production, while the production of Canada in 1893 was 798,406 barrels, or a little less than nine-tenths of 1 per cent.

The Southern Railway has set aside a separate fund for the promotion of small industries along the several lines embraced in the new system.

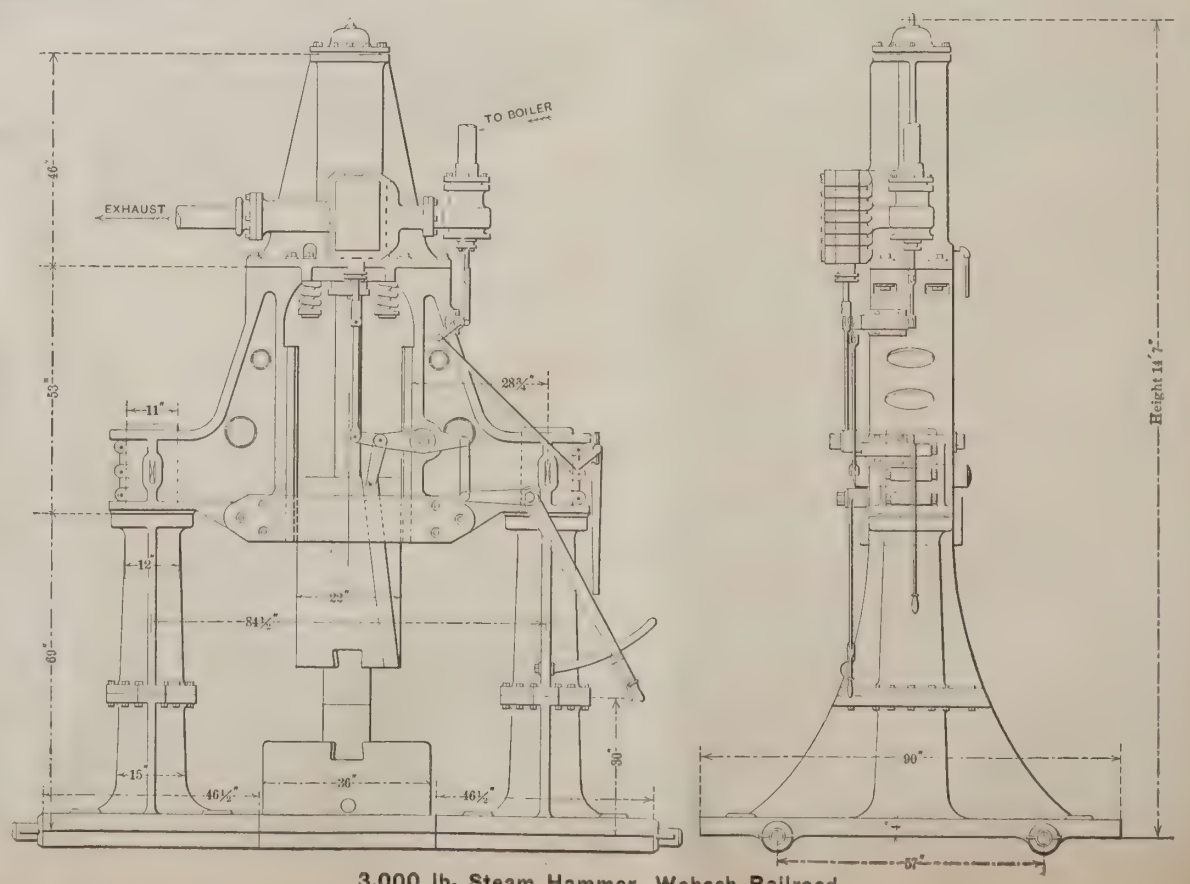
Little Rock, Ark., took its name from a bowlder on the shore. It was said to be the first bit of stone seen by the early voyagers on their way from the mouth of the river to that point, and so they named the trading station Little Rock.



Cylinder of Steam Hammer.

A watchmaker of New York City recently accomplished a remarkable mechanical feat—that of drilling a hole through the entire length of a common pin, from head to point, the opening being just large enough to admit of the passage of a fine hair.

Postmaster-General Bissell has issued an order that hereafter appointments to positions as Railway Mail Superintendents shall be confined to the clerks in the divisions of the railway mail service in which the vacancies occur.



3,000 lb. Steam Hammer, Wabash Railroad.

Announcement of the Results of the M. C. B. Letter Ballot.

The letter ballot of the Master Car Builders' Association to determine the will of the members in reference to the proposed new standards and recommended practices submitted by the June convention was closed Aug. 13, and the result is announced in a circular by the secretary. The subjects marked * were adopted as standard, and those marked † were adopted as recommended practice.

SUMMARY OF VOTES AND RESULTS.

SUBJECTS VOTED ON.	Number of votes cast. Affirmative.	Negative.	Total.	No. votes necessary for adoption.	Results of ballot.
Size of postal card circulars, 3¾ by 6 inches	975	91	1,066	711	Adopted *
Sizes of pamphlets and trade catalogues, 3½ by 6 inches, 6 by 9 inches, 9 by 12 inches	974	92	1,066	711	" *
Sizes of specifications and letter paper, 8¼ by 10¾ inches	998	68	1,066	711	" *
The word "Standard" on each of above	933	133	1,066	711	" *
Terms gaging points for wheels and track	993	73	1,066	711	" *
Maximum and minimum wheel flange thickness gages for new wheels	981	85	1,066	711	" *
Check gage for mounting wheels	954	134	1,088	726	" *
Guard rail and frog wing gage	876	102	978	652	" *
Height of brakebeam	729	248	977	651	" *
Minimum thickness of steel tires	844	204	1,048	699	" †
Groove in face of tire for reference	906	143	1,049	699	" †
Safety chains for freight cars	678	243	921	614	" †
Changing standard bearing and key for 3¾ by 7 inch journals	682	333	1,015	677	" *
Gages for standard journal bearings and wedges	863	189	1,052	702	" †
Airbrake repair card	822	164	986	658	" †
Hook of dummy coupling	1,041	13	1,054	703	" †
Diamond truck wheel-base 5 feet 2 inches	548	505	1,053	702	Rejected
Diamond truck sides	668	395	1,063	709	"
Distance of ladder rounds from sheathing, 2½ inches	765	292	1,057	705	Adopted †

Corrected sheets numbers 1, 2 and 3 of M. C. B. standards and a new sheet, M. C. B. 12, showing the gages adopted, will be ready for distribution, along with a revised pamphlet descriptive of standards and recommended practice, as soon as the lithographs can be prepared.

The text of the revised standards and recommended practice, with reduced copies of all the sheets, will appear in the proceedings early in September.

International Railway Congress.

The fifth session of the International Railway Congress will be held in London in June, 1895. The programme of papers has been published and is divided into five sections. The first section deals with subjects pertaining to the track and permanent way; the second section with cars and locomotives, and the third, fourth and fifth sections with the "Transportation Department," "General Order," and "Economical railways."

The car and locomotive subjects to be treated are as follows:

Steel boilers in fire-boxes. Strains carried in service and conditions of acceptance of sheets.

Iron tubes. Means of avoiding cracks in tube sheets.

Injurious action exerted by the feed-water upon boilers and tubes. Systems of purification.

Programme of tests relative to the production of steam, to wit: Results given by tubes according to their diameter, their length, the system, their arrangement in the boiler and the metal of which they are made; tests on the influence of the size of the smoke-box and different forms of stacks and spark arresters; tests on the different systems of exhaust; tests on the influence which speed may have on production of steam. Eduard Sauvage, Engineer of Material and Rolling Stock of the Eastern Railways of France, 168 Rue de Lafayette, Paris.

Type of engine best suited for high speed. Use of high pressures and the application of the compound principle. Improved method of distribution and balanced valve. Conditions of construction of locomotives, with a view to decreasing the dynamic strains exerted upon the track. Influence from the latter standpoint of the compound arrangement. Mr. Aspinwall, Chief Mechanical Engineer of the Lancashire & Yorkshire Railway, Horwich, England.

Type of cars for high-speed trains and for long runs. Flexibility and condition of train. Improvements made in the interior arrangement. Various methods of heating and lighting. Mr. Park, Carriage Superintendent of the London & Northwestern Railway, Ruelburton, England.

General system of electric traction. M. Auvert, Engineer of the Central Service of Material Department of the Paris, Lyons & Mediterranean Railway, Boulevard Diderot, Paris.

Bent axles on locomotives, by M. Hodeige, Chief Engineer of the Belgium State Railways.

Locomotive fire-boxes, by M. Hodeige.

Locomotive boilers, by M. Beleroche, Chief Engineer of the Central Railway of Belgium.

Lubrication of cars, by M. Hubert, Chief Engineer of the Belgium State Railways.

Switching engines, by M. Hodeige.

Compound Locomotives in Uruguay.

All the coal used for industrial purposes in Uruguay is imported from England, and the long distance from which it is brought raises its price to near $10 per ton. To economise in its use compound locomotives have been introduced on the Uruguayan railroads. The Locomotive Superintendent of one of these writes as follows:

Our coal consumption for April came out as follows:

Coal per train mile	43.33 lbs.
" " vehicle mile	1.69 "
Average vehicles per train	25.97 "

In our statistics all bogie stock counts as two. How does this compare with American practice?

We have 20 compound engines and do not mean to have any more at present, as on an undulating road like ours an engine is not working full power long enough for the compounds to show any decided advantage. I do not notice any material difference between the coal consumption of compound and simple engines, which I attribute to the fact that on a line like ours the throttle is closed half the time. On the Argentine side they still claim an advantage of 20 per cent. in favor of compounds, but the conditions of working are different.

Postal Cars.

The Post Office Department at Washington is at present considering the advisability of specifying some very decided changes in the construction of postal cars. In all probability the new cars will be built without end platforms; that is to say, the vestibule space on the platforms will be utilized for the heating apparatus, the coal, the watercloset, etc. In this event the sills will extend through from one end of the car to the other, the vestibule plates will be applied simply as a means to prevent oscillation, and all semblance of the old platforms will be done away with.

As a general rule the exterior framing has been left to the railroads, and the department, while keeping in view the main features that have marked the progress of car building from year to year, has not especially concerned itself about the carrying and resisting powers of postal cars. It has deemed it sufficient to pay particular attention to the interior arrangement, and to specify that part of it, but in the matter of framing and general design the particular railway company over whose lines the car is expected to operate is considered better fitted by experience to pass upon the structural design, and of course is allowed in each instance to incorporate its own standard framing. All postal cars on the Pennsylvania lines have the Pennsylvania standard framing, their peculiar shaped hood and upper deck framing, and all the ideas in car building peculiar to that road. The same is true on the New York Central, the Baltimore and Ohio, and on all other railroads which have a standard framing of their own. But the interior arrangement, the letter boxes, tables, pouch-racks and all that pertains to a post office proper is distinctively in the hands of the Postal Department, and is the same on all railroads for the same class of service. The design of the interior is made by the Postal Department and furnished to the railroads with the stipulation that all is to be inclosed within a railroad car, built after the most approved patterns, and equal in carrying and resisting powers to any car that the particular railroad may have in service. The matter is treated in much the same way that Uncle Sam furnishes the interior fitting of a post-office in a town, the lock-boxes, the keys, the nameplates, and, in case the town is large enough for a delivery system, the letter boxes that are fastened to the lamp-posts, in fact everything that pertains to the direct handling of mail. The post-office department does not especially concern itself about the dimensions or architecture of the building in which the local post-office may be located in towns, except, perhaps, in cities, where the government generally has a building of its own. It is quite satisfactory if the building is a good substantial structure, has a good location, and equal in points of safety and protection to any of the surrounding structures.

In a railway car, however, things are vastly different. Here we have a post-office on wheels, rushing over steel rails at a high rate of speed, subject to enormous strains of twisting, racking and jolting; subject also to being wrecked or crushed at any moment, the danger of this being intensified by the fact that postal cars are usually located in the most dangerous part of the train. In such a perilous post-office mail clerks have to work, and are required to do so with alacrity and precision that is simply marvelous. A mail clerk in a postal car is required to think, see and move at the same instant. He must brace himself on the floor of the car with the firmness of a sailor on the deck of a ship, and always with the liability of being thrown against the side of the car, with his head full of schedules of connections, the lay of the boxes before him, and the position of the mail bags he must handle, and is made responsible for thousands of pieces of mail. The work must be done quickly, for many times a vast quantity of mail is required to be distributed before the train reaches a certain crossing in order that the mail may be transferred and reach its destination on time.

There is probably no other class of men in the employ of the Government, or indeed in any vocation, in which the pressure upon the nervous system is greater. To meet the duties of a railroad postal clerk on any of our trunk lines requires a robust constitution, energy, endurance, determination, and a retentive memory of names, schedules, railroads and various schemes of distribution. The strain is such that postal clerks become incapacitated in a few years for the great rush of work on the trunk lines, and they are transferred to lines where the duties are less arduous. This policy, however, is not conducive to the best interest of the service, for it fills up the tributary or smaller lines with wornout clerks.

This very serious phase of the question is beginning to manifest itself more and more as the years go by, and it is not at all strange that the Post Office Department is now giving very careful attention to the design of postal cars in which these men are required to work. Another question even more serious, is the constantly increasing number of clerks killed and injured each year from wrecked and telescoped cars. A perusal of the records for the last 10 years shows that as the railway mail service is steadily and rapidly increasing, the number of casualties keep increasing just about in the same proportion as the number of clerks.

Last year 10 postal clerks were killed outright, 66 seriously injured and 115 slightly injured. It is this condition of things, together with the incessant jolting, rocking and swaying of cars, that has made the Department thoroughly alive to the subject of car building. The management of the railway mail service, its arrangement and division of work, its personnel, its system of teaching and inculcating interest among employees may well be said to be in advance of the means afforded it to yet realize the benefits of many improved schemes of distribution. The present postal car and the conditions under which the clerks are obliged to work, due strictly to the design and accommodations of the car, may justly be held responsible for many delays in the delivery of mails. If, owing to the oscillating and jerky action of cars, a mail clerk is obliged to make many false moves, the great quantity of mail usually given him to assort cannot be distributed in time to make its proper connections.

The idea is all too prevalent that a postal car is not much more than a baggage car; whereas there is probably no other class of cars that should require more of the attention of the car builder as to steady and even riding when running at a high rate of speed. The sleeping cars and especially the dining cars are required to run steadily; and undoubtedly the postal car of to-day should be classed as a first-class car, and more attention paid to its construction.

The abolishment of the end platforms is without question a great improvement. It will bring about an advancement in car building in two well-defined directions—that of being able to shorten the overhang of a car, and, secondly, to design a car to run in a train of cars and not simply to run alone by itself, depending upon its own weight for stability, merely hooked onto its neighboring car. It is difficult to understand why end platforms have obtained so long on postal and baggage cars, when their only claim in the construction of a passenger car, that of affording a means of entrance and exit, is lacking here. Other features of the proposed new postal cars, their length and especially the design of the vestibules, will be taken up and discussed in our next issue.

A Supposed Discovery in Chemistry.

Something of a sensation has been created in scientific circles in England by the statement that a new gas, a hitherto unknown constituent of air, had been discovered by Lord Rayleigh and Professor Ramsay. It is said to constitute about one per cent. of the atmosphere, to have a density about 50 per cent. greater than nitrogen, and to be rather inert and characterless. Only a quarter of a pint of the fluid is said to have been isolated as yet. Professor Dewar, the chemist who succeeded in freezing air some time ago, and some other experts are skeptical on the subject. It is thought possible that the gas, instead of being an entirely new element, is simply nitrogen in another guise. Many elements and compounds known to chemistry appear in various forms; and it is suggested that we may have here only another instance of allotropism. The nameless gas yields a spectrum containing a blue line more intense than that of nitrogen, but from the accounts at hand evidently occupying a corresponding position. Professor Dewar says that the substance, whatever it is, must have the same boiling point as either oxygen or nitrogen, otherwise he would have detected it in his experiments in solidifying air. But the discoverers declare that after what was believed to be pure nitrogen had been treated with magnesium, which should have combined therewith, they still had a residue, the new gas.

After several weeks of enforced idleness the Otis Stee Works, of Cleveland, O., are again in operation. About 500 men are now at work, this being about one-third of the number employed when the plant is worked to its full capacity.

A Locomotive for Japan.

The photo-engraving appearing on this page shows the general design of a double-end locomotive built for the Nara Railway, of Japan, by the Baldwin Locomotive Works. As shown by the engraving the engine has a straight boiler, with the dome placed in the center, and an extension smoke box and straight stack. There is no bell, but the usual whistle is attached to the back of the dome. Two sand boxes are provided as shown, one for sanding the rails while the engine is in forward motion, and the other for use while the engine is backing. The usual form of cab for such engines is provided, and the fuel, which is to be bituminous coal, will be carried in the usual space back of the cab. Water is carried in the tanks ranged along each side of the boiler. The combination of the usual American form of smoke-box, stack and headlight, with the European form of coupling and buffers, and the substitution of "guard-rails" for a pilot, give the front of the locomotive an odd appearance.

The locomotive is a simple engine with cylinders 15 inches by 20 inches, and carries a working steam pressure of 140 pounds. It has three pairs of coupled driving wheels 48 inches in diameter, and front and back trucks, as shown, with wrought iron, steel-tired wheels 26 inches in diameter. The engine is built for a 3 feet 6 inch gage, and the total wheel-base is 22 feet 2 inches, the driving wheel-base being 9 feet 9 inches. The total weight of the engine in working order is about 72,000 pounds, of which 54,000 pounds rest on the drivers. The extreme width of the engine is 7 feet 6 inches, and the extreme height 11 feet 10 inches. The buffers are placed 2 feet 9 inches from the rail, and are 4 feet apart, center to center.

The boiler is made of cast steel plates $\frac{7}{16}$ inch thick. It is 48 inches in diameter, and all longitudinal seams are double riveted. It contains 144 iron tubes, No. 13 wire gage, $1\frac{3}{4}$ inches in diameter and 9 feet 2 inches long.

The firebox is $77\frac{5}{16}$ inches long and $29\frac{7}{8}$ inches wide inside. All the plates are of cast steel, the side and back sheets being $\frac{5}{16}$ of an inch thick, the crown sheet being $\frac{3}{8}$ inch thick and the flue sheet $\frac{1}{2}$ inch thick. The water space is $2\frac{1}{2}$ inches at the sides and back and $3\frac{1}{2}$ inches in front. The staybolts are of iron $\frac{7}{8}$ inch in diameter, screwed and riveted to the sheet, and are spaced $4\frac{1}{2}$ inches from center to center. The firebox contains a brick arch supported on studs. The crown sheet is supported by crown bars, and is stayed by the usual braces leading to the outside shell of the boiler. The dry pipe is of copper. The cylinders are oiled by a sight-feed lubricator. The driving axle journals are 6 inches in diameter and 7 inches long, and the truck axle journals are 4 inches in diameter and 6 inches long.

The connecting and parallel rods are of hammered iron, and are fitted with keys for adjustment. The feed-water is supplied by two injectors. The cab is built of ash and is glazed with the best double American crystal glass. The cylinders, boiler and dome are lagged with wood and covered with painted iron.

DOUBLE-END TANK LOCOMOTIVE FOR THE NARA RAILWAY, JAPAN.

Contracts have just been awarded for the construction of the second link in an electric railroad chain from Baltimore to Gettysburg. The owners of the Gettysburg Electric Railroad, which now runs southeast from Gettysburg several miles towards Baltimore, will extend their line southeast through Littlestown, Pa., to Union Mills, Md. These lines will give an electric route from Baltimore to Gettysburg 50 miles long, as against 72 miles by the existing railroad route.

Petroleum will be used instead of coal on the locomotives of the Riga railway in Russia. Reservoirs are to be established for this purpose at Reval, Wesenburg, Norwa, Gatschina and St. Petersburg, capable of containing collectively about 16,300 tons of petroleum.

Car Shop Economy.—I.

BY JAMES F. HOBART.

The description of methods given herewith may be taken as typical of the best practice in car building and repairing, as observed by the writer during several years of constant presence in and around car shops. First, I wish to discuss the cutting and the milling of the wooden parts of freight cars, as the side and end sills, bolsters, etc. To begin at the very beginning, the lumber must be provided first, and in this various railroads have widely differing policies. Some of the large railroads put green lumber into their cars. They will not acknowledge, however, that the timber is green, but during the working in the shop, the sap and water flying out is pretty conclusive evidence that the timber is not seasoned.

The reason for the working up of such unseasoned stock is to be found in the poor policy of the purchasing agent. No lumber is purchased until it becomes absolutely necessary to do so, then the agent rushes into the market and is obliged to take what he can get. He cannot spare the time to wait until a good lot of lumber is offered for sale, so he buys the first lot he can get his hand upon and sends it to the shop, where, if not dried, some of the sap is certainly knocked out during the process of milling.

A much better policy is pursued by another road of my acquaintance, which buys all the good oak it can get hold of, no matter whether it be needed just then or not. By following this policy for a number of years, the railroad in question finds itself with several million feet of excellent dry, well-seasoned oak on hand. The cars of this company are always better than those of other roads. The only reason I can see is that of being built of well-seasoned lumber.

Storing the Lumber.—A great many sheds are provided for the storage of the lumber on this road, but all of the sheds are full to overflowing, and hundreds of thousands of feet have to be piled out of doors. But it is all so neatly piled up that rain and weather have little effect except upon the outer layer, or sides and ends of the outside pieces. Waterproof lumber piling is an art nowadays. It is all laid upon good, heavy foundations of stone, timber or old iron. Old rails make a fine foundation for lumber piles, brick or stone piers being placed underneath the iron rails and extending into the ground below the frost line. This is to prevent "heaving" of the piles of lumber, and is a very necessary precaution in the north, although not necessary south of Mason and Dixon's line.

Lumber up to 16 feet in length can be piled in square piles—that is, as wide as they are deep, so that each pile may be bound or tied together once in a certain number of courses or layers by putting on a layer at right angles or crosswise of the pile. When the lumber, especially timber, is 25 to 50 feet long, it is not convenient to use the same kind for tie-layers, and strips $1\frac{1}{2}$ or 2 inches thick and 10, 12 or 14 feet long are laid in to keep the pile from crumbling to pieces.

Getting Into the Mill.—Lumber piles containing a number of million feet in the aggregate must necessarily occupy several acres of ground, and a system of tramways is decidedly necessary for handling the lumber. As the timber must be put into the yard as well as taken out of it, the tramways should be built to standard gage so that carloads of lumber may be run direct to the piling places on the cars by which it came from the mills of the producer. A regular system of tracks and switches is needed for this purpose, and if much of the lumber is got out locally, so as to be delivered by teams, it is well to have truck roads alternate with the spur tracks so that lumber may be put on any foundation by either truck or car, and removed from all piles by push cars.

Some of the larger shops use electric cars and the trolley system for handling lumber between yard and mill, but the trolley system will be found to be an unmitigated nuisance for this purpose, owing to the wire always being in the way of handling lumber, especially of the lighter varieties, such as scantling, boards, molding, etc. The hand push-car system, with a horse or two, works very well for this purpose. The men who load the cars can push them into the mill. They would have to go anyway, even if electricity moved the cars; therefore they might just as well make themselves useful, and push the cars before them as they go to and from the mill.

Cutting Up Stock.—In the shops here described, everything possible is done by piecework under contract, so to speak, and as a consequence everything must be done on orders from the general foreman. He makes out a slip authorizing the making of 100 end sills for a certain kind of car. A slip is prepared which contains blank spaces for all the operations that must be done to those end sills before they are ready to be delivered to the storekeeper. The "yardmaster" is the first man to get this slip, and he sends some of his men to get, into the mill, stock for 100 end sills, each timber to gage as close as possible for size and length, in order to prevent undue waste. The yardmaster sees that his men select the proper size and lengths of timber to work to the best advantage. They fill a flat push car full of timber and get it into the mill, stopping at the cut-off saw. Here a couple of the yardmen remain, to lift each timber from the truck car to the saw bench. They also are provided with large "ice chisels," with which all ice and snow—if any—are removed; also any dirt or mud is carefully scraped off. These "ice chisels" are a feature in the mill. A great number of them are scattered everywhere within reach, and are found to be very handy for scraping stock, prying open split timber, knocking off bark, loose knots, etc.

The chisel is about $3\frac{1}{2}$ inches wide, $\frac{5}{8}$ inch thick and 8 inches long from sharp end to root of tang, which is 6 or 8 inches long, and driven into a 24-inch handle, $2\frac{1}{2}$ inches in diameter at chisel, where a ferrule 5 inches long and $\frac{1}{2}$ inch thick is driven on the handle, probably to give weight to the tool. The small or outer end of the handle is about $1\frac{1}{2}$ inches in diameter. A couple of dozen of these chisels are scattered around the shop, and they save saws and cutters to a great extent by being thus on hand, so the machine hands can use them at any instant to scrape off any dirt or gravel that may be on or imbedded in the lumber. The chisels are ground on three edges, the end and both sides, and they are kept sharp and in working condition by the toolman, who grinds all the knives and cutters and sharpens all the saws used in the shop.

All stock that is brought into the shop is cut up at once. Nothing is left piled upon the floor or stood on end around the walls. In the case of the 100 end sills mentioned above, no stick of timber which will not cut up economically to the required length is brought into the shop; the sorting is all done in the yard. And it is not done when the truck is loaded with the 100 sticks of timber. The sorting was done when the timber was piled up in the yard. This pile was intended for end sills, and no stick which would not cut up close was piled in it; consequently every stick of timber carried into the mill would just make one, two or three end sills.

At the cut-off saw each stick was squared up, then rolled forward past the saw against a spring stop and cut to the right length. Four men, with two carrying sticks, removed each timber from the saw and carried it direct to the four-side planer, about 15 feet. The "yard boss," or his lieutenant, was on the spot all this time, and his men did the carrying, while others of their number removed the sticks from the car and placed them on the saw table.

A close watch is kept on each stick of timber, and they are all "grained" before being put into the planer. The yard boss looks at each stick and directs his men to turn

around all that need it during the trip to the planer. It will be readily understood that if a timber be put into a four-side machine tip first (the top of a tree is called the tip) then it would be planed smoother than if the butt of the log was presented first to the action of the planer knives. Anybody who wants to prove this can do so by trying to plane a common shingle butt end first.

Planing the Stock.—The planer is a stout four-side concern, one of the heaviest made. Work of this kind used to be done on "surfacing machines," i. e. those having a traveling bed and a cylinder head mounted over it. But the four-side machine will do as much work as six of the old surfacing machines, and do it better.

Success in running a machine of this kind on heavy work depends on having one or two extra sets of vertical spindles, together with bearings and housings therefor. Then keep the extra sets of spindles and their boxes well lined and babbitted, all ready to drop into the machine as soon as the vertical spindles used become loose in their bearings.

The journals on such spindles are necessarily short, and, especially when cutting on 12-inch oak timber, become worn loose quickly. By having one set of spindles ready to put into the machine, another set to be at work on, besides the pair in the planer, gives the machine man a chance to keep the planer going about all the time without waiting to rebabbitt vertical spindle bearings.

The "yard boss" has nothing to do with the larger timber after it has been through the planer and is laid upon horses and rolls alongside thereof. The shorter stuff he is done with as soon as it has been through the planer and is loaded onto push cars again. Then another set of men, called the "floor gang," consisting of a boss and four men, takes charge of the stock. They move it from one machine to another, and no operator has to touch a stick except to lift it onto his machine and lay it off again. This is carrying division of labor to a great nicety, but it pays financially. It enables all machine work to be done under contract, "by the piece," and it about doubles the capacity of the machines from what they do when operated "by the day."

Laying Out Long Stock.—The side sills and other long pieces are laid out on the horses placed beside the four-side planer. The patterns used for side sills are mere strips of wood, 3 inches wide by $\frac{3}{4}$ inch thick, cut to length, and with various marks made upon them whereby the several mortises, gains and bolt holes are laid out. Each hole or gain is not marked out as in handwork; instead certain center marks are made upon the pattern strip, and these marks are transmitted to the work. In machining, these marks are brought to coincide with certain fixed marks upon the table or guide of the various machines. The marks have been so located on the patterns that when thus adjusted the machine cuts will come in the required position, as will be more fully described when discussing the short stock.

Milling Side Sills.—On the heavy timber the machine hands work in pairs. On the shorter stuff they work singly. The double tenon on each end of a side sill is cut complete by the single action of one machine. Three regular dado heads are mounted on a heavy arbor which runs in a sliding frame operated vertically by a power screw feed. Two marks, one near either end of the sill, are struck from the pattern, and one of these marks is brought to coincide with a mark on the machine table. The side sill is then clamped to the table by means of two or three 1¼-inch screw presses, the cutter head started up, and the feed belt shipped onto the tight pulley of the down feed.

The frame which carries the cutter is mounted on a track built into vertical posts. The frame and cutter head is counterbalanced by a heavy weight. The cutter head runs about 3,500 revolutions per minute, and the cutters walk down through the Georgia pine (or oak) side sill as if it were only so much cheese. When the frame carrying the cutter head gets down below the sill, the frame strikes a dog which ships the feed belt and stops further movement of the cutter-head frame.

The frame is built open above the cutters, and the arch is sufficiently large to allow the sill to be pushed endwise through the opening, so the other end of the sill may be brought to the action of the cutter. Two tables are thus made necessary, also two sets of clamping screws. Another mark on the second table serves to locate the position of the side sill, relative to the location of the tenons. After clamping, the feed belt is thrown onto the other feed pulley, and the sill tenons are completed during the up or return stroke of the machine.

Boring and Gaining.—The side sill now lies in position to be moved sidewise, as soon as unclamped, a few feet directly upon the table of a compound boring machine, one vertical, the other horizontal and radial, whereby all the holes necessary may be made without even rolling the sill over. It is only necessary to move it endwise upon the rolls in the table, and to raise and lower it by means of the wedges provided for that purpose in the machine table.

Two men also work together to great advantage on this machine, one sliding the sills onto the machine table, the other man operating the vertical adjustment levers of the machine, also applying the brake to stop the machine quickly when bits must be changed. He also slides the sill out of the way on its road to the mortising machine, where two men also work together.

The gaining is all done on a vertical machine, specially built for that purpose. It is a good deal like a railroad cut-off saw, turned up so the arm is vertical, instead of horizontal. Then the cutter head is fed up and down by power feed, and gains in either direction in much the same manner that the tenoner cut the tenons on the ends of the sills.

Marks on the sills are adjusted to correspond with a mark on the table of the gaining machine for locating the gains. The depth of cut is adjusted by moving the table, which slides upon and is bolted to the floor plate of the machine. The table is adjustable to any angle, so that gains to receive braces may be cut, if desired.

Several sets of cutters are used on this machine; one set in particular consists of four knives, each 4 inches wide and ground to the quarter of a circle. By putting on one or both sets of these cutters the ends of timbers may be cornered on one edge or completely rounded, as desired.

Laying Out Short Stuff.—For all the cars used on a big railroad at least a carload of patterns would be required, to say noting of a barrel of scratch gages for marking the sides of mortises, etc. The marker must have all these patterns "in his head"; he must know just what each one is for, where to find it, and how to use it. It is work which can only be successfully handled by a man who has been years in the business, and who, perhaps, has worked up the system and got out all the patterns.

Perhaps no better way of describing the working of a pattern system can be given than to describe the laying out of a pattern for and the working of the stock itself for some particular part of a car. Take, for example, the bottom side sill of a 6-ton gondola car. The pattern consists of a plain piece of mahogany, the ends cut off in the ordinary manner (on a machine saw), with no attempt at finishing up the ends, or of cutting to exact length, although the pattern is as long as the sill, tenons and all.

A strip is nailed and glued on one edge of the pattern—the face or work edge—to serve as a guide in laying the pattern on the work. A double tenon must be cut on each end of this sill, also two mortises in one side and two holes bored through besides the mortises. The sill is about four feet long, and perhaps six by ten inches. For laying out the tenons there is a single hole in the middle of the length of the pattern. This hole is about $\frac{5}{16}$ inch in diameter, just big enough to allow the marker's scratch-awl to go through it.

The awl is put through this hole, and afterward a scratch mark is struck across the sill through the prick mark. In machining the tenons this mark is brought fair with a mark on the tenon machine, the sill is clamped and the tenon cut as already described, but in a smaller machine. Then it is removed, turned end for end, clamped again, and the other end tenoned, the same mark being brought against the same mark on the machine again.

Laying Out Mortises.—Two holes are cut through the pattern where the mortises come; the holes are much wider than the mortises, say three inches, while each mortise is but two inches. No attention is given to getting the sides of the hole true with the desired mortise, except at the ends thereof. The ends of the mortises only are struck by the pattern, the sides are scratched by a sort of double gage made specially for one particular size (width) of mortise.

The two holes are located by prick marks, and a pencil mark is drawn across the work to catch the eye; the mill man whenever he sees a pencil mark knows that a hole must be bored somewhere in that mark, therefore he looks for the prick mark and uses it as a center in starting the auger to work.

All through the shop methods similar to these described are in use, and a very economical manufacture of wooden shapes is the result. When fully milled the "floor boss" counts the pieces, his men truck them to the storehouse, and he takes a receipt from the keeper of that concern. In the ironwork department a good many labor and time saving dodges are likewise employed, and of these I will try to give a brief description in the next paper.

(TO BE CONTINUED.)

Restoring Strength to Iron.

Some time ago a railroad bought six new switching engines that were put into the same hard service in a yard where there was a great deal of running over switches and frogs that subjected the running gear to severe shocks. The engines were all of the same pattern, strongly built, with unusually heavy axles, the designer believing in a good margin of strength. After these engines had been in the service for several years, one of them broke an axle. An inspection of the fracture showed that what was originally fine fibrous iron had become coarsely crystalline, the molecular change, no doubt, having been induced by the constant jars. Within six months all the six engines failed with broken axles, and the fracture in each instance showed the same condition of the iron. The superintendent of motive power of the company, when the breakages happened, believed that reworking restored the strength to iron that had become weakened through use. He determined to put the theory to a practical test, so he worked up the broken axles into piston rods, crank pins, rod straps and other parts of locomotives that are subject to severe and complex strains. The metal gave excellent service.

Master Car and Locomotive Painters' Convention.

The Twenty-fifth Annual Convention of the Master Car and Locomotive Painters' Association will be held at Buffalo, N. Y., on the 12th, 13th and 14th days of September. The headquarters of the association will be at the Genesee Hotel, where special arrangements have been made for all in attendance. The rate for rooms will be $3 per day, which may be engaged in advance of the meeting by addressing the Genesee.

The following is a list of subjects that will be reported on by committees and discussed at the convention:

1. What is the best method of keeping accounts in the paint shop? Labor and material.
2. What methods and materials produce best results in repainting passenger cars that are badly cracked? and is there any method by which cracks in old paint can be obliterated without burning off?
3. In adopting a classification of repairs to passenger cars, what are the various conditions of the paint or surface that should determine the class of repairs, or what standard can be adopted by which to determine when the condition of the paint requires certain class repairs?
4. An essay on painting passenger cars, in the form of questions and answers.
5. What is the best method of computation and establishing rates for piecework on the different classes of painting repairs for passenger equipment cars?
6. What is the best method of computing and establishing rates for piecework on the different classes of painting repairs for locomotives?
7. What is the best method to adopt to insure the proper care of and prevent loss of paint shop tools, namely: brushes, chamois-skins, sponges, dusters, buckets, cups, etc.?
8. What advantages, if any, are there in using ready prepared primers and surfacers on cars and locomotives in preference to those prepared from our own formulas, convenience, time and durability considered?
9. What primers and surfacers, or formulas for the same, which do not contain white lead, have proved satisfactory substitutes for lead primers and surfacers on the outside of passenger cars and locomotives?
10. What style of finish in the construction of passenger equipment cars is the most desirable from a painter's standpoint, namely: the easiest painted or cleaned and kept in repair, durability and economy considered—the panel siding with battens, or a 2 or 2½ inch beaded or tongue and groove siding
11. Report of the Committee on Tests.

Inquiries Relative to Economical Operating.

The following list of questions relative to means of economizing in the operation of the mechanical department of a railroad has been recently submitted to the officers of that department on a large road. It shows the general drift toward adopting more economical methods of management.

Are the standards adopted by the Mechanical Associations being followed?

Have they been found faulty in any respect?

Are the steam producing and heating plants in the various shops doing good work, as far as arrangement of details and care in use are concerned?

Can they be improved readily without going to any material expense?

Are the methods of shop and office heating the cheapest and most efficient that can be used, without material overhauling of the same?

Are the various steam engines and other steam using apparatus doing economical and efficient work?

As far as possible, it would be well to examine water station engine plants also.

Is the shafting in good shape, and do the tools seem properly speeded?

Are the tools arranged both as to grouping and the individual handling of each tool to do the best work? and the use of oil both on shafting and tools well looked after?

Does the shop supervision and discipline seem good?

Is all material, either new or old, around the shops proper, properly cared for, or disposed of? and are the yards, floors and tools neatly kept, and are all small tools well cared for?

Are the proper means used without much expense, for taking advantage of the various methods of saving time now in force at some places by means of compressed air or other special tools?

Is there any direction in which too much time or material seems expended in shop practice, especially as regards common labor, or damage to material in working?

Can the office methods be improved upon to keep all necessary records at less cost?

Is scrap material used as far as can be economically done before calling for new? This applies to metals and lumber to be worked up, and old wood, shavings, etc., to be used as fuel.

Do the forms of shop requisitions, orders, timebooks, etc., used seem a complete check upon expenditures?

Is there a good system of handling the drawing of material and the transmission of orders and messages from shop to shop, so as to save the time of men in going from place to place?

A freight train on the Wabash Railroad struck a horse two miles west of Jonesboro, Mo., Aug. 20, resulting in the ditching of the engine and nineteen cars, and killing the engineer and two tramps who were stealing a ride on the train.

A dispatch from St. Augustine, Fla., dated Aug. 19, says: "The Jacksonville, St. Augustine & Indian River Railway to-day beat the world's record for hauling the longest train of loaded passenger coaches. It was the regular morning train from Jacksonville to this city, and consisted of twenty-five passenger coaches and one baggage car, the passengers numbering over 1,600, most of them an excursion party to the military encampment here. The Memphis Route has held the world's championship heretofore with a record of twenty-three coaches. To-day's train was drawn the entire distance—thirty-eight miles—by a Schenectady locomotive, and made the run in a few minutes over an hour."

High Speed on Railways.

BY W. H. WESTON, M. E.

The increasing demands upon the railways of the country are all in the direction of speed, economy and safety. Safety to the public means economy to the railroad, and economy to the railroad means economy to the general public. The elements that allow and promote high speed are indirectly also those which give economy and safety.

Economy means time saved, least wear and tear on rolling stock, roadbed, etc., commensurate with the amount of work done. Attaining high speed is not so much a matter of trouble with the engines as it is with the roadbed, rails, crossings, grades, etc. A meanly constructed, crooked line of road is the principal hindrance to all the elements of economy and fast running, and everything desired for the present and the future. High speed on a crooked, uneven line of road is simply impossible. Therefore, on most of the railways continuous fast running of heavy trains for any distance is beyond possibility; that is, with the roads in their present state. These lines with their many sharp curves and heavy grades offer very great hindrance to the demands of future travel. It is unreasonable to expect—as the majority of people do—that a railroad that is so built as to run through one point and avoid another within a few hundred feet can be used for 70 miles an hour speed. That irregular local lines are needed cannot be denied; but it should not be expected that 70 miles an hour can be attained on them. These two elements cannot be secured on one line.

In order to secure high speed throughout the length of a road: First, the line must be straight and level. Second, the rails must be heavy, at least 100 pounds. Third, the road-bed must be properly built, and have the best of ballasting. Fourth, the sections must be so kept that all joints and rail lengths will be up in perfect line. Fifth, a road must be double tracked for its entire length, and a fast train must not have freight and local trains to interfere with it; that is, it must have unrestricted freedom of the whole line at its time of running. If a train must stop at a half dozen stations in a run of a hundred miles, and be delayed on a single line by having to wait at turnouts for passing trains that are late half the time, it should not be expected that an average high speed for the run can be secured, even in case the roadbed is in first-class condition. But it usually is expected that a train can be hauled through at quick time, even against the disadvantages of the above mentioned hindrances. And also usually on the poorest of roadbeds, both as to first construction in line and material, and also in maintenance.

Locomotives are turned out from railroad builders' shops that are, generally speaking, fully capable of what they are planned for—to haul heavy trains, and to haul fast trains. Most engine builders, motive power superintendents and master mechanics know how to bring out an engine for its special work. Ordinarily, locomotives are, when given a proper chance, capable of doing much more and much better work than they usually are allowed to do on account of the poorest of means being given them to do their work on. And they are very soon rattled to pieces and worn out by running over a line of track that is often disgraceful.

Poorly constructed lines of road are not always the fault of the civil engineers in charge, but are caused by the want of a sufficient amount of money expended by the management. Taking everything into account the average dividend for 20 years' running would, in most cases, be greater on a road costing $60,000 per mile than if it was built on an expenditure of $40,000, with light iron, heavy grades and poor ballasting. There are very often to be found examples of lines built irregularly with many sharp curves in them, because it was desired by poor judgment to avoid a cutting at one point or a fill at another. And the result is that now when fast trains are wanted they cannot be had, simply because the road is not fit to run them on. Yet the trial is often made to provide high speed on these railways, and because it does not succeed the failure is entirely charged to the engines, when in reality there is no failure on the part of the locomotive.

In the first place, a proper road must have a line that is practically straight from one end to the other, and by this is meant one that has nothing sharper that a two-degree curve in it. Such a line could readily be built if so desired, and at the same time touch all the special points and towns or parts of towns that it was thought advisable to pass. The large amounts of money that are spent every year by existing railroad companies to straighten their lines at various points is sufficient evidence that crooked first construction is a vast disadvantage, and that satisfactory and paying results can only be had by avoiding such construction.

When a cut is made, it would be far better to spend a little more in proportion and bring it down to a true level. And this extra expense will always be made up entirely in a comparatively short time, if the road has a business that warrants it being operated. It may be argued that no steam is used in going down a grade, consequently a grade is no loss. But it will always take more steam to get any kind of a train up to the top of a hill than is saved in going down the other side, when compared to a run on a level. In thus speaking of grades, of course exception is not taken to those that are unavoidable, such as where there is a continual rise in the country along a line for a very long distance.

Next, there is no excuse for sharp hollows being left only half filled, while they might be brought up to a level easily, at the time of building, with but a slight excess in cost. Now, provided the line and level are all right, the next thing in construction is the ballasting. This should, for high speed, or in fact for any heavy work, be composed of stone. There is no material that has ever been tried that is practically as good for ballasting as broken stone. The advantages of this kind are numerous. In the first place, it remains in position longer and better than anything else will. Next, the drainage of such ballasting is perfect, or under ordinary circumstances can be made so. This is a great element in its favor, as it preserves the ties and gives a chance for a very much longer life of them; and the ties and iron when put in proper place and in good line, and level, will remain in position far longer than in any other material.

Of course the cost of stone ballasting, in the first place will be more than for common material, but in the working of a road for 10 or 20 years, probably the stone ballasting is the cheapest—that is, as far as the latter is concerned, simply in itself; and when the saving on rails, ties and rolling stock is taken into account it is far cheaper than any other ballasting. The first cost and the quality of broken stone will of course vary greatly in different localities. But there is scarcely a road where high speed is wanted but can secure this material if desired.

High speed demands heavy rails; and the safety of travel, and a proper length of the life of rolling stock demand them. In regard to the actual weight of rails per yard, a 70-pound rail is far too light to be economically used on any prominent railway. A 100-pound rail is near to what should be used, although a 120-pound one would in a great many cases at present time be more economical still.

Switches require far more care in the selection, placing and maintenance than is given. Roads are numerous that have hardly a switch on them that is fit to run over at a high speed, on account of poor details, poor construction and not being taken proper care of. On a line that is to answer the requirements of the present time every part of the roadway must be carefully and thoroughly looked after and kept continually at its best. When this is done on a road that is properly built, the engines will haul trains at high speed satisfactorily and economically. Give existing engines a proper road to run on, and they will do all that is wished for.

Cypress in Car Construction.

A yellow pine manufacturer made the statement the other day that he was losing a certain amount of business because of the adoption of cypress by car companies for use as car siding and roofing. Only a few weeks ago we had a comment on freight car construction, in which it was remarked that the great strength of long-leaf yellow pine was commending it for freight car siding and roofing, as it thoroughly tied the framework together; and that, while it was rather heavy, it more than made amends for that fact by the increased strength it gave to the construction.

But it seems that the argument is not all on one side of the question. Car builders like a reasonably soft and easily worked wood, in which particular cypress excels long-leaf pine, which, while workable, is not so available to the work of the carpenter as is cypress. Every one knows that the delight of a carpenter's heart is a wood—like white pine or cypress—which is light, soft and easily handled and worked. He will use anything else only under protest, regardless of the genuine merits of the material. So there is no reason why cypress should not be a very popular wood for car roofing and siding. It has a reasonable degree of strength, is light and easily worked. Moreover, it takes and holds paint well, and, though it commands a higher price than yellow pine, can be furnished much cheaper than white pine.—*Northwestern Lumberman.*

The Engineer Who "Tinkers."

Some one ought to say a word for the engineer who knows enough to "tinker" with his engine when it needs it. Away back in the dim past some fellow, undoubtedly with innocent intent, made a few remarks about the trouble that comes along with too much engine-tinkering; and those remarks have ever since furnished a perennial text for the just-to-fill-out-a-column editor of technical journals. They have been changed into all sorts and conditions of phraseology, good, bad and indifferent, and got into spaces of 3 to 100 lines. Every kind of epithet has been applied to the man who does the "tinkering," and every possible ill to which a steam engine could be heir to has been shown to have resulted from it.

Now, there are men around engines who ought to do no "tinkering," but they are not engineers. They are men who rattle around loose in the places engineers ought to fill. These be they who never ought to get within a half-mile of an engine with wrench or hammer.

No one ever knew a *real* engineer do too much tinkering. He is just lazy enough not to do useless work, and just enterprising enough to do such "tinkering" as is required. An engineer who hasn't push enough about him to "tinker" the pounds and other little ills out of his engine ought to get an easier job without serious delay. He might do well at holding down a chair or something of the sort, but as an engineer he hasn't just a little chance for success. In the best interest of his employer he ought to get another job before his engine has to go to the machine shop, or the machine shop go to the engine.—*American Machinist.*

Third-Class Scotch Dining Car.

The following engraving, which is taken from *Engineering*, gives an interior view of one of a number of third-class dining cars recently constructed in the Great Northern Railway Company's shops at Doncaster, England, from the designs of Mr. Patrick Stirling, the locomotive superintendent of the line, the work being carried out under the direction of Mr. F. Howlden, the head of the carriage department. These cars are running on the east coast joint service from London to Edinburgh. They are 52 feet 6 inches long and 9 feet wide, while the canopied roof is 8 feet 2 inches above the floor level. The cars are constructed of teak and run on two four-wheeled trucks. Each will seat 42 passengers, giving a space of 2 feet 1 inch to each.

Third-Class Scotch Dining Car.

The parcel racks above the tables may offer a suggestion to American carbuilders.

The invention of bells is attributed by some of the best foreign campanologists to the Egyptians, who are credited with having made use of such percussion instruments to announce the sacred fêtes of Osiris.

"This laundry bill is awful," protested Satan. "Yes," acquiesced Lucifer. "I tell you what," insisted the Prince of Darkness, "we've got to depart from the conventional white in clothes for Hades or else stop burning soft coal."

Having taken the gold cure himself, Debs tried to cure the workingmen of the disease of having either gold or silver.

The sale of the Minneapolis & St. Louis Railroad by the Sheriff will take place in Minneapolis on Oct. 11. About $5,000,000 will be the price needed to redeem the property, and it is expected that the Rock Island will be the purchaser.

Early Sleeping Cars.

Apropos to the article that appeared under this heading in the last issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER, one of our readers has sent us the following description of what is claimed to be the first patented sleeping car built in this country. It was invented by Mr. T. T. Woodruff, and was built by Messrs. T. W. Wason & Co., of Springfield, Mass., now the Wason Manufacturing Co. The following is from the Springfield *Daily Republican*, of October 7, 1857.

Woodruff's Patent Seat and Couch Car.

We have been much interested in examining a new seat and couch car nearly perfected at the car factory of Wason & Co., in this city, the invention of Mr. Woodruff of Alton, Ill. The car is of the average length, containing upon each side 28 good seats, the whole car containing 56, or four less than the usual number.

These seats face each other in pairs, that is, two persons face two other persons always when the car is full. Everything is elegant, and one would not suspect at the first glance that the whole car could be thrown into couches in which every one of the whole 56 passengers could lay down at full length, yet such is the case, and it is so arranged that each one in a compartment may go to bed singly without depriving the others of their seats, and for the last one two seats will be left. In the first place there is an upper berth six feet long which can be swung down into location and be above the heads of all. Into this one may retire, drop the curtain and go to sleep; when the second wishes to retire, the backs of the seats next to the wall of the car are swung up and united to a stationary section of the berth that stands as a table between the two outside passengers, and thus the second couch is constructed, and over this the curtain drops.

There are two passengers left sitting face to face next the passageway; when the third wishes to retire, the two seats (which are double) under the berths and hung together by an adaptable hinge, are unfolded and just fill the space between the seats, thus making the third couch 6 feet long. There are then two unoccupied seats left, and in these, two men can sit, thus making five in each compartment, or the fourth can make his couch in the same manner the third did. We do not see but the thing is perfect. It certainly needs nothing but to understand it to make it practicable everywhere, and it is a very great improvement; these long night trips are made comfortable by it; it must at once attract the attention of railroad men, and passengers on long routes will give it their universal blessing whenever it may be brought into use.

The car is finished in Wason & Co.'s best style, and will be deemed at the West, whither it is bound, a good specimen of Yankee skill.

Our correspondent has also favored us with the following clipping from the Springfield *Republican* of June 27, 1863. It describes the then most elegant sleeping car as well as specimen of the car builder's art in America.

An Elegant Sleeping Car.

The magnificent sleeping car of which we spoke a few weeks ago has just been completed at the manufactory of Wason & Co., and was out yesterday for a trial trip. It has sixteen wheels, and consequently a scarcely perceptible jar when in motion, certainly a great desideratum in a sleeping car. The outside is elegantly ornamented, and has the elevated roof, which is fast becoming popular with railroad men and the traveling public, and the patent ventilator of Westlake & Co., Milwaukee, Wis. But it is upon the interior that the greatest pains have been expended, making it really a moving palace. At each end is a washroom provided with marble basins, mirrors and every convenience. Next this is a stateroom, made by an ingenious arrangement so that it can be enlarged into a sizable room, or remain of the same capacity as the other berths. These staterooms, of which the car has two, are provided with a table and seats for four persons, as well as beds for four, which latter, however, turn up in the day, leaving no visible indications of their existence. In these staterooms a gentleman with his family could make railway trips, usually long and wearisome, with as much ease and privacy as he could enjoy in his own drawing-room. The other seats in the car are not arranged in the ordinary way, but longitudinally, and are quickly convertible into three comfortable berths, each side of the seven sections into which the car is divided seating and sleeping four persons. The berths are furnished with bedding and every possible means taken to promote the comfort of passengers, being provided with beautiful and costly curtains, while the seats are elegantly upholstered. The top inside is gilded and ornamented in the best style. The woodwork of the interior is black walnut, and the whole appearance is elegant and tasteful in the extreme. The cost of the car was something over $6,000, and it is, without doubt, the handsomest and best sleeping car in the United States, reflecting great credit upon the builders, Wason & Co., and the designers and owners, Field & Pullman, of Chicago, Ill. It will run on the Chicago, Alton & St. Louis Railroad, for which route it will leave this morning, and it certainly speaks highly for the management of that road that they have secured the use of a car of such unparalleled beauty and excellence. The trial trip yesterday, in which about forty of our principal men rode to Palmer, enjoying for a short time there the hospitality and good cheer of Col. Frank Morgan, was satisfactory in every respect.

Two men left a large case at a railroad depot at Memphis recently. As they did not return, the case was opened and found to contain the mummy of a man, which, it is said, came from a mine in Norway. The body was 9 feet 1¼ inches long, and was in a splendid state of preservation.

Traveling in a second-class carriage, a gentleman had a small misunderstanding with a lady in reference to the opening of a window. "You don't appear to know the difference between second and third class," the lady said cuttingly. "O madam!" he replied, "I am an old railway traveler. I know all the class distinctions. In the first class the paseengers behave rudely to the guard; in the third the guards behave rudely to the passengers; in the second (with a bow to his fellow-passenger) the passengers behave rudely to each other."—*London Tit-Bits.*

Freight Cars.

From the average observer the freight car is something that receives a very small share of attention; but, notwithstanding, it is, as P. T. Barnum would say, "One of the greatest things on earth." It can move at the air-splitting velocity of 70 miles an hour, yet it is equally adapted to its ability to remain motionless for weeks. Ten thousand miles a year is a common record for the freight car to travel. Its natural life is in the neighborhood of 18 to 20 years, with ordinary wear and tear and an occasional trip to the main shops for the renewal of such parts as may have become defective; and while the period named is sufficient to bear a profitable revenue to its owners, yet the grave possibility of its being rudely converted into a shapeless mass before it is 24 hours old is not lessened.

The astounding number of 25,000 employés yearly are either killed or crippled on the rail, and a fair estimate charges the bumper and wheel of the freight car with one-quarter of this human sacrifice, so that by this time we must acknowledge that some consideration is due to this critter on wheels. The freight car is one of the greatest money earners of the age, if it is made to do what a railroader would term "to hustle." It is upon the management or controlling of the thousands of freight cars that the interests of a railroad are largely dependent. From the time a car stops rolling until its wheels again revolve it is not paying for its axle grease, consequently it must be bridled and driven as the horse earneth his oats.

In actual service at this time there are over and above 1,000,000 freight cars in the United States, representing 500 or more different railroads. It is estimated that about 75,000 are in constant movement at every tick of the watch, day and night. It is a wonder how this vast number of cars can be successfully bridled, controlled and accounted for, both separately and collectively; and the fact that each company's cars are not restricted to the home road still adds to the seemingly great problem. So systematic and correct is the method by which the freight car accounts are kept, that while it may seem marvelous yet it is not difficult for any railroad company to have at all times a statement showing the location of its entire equipment; and, in fact, so accurately can this record be kept that it would appear as though the respective roads had a private wire connected with every car and an operator on board ticking back to the home office every time its wheels were turned, and other tell-tale items.

Previous to the annulling of the recent Philadelphia and Reading leases the Transportation Master of that line had under his supervision the handling and accounting of 125,000 freight and coal cars owned and controlled by the company referred to alone, and representing a capital of upwards of $50,000,000. These figures are outside of the hundreds of foreign cars moving over the Philadelphia and Reading system daily, all of which are traced and recorded in their movements throughout the country by the respective car service officers. If you should enter the car department and inquire the whereabouts of any car whatever belonging to that line, the information would be forthcoming in just about five seconds. If need be, the contents of the car would be given, the number of the train and hour said car left the last station, the number of the engine drawing the train, the names of the train crew, and what cars accompanied it on its journey. Some roads are even able to tell you the kind of weather the car passes through while in motion, as well as when loading and unloading.

This enormous array of figuring does not stop here. At the end of every 30 days the mileage is computed and the tale of activity or detention is told. The number of miles each car travels is figured out and put down as a part of its history, so that there is a complete record of the movements of the freight car in every detail from its daily location down to the cost of moving it over the respective divisions and under any kind of lading, should it be required.

Still another interesting fact is that a car, like the individual, must travel on a ticket, and not only one, but three—one for the conductor hauling the car and one tacked on either side of the car to guide it to its destination. As to the settlement of the vast sums earned by one company's cars on the line of another, there is greater confidence displayed, or rather placed, in humanity, than in any other commercial operation. Over $100,000,000 pass hands annually in the settlement of mileage accounts, with no opportunity to go behind the signatures of the respective officers for examination of the figures as certified by them, while other positions of trust require bonds of the highest order.

Do any cars get lost, strayed or stolen? In very rare cases only, and even then some one has failed in his duty. A conductor of a freight train is not retained for his clerical ability, but more for the proper handling of his train, and occasionally he will err in reporting numbers and initials by which each car is known; yet the chances are 8 to 10 that the error will be corrected somewhere. But should it occur, as is the case once a year or so, that a car seemingly moves off the earth, it is usually located somewhere with its name badly blurred, or through some other cause has secreted itself, and is returned promptly to its proper latitude. On such occasions there is more joy over the return of one lost car "than the ninety and nine that went not astray."—J. F. BOUGHER, *in the Official Railway Guide.*

Railroad Mileage of the World.

The following list has been published showing the railroad mileage of the world in 1892:

America.

	Miles.		Miles.
United States of America	174,784	The Argentine	8,163
British North America	14,870	Paraguay	157
Newfoundland	243	Uruguay	1,056
Mexico	6,625	Chili	1,926
Central America	622	Peru	1,036
United States of Colombia	261	Bolivia	593
Cuba	1,076	Ecuador	186
Venezuela	497	Brit'sh Guiana	22
Republic of San Domingo	71	Jamaica, Barbadoes, Trinidad and Martinique	321
Puerto Rico	11		
Brazil	6,390	Total, America	218,910

Australia.

New Zealand	2,008	Tasmania	467
Victoria	2,920	West Australia	669
New South Wales	2,399	Hawaii	56
South Australia	1,823		
Queensland	2,352	Total, Australia	12,685

Africa.

Egypt	961	Mauritius, Reunion, Senegal Territory, Angola, Mozambique, etc	671
Algeria and Tunis	1,984		
Cape Colony	2,444		
Natal	399		
Transvaal	194	Total, Africa	7,212
Orange Free State	559		

Europe.

Prussia	16,275	The Netherlands, including Luxemburg	1,913
Bavaria	3,597	Switzerland	2,082
Saxony	1,584	Spain	6,771
Wurtemberg	967	Portugal	1,425
Baden	1,000	Denmark	1,283
Alsace-Lorraine	1,005	Norway	971
All other German States	3,027	Sweden	5,259
Austria-Hungary, including Bosnia, etc	17,620	Servia	336
Great Britain and Ireland	20,325	Roumania	1,622
France	24,018	Greece	569
Russia, including Finland	19,656	European Turkey, Bulgaria, Roumelia	1,130
Italy	8,498	Malta, Jersey, Man	68
Belgium	3,379		
		Total, Europe	141,380

Asia.

British India	17,768	Portuguese India	51
Ceylon	191	Malay States	87
Asia Minor	998	China	124
Russian trans-Caspian District	890	Cochin China, Pondichery, Malacca, Tonkineto	112
Persia	34		
The Dutch Indies	1,068	Total, Asia	23,229
Japan	1,876		

The totals of the five great divisions of the earth are as follows:

	Miles.		Miles.
America	218,910	Asia	23,229
Europe	144,380	Africa	7,212
Australia	12,685		
Grand total of the world			406,416

The First Mechanical Flight.

The first successful effort to fly by mechanical means is thus described by *Engineering*:

On July 31, for the first time in the history of the world, a flying machine actually left the ground, fully equipped with engines, boiler, fuel, water and a crew of three persons. Its inventor, Mr. Hiram Maxim, had the proud consciousness of feeling that he had accomplished a feat which scores of able mechanics had stated to be impossible. Unfortunately, he had scarcely time to realize his triumph before fate, which so persistently dogs the footsteps of inventors, interposed to dash his hopes. The very precautions which had been adopted to prevent accidents proved fatal to the machine, and in a moment it lay stretched on the ground, like a wounded bird with torn plumage and broken wings. Its very success was the cause of its failure, for not only did it rise, but it tore itself out of the guides placed to limit its flight, and for one short moment it was free. But the wreck of the timber rails became entangled with the sails and brought it down at once. The machine fell on the soft sward, imbedding its wheels deeply in the grass, and testifying, beyond contradiction, that it had fallen and not run to its position. If it had not been in actual flight, the small flanged wheels would have cut deep tracks in the yielding earth.

The entire weight of the machine is 7,700 pounds. In the run, at 630 feet from the starting point, the entire weight rested in air, and for 300 feet the machine, with its crew, flew forward. It lifted off the bottom track, but was held down by an inverted upper track placed for this purpose. This was formed of timbers 9 by 3 inches, and against them three flanged wheels ran carried on long projecting arms. One of these arms bent, and the rear of the machine got free. It then turned somewhat to the right, with the effect that one of the forward wheels snapped the timber guide and flung the plank across its path and against a post firmly fixed in the ground. The ride ended suddenly and disastrously, but, nevertheless, it was the most remarkable ride ever taken by man.

The propelling power of the machine is derived from two screws 17 feet 6 inches in diameter, revolving at 400 revolutions per minute, and giving a total thrust of 2,000 pounds. Each screw is driven by a compound engine, both engines drawing their steam from a tubulous boiler of most ingenious construction. The weight of the boiler, complete with 200 pounds of water, is only 1,200 pounds, yet Mr. Maxim contrives to get 300 horse power out of it. The fuel is gasoline, which is gasified and burned as a gas in a burner with 1,000 jets.

A special mouthpiece for public telephones has been introduced in Germany with the object of avoiding the spread of diseases carried by the condensed moisture of the breath. A pad, or a large number of disks of paper, with a hole in the middle, is inserted in the mouthpiece, and the upper disk of paper is torn off after every conversation,

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

SLOPING CROWN SHEETS.

A common practice in locomotive building is to put the crown sheet in sloping from the front to the back, with the front of the sheet from 2 inches to 4 inches higher than the back. Doubtless many locomotives have been built with the crown sheets placed thus when the designer simply followed practice and did not have a very clear conception of just why it was best to place the crown sheet in this position. Referring to the practice we have conversed with a number of prominent locomotive men, and have found few with the settled conviction that this form of construction is the best. The generally accepted idea for it seems to be that it is to insure against the back of the crown sheet becoming bare of water when the engine is decending a steep grade. Speaking from many years' experience in the cab, on hilly roads, we have never been able to see much force in this argument. Locomotives have to ascend as well as descend hills, and although they "raise the water" some while working hard ascending hills, there is as much danger (if not more) of the front of an inclined crown sheet getting scorched going up a hill as there is of the back of a straight crown sheet being scorched going down a hill.

At the April meeting of the Southern and Southwestern Railway Club, Mr. Pulaski Leeds gave as one of his reasons for sloping crown sheets that sediment worked off these sheets better than off of straight sheets, although he admitted that he did not think this action amounted to very much. The main object, Mr. Leeds stated, was in case of scorching to insure that the front of the sheet would become overheated first, thereby localizing the damage to the front of the sheet and the flues. This may be a wise precaution, but if it is we think it should be made plainer than has as yet been attempted.

The record of locomotive boiler explosions shows that quite as many of these occur while the engines are ascending hills, or doing other kinds of hard work, as when standing idle or running shut off down hill. Many of these explosions which have occurred while the engines have been engaged in heavy work have been traced to low water. This indicates that in these cases the water was allowed to get low in order to successfully accomplish some task of work, such as to make a meeting point or to get a heavy train over a steep hill without doubling. Every practical railroad man knows that this is done many times every day on the railroads of this country, and there is no successful locomotive engineer of considerable experience who has not seen emergencies when he had to resort to every possible expedient to make a successful run. Among the expedients was that of letting the water in the boiler get as low as he dared. Frequently in operating a locomotive the making of an important meeting point (failure in which would cause serious delay) or the successful climbing of a hill (failure in which would cause doubling, delay, expense and hard work) depends on a few pounds pressure more or less in the boiler, and this depends on the possibility of allowing the water level to fall ¼ inch or ½ inch. It is not surprising that such chances are frequently taken; but when they are, the chances of disaster are increased by sloping crown sheets that may become bare at the front when there is an apparent abundance of water at the back.

THE RAILROAD CLUBS.

The President of the Master Mechanics' Association paid a deserved tribute to our railroad clubs in his address before the Saratoga convention when he said, in speaking of the economical advantages to railroads of the associations of railroad men:

I would scarcely be doing justice to the subject with which I am dealing, did I not call attention to the good work of the various railway clubs throughout the country in their monthly meetings. Their work is commendable to the highest degree, and the combined fruits of their labor convey a spirit of progress, that must brighten the pages bearing the record of American railway progress. It is especially noticeable in club work that men who have in the distant past confined themselves largely to locomotive construction and maintenance, have within the last few years extended their thoughts and efforts to car construction. On the other hand many of those who have confined their ideas exclusively to cars, are now earnestly extending their efforts to locomotive practice and principles of construction.

Those who are familiar with the work of the railroad clubs must applaud these remarks. The influence of these clubs is almost altogether educational, and it is becoming stronger each year as their organization is becoming more perfect, and as interest in their proceedings grows among both the mechanical and transportation officers of railroads.

As mentioned in the remarks of Mr. Hickey, one of the chief benefits of club work results from those in the different departments of railroads becoming interested in matters pertaining to other departments than their own. The value of the educational and broadening effects of this can hardly be overestimated. It is as natural for men to get into a rut when their interests are bound within narrow limits as it is for a stream to run within the confines of its banks. In the past, railroad service has suffered a good deal because the horizon of the roadmaster, and of the master mechanic, and of the trainmaster, and of the car builder, was bound by the interests of his particular department. Knowing little of the work and requirements of any other department, the natural tendency of each was to regard his own department as the only one on the road of really great importance, the others being considered necessary adjuncts, but relatively of much less importance. The results of this have been misunderstandings, ill feelings and friction between the different departments that have acted in every way but to promote the economy of operation and the efficiency of the service.

The influence of the clubs is opposod to these narrow views, and is rapidly dispelling them by teaching their members the need of more intimate and harmonious association, and that the successful operation of a railroad demands that the several departments work in accord and co-operation with each other.

It is usual for all the railroad clubs to suspend their regular meetings during the summer months. One club recommenced holding its meetings in August, and all will do likewise during September. During the next nine months a good deal of educational work will doubtless be accomplished through these meetings, and it may be pertinent to offer at the beginning a few suggestions, which, if adopted, will make the meetings more interesting to many, and will enhance the value of their work and of the reports of their proceedings.

Probably the most common fault of those who discourse on railroad matters before both the local clubs and the national associations, is a too low tone of voice employed in speaking. Those who undertake to address a meeting of associates should remember that *all* present desire to hear *everything* that is said. They have a right to hear everything that is said, and speakers should recognize this and pitch their voices to the tone that they *know* will enable every one present to hear easily and plainly. It is to the great credit of our railroad men that they are eager to learn new ideas and to receive new suggestions, and this is attested by the attention they usually give a speaker. Many speakers, though, that we have heard address these gentlemen, far from appreciating the interest and courtesy implied by this attention, have carelessly made their remarks in so low a tone that even the trained ear of the stenographer could not catch their words, and nine out of ten of the people present were in entire ignorance of what was being said. This is a shameful discourtesy on the part of speakers; and if this plain presentation of the matter will induce these low-toned gentlemen to become high-toned ones, and, when speaking, to turn a little more *wind* on their voice-producing apparatus, their object in speaking will be more fully accomplished, and their hearers will feel better satisfied.

Now that it has been agreed among the clubs to interchange the reports of their proceedings, it should be seen to that the interchange should be liberal enough to supply all club members with copies who desire them. The reports of the various clubs should be sent to the home or business addresses of all members who want them, and their receipt should not be made a condition of their attending meetings, as a "reward of merit," as has been suggested. Most of the mechanical members of the clubs will want to preserve a file of these reports for future occasional reference, and to these no plan of delivery will be satisfactory but such as brings to them the reports of the club and associations they are members of.

Apropos of the subject of crudely edited club reports and the careless language of many who write and discourse on mechanical subjects, it may be said that in this issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER we have occasion to republish three paragraphs, or 450 words, of the report of a railroad club committee. We have had to add 60 words to these to make their sense explicit. Of the 60 words added, the word *the* was added 41 times. It seems to be the style for some people who write on mechanical subjects to avoid using the word *the* on all possible occasions. Speaking naturally a man would say:

"The grates are in bad shape, the flues are leaking, and the valves are blowing. The engine can't handle the train on the hills."

Written in the way we are criticising, these facts would be stated thus:

"Grates in bad shape, flues leaking and valves blowing. Engine can't handle train on hills."

Why these writers do not write as they would talk is an unexplained mystery. It looks very much like excessive economy of personal effort, the idea being that a reader can guess the meaning of a writer easier than the latter can explicitly state it. If this is the reason it is a very wrong one, as the burden of labor should fall on the writer and not on the reader. The writer undertakes to supply information to the reader. If his means of communication are crude and lacking in completeness the result is a loss of useful effect, the same as if he undertakes to transmit power through a crudely designed and inefficient line of shafting. The work the reader has to do in guessing the presence of words that are missing detracts just so much from the impression of what is read, just as friction in the shafting or the machine detracts from the useful work accomplished with a given amount of applied power.

The writers of reports for railroad clubs and associations should exert themselves to make their reports explicit and easily readable. They should do all the hard work themselves, and thus make the task of the reader as light as possible. There is a certain amouut of work to be done in transmitting intelligence through writing, and just in proportion as a writer shirks his task a reader must exert his faculties to understand, and in proportion as this is done the reading is unpleasant and tiresome, and the effect of what is read is lessened.

NOTES FROM THE ARGENTINE.

The communication from a correspondent in La Plata, Argentine Republic, which appears on another page of this issue, gives some interesting and up to date information about the railroads in that country, and of the proposed new extensions that are likely to be built in the near future. An interesting portion of the communication refers to the good satisfaction given by American rolling stock in the Argentine. North American rolling stock gives good satisfaction in every foreign country to which it is sent, and this embraces nearly every country in the world. The builders of American cars and locomotives appreciate the importance of such reports as this, and it is for such reports and such performances that they strive to have cars and locomotives built for foreign service equal in every respect to those built for use in the United States. This is the only safe way to build up a foreign demand for American products, and our manufacturers may be depended on to strictly adhere to the practice.

Our correspondent mentions the fact that the transportation of live stock in Argentina has become a very important business in that country, and demands improved facilities. The country is eminently a pastoral one, and the raising and shipment of live stock will surely continue to grow in volume and importance for many years to come; and as railroads are extended and the country developes, the demand for the best kind of stock cars will become imperative. In this country the long distance shipment of live stock has been improved to almost perfection. Pounds of beef and mutton are too valuable here to allow of their being wasted by poor facilities of transportation, therefore our Argentine neighbors show their wisdom by sending an expert railroad man to study our methods and the construction of our stock cars. The general manager of Argentine's largest railroad visited this country a few months ago and, as then announced in this paper, made a tour of our principal railroads to study the most improved methods. Among the results of his visit will probably be a still further modification of Argentine rolling stock to conform with the best North American practice.

THE STRIKE INVESTIGATION.

The National Labor Commission appointed by the President of the United States to investigate the recent railroad strike has been holding an inquest for the past two weeks on the defunct American Railway Union and its disastrous strike. As we go to press, the Commission is said to have nearly finished its investigation and to be nearly ready to report. There has been some speculation as to the probable nature of the recommendations the Commission will make; and it is broadly intimated that it will recommend some scheme in the nature of a state board of arbitration, with authority to settle labor disputes. Both the railroad officers and the strike leaders who testified before the Commission have emphatically expressed their disapproval of such a plan, and the probabilities are that if the recommendation is

made it will meet with little more popular approval than the mere suggestion received at Chicago.

All intelligent people believe in settling disputes of a serious nature by arbritration, when the circumstances are such that both parties to the dispute can reasonably submit their interests to the decision of arbritrators. This is not always the case. The demands of one party may be so manifestly unjust as to not admit of entertainment or arbritration, or the probability of a fair and just arbitrament may appear to either so doubtful as to make them unwilling to submit to the possible injustice. The people of this country want no law that under such circumstances would compel arbitration. It is too early in our national life to talk of the compulsory arbritration of such disputes. The time may come when such a plan will be practicable, but it is far distant. A great work of education must first be done, and the demagogues must be less numerous in the land and in places of high authority than now.

There can be but little doubt, however, that the investigation of this Commission, coming as it did rapidly after the termination of the strike, is good for all interests concerned. The facts of the case were more easily obtainable during the time the Commission sat than they would be a month or two hence, and it is of much importance that the facts should be correctly known and authoritatively recorded. The testimony before the Commission has proved, if proof was still wanting, that the A. R. U. strike, both at the Pullman shops and on the railroads, was the most gigantic folly, and its leaders the most vainglorious fools of modern record. Numerous thousands of railroad men who were euchred out of good situations by the strike now doubtless share this view, as do also the numerous other thousands who supplanted them. So the lesson of the strike is widespread and deeply impressed.

THE COST OF CAR REPAIRS IN THE WEST.

At the last Master Car Builders' convention, Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific, suggested that, as the cost of repairs ranged very much higher in the States west of the Missouri River than in the Eastern States, the railroads in the Western territory be permitted to charge a price for the repairs to foreign cars approximating the cost of the same, and mentioning a 10 per cent. increase as a fair figure. Although the suggestion was not adopted by the convention it excited considerable discussion, and we publish a report of this on another page in this issue.

Naturally enough, the suggestion was met by st ong opposition from the representatives of some of the Eastern roads. Mr. McConnell stated that the Western roads have to pay 25 per cent. more for labor than the Eastern roads do, and that the price of materials is approximately greater in the West; as, for instance, the prices for iron castings range from $1.75 to $2.25 per 100 pounds. In using these for repairs to foreign cars a charge of but $1.60 per 100 pounds is allowed. The Western roads consider this a manifest injustice, from which they should be relieved.

The Eastern representatives claimed that the rules should not be changed; that the traffic charges are enough greater on the Western roads to make up for this apparent loss; that at some places in the East castings cost as much as in the West, and that, anyway, the repairs to Eastern cars on Western roads were for the benefit of the Western roads only, as they were using the cars, and similar repairs would have to be made to their own cars if similarly used. It was admitted that under the allowed charges Eastern roads made money by repairing foreign cars, and Western roads lost money, yet to the Eastern view there was no apparent injustice in this.

There is an old saying to the effect that everything is blue to those who see through blue glass. As there is a good deal of truth in this it may be useless to argue the matter, or to point out that traffic charges have nothing to do with the case, and that repairing cars about to leave a road forever is quite a different matter to repairing those that remain at home and give some return on the investment. It is quite within the range of probability, however, that the matter will receive more attention at the next convention than it did last June.

We publish on another page a series of questions relative to economy in shop management that has been addressed to the officers of the mechanical department of a large system of railroads. We mention it not to call attention to any of the particular questions asked, but simply to commend and recommend such action. To operate a large railroad economically requires ceaseless vigilance to prevent the small leaks in the various departments that in the aggregate amount to vast annual losses. In no department of a railroad are there more chances for small but expensive leaks than in the mechanical department. Here there are so many men who affect economy of operating that to keep every one in line requires unending effort and agitation.

There will be two conventions of railroad mechanical men in September, the Master Car and Locomotive Painters' convention meeting at Buffalo on the 12th instant, and the Traveling Engineers' convention meeting at Denver on the 11th instant. The work to be handled by both conventions is of considerable practical importance, and well worth to railroad interests the time that will be spent in their consideration. The subjects to be discussed at these conventions are named in the notices published elsewhere in this issue relative to the respective meetings.

An analysis of the cinders caught in the extension smokebox of a locomotive burning bituminous coal was made, with the object of determining the value of the material as fuel; the intention being to use it in the manufacture of coal bricks. The analysis showed the cinders to be of the following composition :

Water (absorbed from air)	1.4 per cent.
Volatile and combustible matter	2.55 "
Fixed carbon	73.35 "
Ash	22.7 "

According to this analysis, nearly 76 per cent. of the cinders carried to the smokebox by the exhaust is combustible and of value as fuel. If this is a fair representation of the fuel value of this material it seems that some determined efforts should be made to utilize it. In that case the extension front end (which has been much criticised lately, and which is gradually undergoing a reduction in length) would prove of additional value.

Literature.

Report of Proceedings, of the 27th annual convention of the American Railway Master Mechanics' Association. Edited by Angus Sinclair, Secretary, 256 Broadway, New York.

Much of the contents of this report has appeared in the NATIONAL CAR AND LOCOMOTIVE BUILDER since the adjournment of the convention, but the bound report is of no less interest on that account, as it contains a great deal of illustrative and discursive matter that has not been published in any of the technical papers. The report presents the usual neat appearance that has characterized the reports of this association since they have been issued under the able editorship of Mr. Sinclair. This implies not only a good looking cover, but a carefully edited volume; and this means good readable type, a minimum of typographical errors, and a general dressing up of the careless language too often heard in the discussion of mechanical matters by men who know more of what they are talking about than of the rules of correct expression. The care in editing shown by this report is lamentably lacking in some of the reports of railroad club proceedings that reach this office. Care in the editing of such reports is of more importance now since the interchange of these has begun, as they will be read by more people, and more of them will be preserved in libraries.

Poor's Manual of Railroads. 1894. 27th Annual Number. Price $7.50. H. V. & H. W. Poor, 44 Broad street, New York.

The 27th number of this most excellent and reliable book of railroad statistics is an improvement on its predecessors in several ways. One of these is the incorporation in it of the features of "Poor's Hand-Book of Investment Securities," viz.: statements showing the financial condition, etc., of the United States, the several States and the chief cities, towns and counties of the country; also statements showing the history, financial condition, operations, stocks, bonds and investments, directors, officers, etc., of all leading industrial enterprises, and a series of statements of street railways, showing for a series of years the mileage, history, operations, financial condition, etc., of the leading street railway companies in the United States. The Manual is the embodiment of the official reports of all the railroad companies in the country. It is the only work of the kind published and is therefore very useful to every one interested in railroads, either financially or in their operation, or desiring information concerning them. Statements carefully revised by each company before publication, are given for about 2,000 companies. The present number contains 1,495 pages of useful information.

The Empire State Express, on the New York Central & Hudson River R. R., continues to easily maintain its famous reputation as the fastest train in the world. So does engine No. 999 as the "Chief of Racers." Recently this engine and train left Syracuse at 4.48 P. M., 48 minutes late, and arrived at Albany at 7.14 P. M., 19 minutes late, having made up 29 minutes between Syracuse and Albany and maintained a speed of 58.76 miles per hour, making no allowance for the three minutes stop at Utica, which, if deducted, would show an average speed of 61.7 miles per hour. On this occasion the train ran the distance from Utica to Albany, 95 miles, in 90 minutes.

When the Empire State Express was first put on, there were envious ones who declared that the high rate of speed it was scheduled to run could not be maintained very long. The run here recorded is but one of numerous such examples which show that the time of this train is easily made by the excellent motive power employed, and that, if desirable, the time could be shortened considerably.

The five A. R. U. men charged with causing the fiendish wrecking of the Southern Pacific passenger train near Sacramento during the strike, have been held to the Superior Court, the trial court at Woodland finding the evidence warranting this action.

Proprietor Railroad Eating-house: "If any one calls, tell them I will be back in half an hour."

Waiter: "All right; shall I tell them where you have gone?"

Proprietor: "Suffering Moses, no! I'm going out to get some dinner!"

Master Mechanics' Association Committees for 1895.

The subjects to be investigated by the committees of the American Railway Master Mechanics' Association during the coming year have been named, and the committees appointed. The following is a list of the same:

Exhaust Nozzles and Steam Passages (continued).—Committee: Robert Quayle, William Forsyth, James McNaughton, W. S. Morris, D. L. Barnes.

Locomotive Fire Kindlers (continued).—Committee: John Hickey, J. O. Pattee, Geo. D. Brook, W. T. Reed, John A. Hill.

Shop Tests of Locomotives (continued).—Committee: Wilham Forsyth, A. S. Vogt, George Gibbs, D. L. Barnes, W. H. Marshall.

Gages for Sheet Metal, Tubes and Wire.—Committee to confer with manufacturers and others, and to submit a practical system for adoption by the Association. Committee: George R. Henderson, T. W. Gentry, C. F. Thomas, A. W. Gibbs, Alex. Gordon.

Utilization of Railroad Scrap Material.—Committee to report on best method of handling the same. Committee: H. J. Small, H. Monkhouse, Henry Schlacks, George W. Smith, H. P. Robinson.

Causes of Bulging of Firebox Sheets.—Committee: P. Leeds, John Hickey, John Ellis, A. E. Manchester, George H. Baker.

Best Material for Boiler Tubes and Specifications for Same.—Committee: T. A. Lawes, W. L. Gilmore, R. B. Redding, P. H. Peck, M. N. Forney.

Pistons and Piston Rod Fastenings.—With special reference to pistons of large diameter and light weight. Committee: R. H. Soule, W. H. Thomas, William Swanston, J. D. Barnett, S. Graham, Jr.

Riveted Joints.—To submit a set of proportions for riveted joints representing the most approved practice. Committee: A. E. Mitchell, S. Higgins, George W. West, H. D Gordon, L. R. Pomeroy.

Wear of Driving Wheel Tires as Affected by Weight on Same.—Committee: W. H. Lewis, J. N. Barr, E. M. Herr, J. H. McConnell, George F. Wilson.

Transmission of Power.—Report on relative merits of pneumatic and electric transmission of power in railway shops. Committee: T. B. Purves, Jr., John Medway, F. M. Twombley, C. E. Fuller, J. T. Gordon.

Notes on the Handling of Petroleum.

A paper read before the Institution of Civil Engineers in London deals with the transportation of crude petroleum in bulk, from the point of view of minimising the risks of fire and explosion, by Mr. Boverton Redwood. The subject was discussed in reference to transportation by tank steamships, but much of what was said applies with equal force to the transportation of this highly inflammable substance by tank cars. Experience has taught that the danger of explosion while handling petroleum lies not so much in directly igniting the oil as in igniting the inflammable and explosive mixtures of petroleum vapor and air.

The author of the paper alluded to stated that certain descriptions of petroleum evaporate freely at common temperatures; that the vapor given off is much heavier than air, and remain for a considerable length of time in any receptacle capable of holding a liquid, or may flow unperceived for some distance in a stream similar to that of a liquid: that the vapor is highly inflammable, and capable of carrying back flame to the source whence it emanates; and that mixtures of petroleum vapor and air may be either inflammable (burning silently) or more or less violently explosive. It was further shown that petroleum, at temperatures below that at which vapor is freely evolved, may be converted into a highly combustible spray. Crude petroleum consists of a great number of hydrocarbons some of which are exceedingly volatile, and the vapor given off may be from 2½ to 3½ times heavier than air, its density depending upon the chemical composition of the hydrocarbons present. From the vapor density the volume of vapor given may be calculated, and it was thus found that one volume of a petroleum spirit consisting principally of hexane, yielded 187 volumes of vapor at 60 deg. Fahr. The percentage volume of the vapor of a volatile hydrocarbon taken up by air depends upon the tension of the vapor, and varies with the temperature. When the vapor of petroleum is brought into contact with air, diffusion takes place, the heavy vapor traveling upward into the lighter air, and the air passing downward into the vapor.

Referring to the conditions under which an explosive mixture of petroleum vapor and air may be ignited it was stated that neither the glowing end of an ordinary wooden match or of a "fixed star" vesuvian, the flame of which has been extinguished, nor a red-hot coal which has ceased to blaze, nor a shower of sparks from a flint and steel or from the fireworks known as "scintellettes" and "golden rain," are capable of causing the combustion of the mixture; but a platinum wire raised to white heat by means of electricity invariably causes ignition, though at a red heat no such effect is produced. Either the electric spark, or a flame, at once causes the explosion of such a mixture, but an inflammable mixture containing a small proportion of vapor may be ignited by a large flame, when a small flame or an electric spark proves ineffective for the purpose. The use in an oil tank of a heated rivet at a temperture below that which is requisite for the ignition of a mixture of petroleum vapor and air may nevertheless be attended with danger, owing to the ignition of the oil which remains between the plates at the laps.

So long as the cargo tanks are full of oil there is very little risk of fire or explosion, except through serious structural damage resulting from collision or other accident. The accumulation of vapor due to leakage of oil from the tank domes of the oil tanks must, however, be guarded against, and care must be taken that these do not become overfilled or empty in consequence of increase or diminution in the volume of the oil.

Smoking and the use of matches about tanks filled with petroleum should be prohibited. The chief risk occurs during loading and discharging, and the precaution just named should then be zealously enforced. The tank covers should be kept closed as much as possible, and in the case of crude petroleum provision must be made for the safe discharge of vapor during loading. Before the tanks are entered for inspection they should be ventilated, and if repairs necessitating the use of hot rivets are to be effected the oil compartments and adjacent spaces should be thoroughly cleansed and efficiently ventilated by a steam jet or fan blower, until on testing by a competent expert the complete removal of inflammable vapor is found to be accomplished.

Personal.

Mr. F. H. Fechtig has been appointed Purchasing Agent of the Atlantic Coast Line, with office at Wilmington, N. C.

Mr. S. M. Rogers has been appointed purchasing agent of the Iowa Central, with headquarters at Marshalltown, Iowa.

Mr. T. H. Aldrich, General Manager, and P. K. Thomas, Superintendent of the Tennessee Coal and Iron Railway, have resigned.

Mr. R. T. Rundlett has been appointed General Manager of the Wiscasset & Quebec Railway, with headquarters at Wiscasset, Me.

Announcement is made of the death of Mr. Mordecai W. Jackson, founder of the Jackson & Woodin Manufacturing Co., of Berwick, Pa.

Mr. E. M. Reynolds has been appointed Purchasing Agent of the Lehigh & Hudson River Railway, with office at Warwick, N. Y.

On Aug. 16 M. Aldace F. Walker, of Chicago, was appointed receiver of the Atchison, Topeka & Santa Fe, to succeed Mr. J. W. Reinhart, resigned.

Mr. J. R. O'Brien, General Superintendent of the Iowa Central, has resigned to accept a similar position with the Oregon Railway & Navigation Company.

Mr. George W. Stimson, Purchasing Agent of the Cleveland, Cincinnati, Chicago & St. Louis road, has resigned the office and has been succeeded by Mr. A. M. Stimson.

Mr. Homer T. Dick, Purchasing Agent of the Ohio Southern, has become Superintendent of the road, and is succeeded by Mr. R. L. Barret, with office at Cleveland, O.

Mr. Charles W. Case, who became General Manager of the Great Northern Railroad last November, has resigned and has been succeeded in that office by Mr. Charles H. Warren.

Mr. Willard C. Tyler, the genial representative of *The Railway Review*, sailed on Aug. 6th for Scotland, to enjoy a brief vacation. He expects to return about the middle of September.

Mr. John McGee, Foreman of the Buffalo shops of the Western New York & Pennsylvania, has been appointed Master Mechanic of the shops at Olean, N. Y., to succeed Charles E. Turner.

Mr. G. W. Conklin, Master Mechanic of the Bradford Division of the New York, Lake Erie & Western, is appointed Superintendent of the Tonawanda Valley Railroad. He is succeeded by Mr. C. P. Weiss.

Mr. Frederick Swift, Receiver and Director of the Cleveland, Canton & Southern Railroad, has resigned both offices, and Judge Ricks has appointed General Superintendent J. W. Wardwell, Receiver.

Mr. C. H. Hudson has been appointed General Manager and Col. C. P. Minetree has been appointed Purchasing Agent of the Memphis & Charleston Railroad. Both officers have their headquarters at Washington, D. C.

Mr. M. A Gray, who has been Superintendent of the Georgia Midland & Gulf Railroad since it was opened for operation in 1887, has resigned, and that office is abolished, the duties being assumed by Mr. C. W. Chears, General Manager.

The Great Northern has been divided into three general divisions, and Mr. E. W. McKenna appointed General Superintendent Eastern Division, and Messrs. D. McLaren and J. D. Farrell appointed General Superintendents of the Montana and Western divisions respectively.

Mr. Charles E. Turner, Master Mechanic of the Western New York and Pennsylvania at Olean, N. Y., has been appointed Superintendent of Motive Power on the Buffalo, Rochester & Pittsburg, with headquarters in Rochester, N. Y., succeeding Mr. William T. Small, deceased.

Mr. W. R. Crumpton, who has been General Manager of the Baltimore & Lehigh Railroad since 1891, has resigned that position, the railroad being now operated by Mr. Alexander Brown, of Baltimore, as the representative of the bondholders' committee, which now controls the property.

Mr. James McGee, formerly Master Car Builder of the Houston & Texas Central Railroad, has recently been appointed Acting Superintendent of Motive Power and Machinery of that railroad. This is a new office created on Aug. 1, when the machine shops and car shops were consolidated into one department under the direction of a superintendent of motive power.

Mr. John Newell, President of the Lake Shore & Michigan Southern Railroad, was stricken with paralysis while in his car at Youngstown, O., on the night of Aug. 25, and died early the following morning, Aug. 26. Mr. Newell was born in 1830. He entered the railroad business in 1846, since which time he has been identified with many roads in different capacities. He was, by profession, a civil engineer, and he started on his railroad career at the bottom of the ladder. For one year and six months he was a rodman and then assistant engineer of the Central Vermont. From 1851 to 1863 he was engaged in engineering work on several roads and then for two years was President of the Cleveland & Toledo Railroad, now a part of the Lake Shore system. In 1868 and 1869 he was Superintendent of the New York Central & Hudson River. He went to the Illinois Central in 1869 as its Vice-President. Two years later he was elected to the presidency of the road, which he held until Sept. 11, 1874. In 1875 he became connected with the Lake Shore. He was General Manager until 1883, since which time he had been its president as well. Mr. Newell's home was in Chicago. His wife and several children survive him. One son, A. B. Newell, is Superintendent of the Western Division of the Lake Shore & Michigan Southern. Another is in the coal business in Cleveland. His eldest daughter is married to a son of the late ex-President James A. Garfield.

Cinderpits.

The American International Association of Railway Superintendents of Bridges and Buildings has appointed a committee to report on "Depressed Cinderpits and Other Kinds." The chairman of the committee that will investigate this subject is Mr. Walter G. Berg, Principal Assistant Engineer of the Lehigh Valley Railroad. The other members of the committee are: Messrs. Abel S. Markley, of the Pittsburgh & Western; George W. Andrews, of the Baltimore & Ohio, and R. M. Peck, of the Missouri Pacific. The committee has issued a circular containing the following questions :

What system for dumping and removing ashes from locomotives is in use on your road? Give general description and the location, whether in a main track, side track or special track.

If a pit is used, give depth, clear width and length, and describe in general the kind of foundation, materials in side wall and bottom of pit, coping, rail fastenings or supports, drainage, and the methods used to protect against heat.

If a conveyor system, elevated platform with dumping trestle, or other method is in use, describe same, giving principal dimensions, materials and details.

What is the arrangement, location and height of ash car track in relation to the pit or dumping track?

What kind of coal is used? Does the choice or dimensions of a cinderpit system depend to a certain extent on the kind of coal used, and if so, in what respect?

It is particularly desired to obtain the first cost of cinderpits or other systems for removing ashes; also the unit cost of operation (i. e., handling the ashes from pits to cars); and the outpit capacity of a pit or plant of given size.

We are especially desirous of obtaining blueprints of cinderpit systems in actual use on your railroad, with such remarks as you may feel willing to make on the efficiency of the design, the reasons for its adoption, and any possible improvements you might have to suggest or general views to offer on the subject of the best system to recommend under stated conditions.

Annual Report of the Chesapeake & Ohio.

The Chesapeake & Ohio Railroad Company has just issued its annual report for the year ending June 30. There was an increase in mileage of 28 miles, making the total mileage owned by the road 1,278. The gross earnings for the year were $9,044,108 ; operating expenses, $6,027,187 ; net earnings, $3,016,980 ; fixed and other charges, $3,002,920, leaving a surplus of $14,060. The falling off in gross earnings was $1,292,702, and in net, $187,069. The road is a heavy carrier of coal, iron and lumber, and there was a falling off in these three items of 610,951 tons, the largest decrease being in coal. The report says that the physical condition of the property has not only been maintained, but also improved during the year. The directors of the road are gratified at the results in the last year, and express great satisfaction at the ability of the company to earn its fixed charges in such unusual times as those through which it has passed.

Industrial Conditions in China.

The two occupations of China are, learning and agriculture. The standard of comfort for the laboring masses is fixed by that of the smallest cultivators, who form the largest section of the population. Poverty never involves actual starvation, except in times of famine. It means having to eat plain rice. The average man in China probably gets enough to eat, such as it is, in ordinary times. The farms are small, from half an acre to four and a half acres; the estimate is that one acre will support twelve persons in abundance. Wages are very low. A recent Chinese writer states that the average earnings of workmen are 20 cents a day, and that half of this is enough to support a family of five, after Chinese fashion. The new penal code fixes the value of labor impressed into the public service at 14 cents a day. But these are minimum rates. In cities carpenters and masons get 30 cents a day without food; servants, $6 a month without food; farmhands, $17.50 a year without food; clerks and accountants, $10 to $30 per month without food. A soldier's pay is $5 a month with board, but half of this is paid in rice. In some of the cities common laborers will work for 6 cents a day.

Advantages of Electrical Welding.

In an article on "Electric Welding and Metal Working" in the *Engineering Magazine*, Mr. Hermann Lemp mentions these advantages of electrical welding :

The heat is sharply localized to the joint and metal near it. The temperature obtained and required can be exactly regulated. The rapidity of heating and its distribution can be controlled by simple means. Irregular forms can be welded in the desired relation of its various parts. By this process all metals, as well as the alloys of all metals, are weldable. The welding operation is carried on under the direct inspection of the operator. The operation can be and often is made automatic, and the result is absolute uniformity; oxidized surfaces are excluded from the joint, and only clean metal unions made. Pieces can be welded to exact size, and finished pieces may retain their finish during welding. The process may be applied to pieces in place as in track-welding. Water power may be employed for the work or the cheapest fuels of lowest grade. The greatest convenience and cleanliness attends the practice of the process. The cost of fuel is not greater and generally less than in forge welding, while the labor is reduced one-half.

Perfection of Cabinet Work.

There has been a good deal of denunciation of Geo. M. Pullman in the daily newspapers for some time past, some of it certainly deserved and some of it undeserved. The man has been very much talked about, and among the things that have found their way into the newspapers is an interview with ex-Alderman Leonard Siebert, of Bloomington, Ill., who helped Mr. Pullman build the first sleeping car, way back in 1859. In concluding his interview Mr. Siebert said :

"I have never seen Pullman since I worked for him, but I want to say one thing. He raised the standard of woodwork and decoration on cars to such an extent that thousands of workmen have received a benefit. He early commenced to employ the best designers and draftsmen and turned out such fine cars that all the roads emulated his example. Thus, not only were his employees the gainers, but great benefit resulted to men in car shops all over the country, and great expense was put on the coaches. A result of this is seen in the shops here. Coaches formerly cost $2,000, where now, with improved machinery, they average $7,000. The idea of elevated roofs, elegant interior decoration and costly woodwork certainly originated with Mr. Pullman."

Every word of that is true. The cabinet-makers' art has found its best exponent in the Pullman sleeping cars, and in the style of the woodwork, the decoration and ornamentation the Pullman cars have been an educating force of considerable potentiality. The furniture manufacturer who has had goods thrown back on his hands because of drawn joints, split and warped panels, has been lost in admiration at the perfection of cabinet work shown in the Pullman cars. Despite the strains and extremes of temperature to which it is subjected, the woodwork of a Pullman car stands as it rarely stands elsewhere.—*Furniture News.*

Renewing Steel Rails.

Mr. W. E. McKenna, formerly Assistant General Superintendent of the Chicago, Milwaukee & St. Paul, and recently appointed General Superintendent on the Great Northern has recently been granted a patent for renewing old steel rails. The patent describes the process as consisting in heating the old rails to a temperature near to below the point at which the carbon contained therein would be affected, and simultaneously straightening and reducing the cross section equally in all directions except in height. The result is a rail of slightly less width, but of the same height and the same or greater length. A detailed analysis of the chemical and physical results obtained has been made under the direction of Messrs. J. N. Barr and George Gibbs, of the Milwaukee road, demonstrating that the chemical characteristics remain unchanged and the physical properties remain the same or are improved. The patent is said to be a fundamental one, and is of especial value in view of the practice of removing rails where the flowage of metal at the ends has become so great as to occasion uneven joints. The following figures are given as showing the relative values of so-called rails by each of the three different methods of disposal: As scrap, $10 per ton; by sawing off the ends. $14.43; by renewing as above, $19.71. It is claimed that 96 per cent. of the rail is restored to its usefulness by this process, while by sawing about 30 per cent. is lost. Tests of the invention have been made at the works of the East Chicago Iron and Steel Company, but it is proposed shortly to organize a company to carry on the work.—*Railway Age.*

The Cold Bend Test.

At the annual meeting of the American Association for the Advancement of Science, held in Brooklyn, N. Y., in August, Mr. Mansfield Merriman, in his vice-presidential address on "The Resistance of Materials Under Impact," made the following remarks :

During all this development of static testing one impact test has survived and everywhere held its own. This is the cold bend test for wrought iron and steel. In the rolling mill it is used to judge of the purity and quality of the muck bar ; in the steel mill it serves to classify and grade the material almost as well as chemical analysis can do, and in the purchase of shape iron it affords a quick and reliable method of estimating toughness, ductility, strength and resilience. It is true that numerical values of these qualities are not obtained, but the indications are so valuable that if all tests except one were to be abandoned, the simple cold bend test would probably be the one which the majority of engineers would desire to retain.

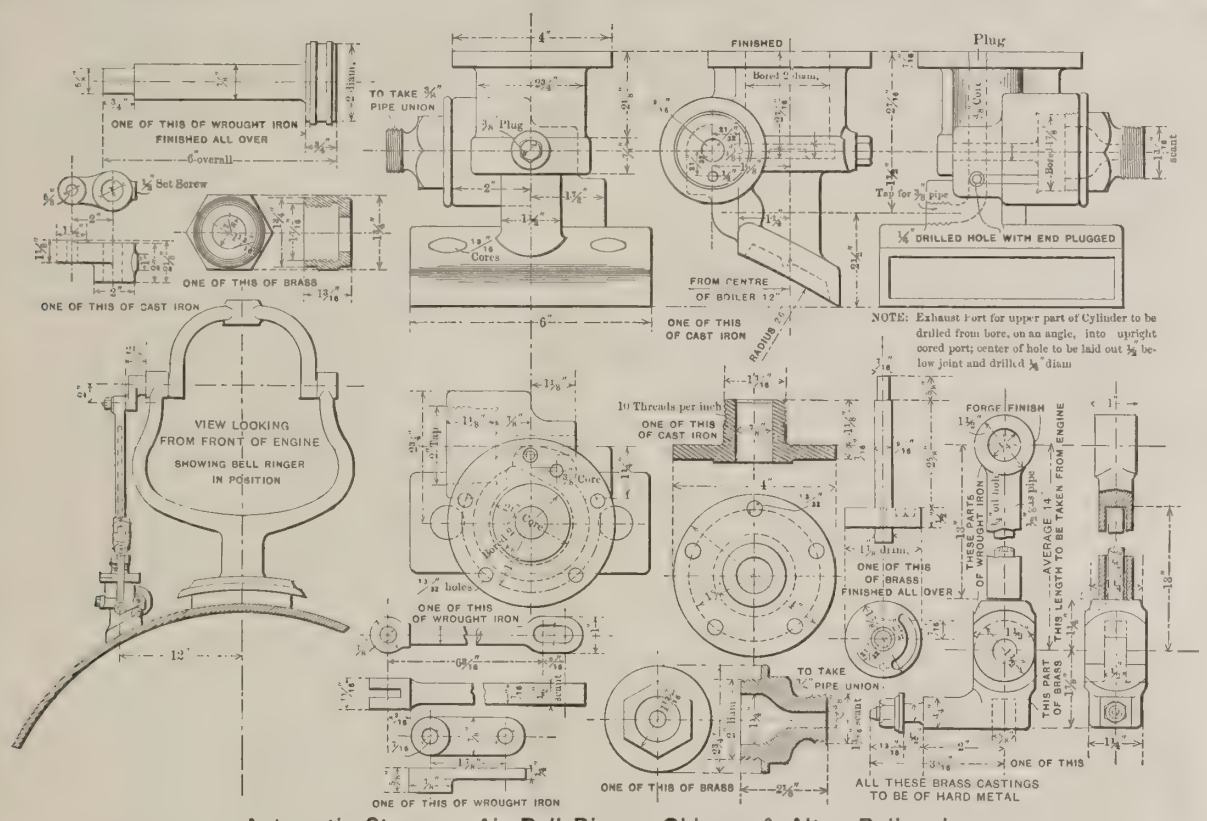
Chicago & Alton Railroad Automatic Bell Ringer.

The drawings which are reproduced on this page illustrate in detail the construction of an automatic bell ringer adopted as standard on the Chicago & Alton Railroad. It can be oparated by either air or steam, and was designed by Mr. Jacob Johann, the Superintendent of Machinery of the road. The drawings illustrate the construction so plainly that an extended description is unnecessary, but a few remarks may be pertinent respecting the attachment of the device to the boiler, and its method of operation.

The device is attached to the boiler shell on the right hand side of the engine by two ¾-inch studs, its center line coinciding with a vertical plane passing through the center of the bell frame.

The exact length of the telescoping rods connecting the piston with the crank on the end of the bell yoke journal is necessarily determined for the engine to which the bell ringer is attached, and is so adjusted that when the piston is at the bottom of the cylinder the bell will swing perfectly free, the two parts of the connecting rod lacking about $\frac{1}{32}$ inch of being closed solidly together when the bell is at the lowest point.

The air for working the device is carried in a ⅜ inch pipe from the main reservoir, through the cab, where at some convenient point a valve is located controlling the supply of air. The forward end of this supply pipe is attached to the bell-ringer by a ⅜-inch union, in which is placed a "choke" with a hole only $\frac{1}{32}$-inch full in diameter, to regulate the supply of air. At a convenient point on the supply pipe a small oil cup is placed, which is made with a close fitting cap; and a cock is placed between the oil receptacle and the pipe, which can be closed while the cup is being filled. The exhaust pipe is carried under the jacket to the smoke arch.



Automatic Steam or Air Bell Ringer, Chicago & Alton Railroad.

To put the bell ringer in operation it is only necessary to turn on the air, when the bell will at once commence ringing unless it happens to be standing upon the center, in which case it can be started by a slight pull at the bell rope, which should be left attached as usual to an arm on the left hand side of the bell yoke. To stop the bell when ringing, it is caught at the center of its travel by the bell rope. When stopped in this position, it will remain at rest without shutting off the air pressure, and will be already to go to work again at once whenever thrown off the center by a single pull on the bell rope.

This device is not patented; and Mr. Johann informs us that those who wish to adopt a similar arrangement are at liberty to do so.

Distressed Young Mother (traveling with a crying infant)—Dear me! I don't know what to do with this baby.

Kind and Thoughtful Bachelor (in the next seat)—Shall I open the window for you, madam?

Receiver Trumbull, of the Denver & Gulf road, has asked permission of the United States Court to abrogate the trackage contract with the Rio Grande between Pueblo and Trinidad, which requires the payment of $180,000 per annum. Permission is asked to make a new contract with another company at $70,000 a year.

Pneumatic roller skates have been recently invented. It is claimed that these skates will to a great extent supersede the bicycle, 10 or 12 miles per hour being readily made with them on fair roads, and hills may be mounted or descended with as little exertion as attends the riding of the cycle. The weight of a pair of these skates is only 2¾ pounds, and the diameter of the wheels, including tires, 7½ inches. They are equipped with ball bearings, as well as the pneumatic tires.

Felling California Giant Trees.

One of the most remarkable timber belts in the world stands in Humboldt and Mendocino counties, California. It embraces 4,125 square miles, containing 132,000,000,000 feet of timber. With the aid of the microscope scientists have found the age of some of these trees to be nearly 3,000 years. Some of the fallen trees have remained where they fell for 800 to 1,000 years.so it is estimated, with scarcely any deterioration of the wood. Eastern tourists in California know little of these redwoods (Sequoia sempervirens). They usually see the few mammoth redwoods of Calaveras Sequoia gigantea), and go home and tell Eastern friends about this disappearing tribe of giants. The lumber redwoods of Humboldt are less talked about, yet one of its trees will yield over 100,000 feet of boards and fill a freight train with logs. Felling these trees, which are 150 to 250 feet high, is a fine art, acquired only by the most expert chopper. This man must have excellent judgment as to the lean of the tree and its other peculiarities which may affect the direction of its fall. He drives a stake 100 or 150 feet from the base of the tree and prepares a level bed in direct line from base to stake. On that line the tree must fall. An ax kerf or cut is then made in the trunk on the side the tree is to fall. The apex of the obtuse triangle made by this kerf points exactly at the distant stake. The tree is cut one-third through with the axe.

On the other side of the tree, opposite the ax kerf, a saw kerf is started. This is done by boring two holes horizontally and driving in wooden pins on which the 12 to 20 foot saw rests until the kerf is sufficiently deep to steady the saw. Broad, thin iron wedges are driven in after the saw to prevent the doomed tree from pinching it. At each end of this saw "ears" are bolted on, which can be removed and the saw withdrawn in case of trouble. Wedges are made to follow the saw until the wood dividing the saw kerf from the ax kerf is narrowed to a width where wedges can be made to force the tree, with all of its great weight, to lean in the direction it is to fall. The tree is toppled over, and so exact are the chopper's work and calculation that almost invariably the falling trunk drives the stake aimed at when operations were begun. Any error in the fall of the tree is likely to cause the tree to break and cost the lumberman more than the chopper's wages for a month—$125. These virgin forests are so densely timbered that, if cleared at once, there would not be room enough on the ground for the tree-trunks. "Peelers" follow the choppers. With long steel bars, flattened on one end, they pry off the thick bark and burn it. Then comes the crosscut saw man, who cuts the tree into logs. These are transported to the mills by rail, cut into boards, and shipped to market. Redwood is so free from resinous matter that it will not burn easily, and when fired it chars. The immunity from fire of towns built of redwood lumber is remarkable. Large conflagrations are unknown. This lumber shrinks so little it is used by builders in a green state. The beauty of the wood for finishing consists in its curly face and also a bird's-eye grain. One tree measured over 20 ft. in diameter and accommodated 20 men seated in the ax kerf.

The furnaces of the Valentine Iron Company, of Bellefonte, Pa., were fired up Aug. 27, after having been suspended since the coke strike. The employés will probably be kept busy all winter.

Dusty Rhodes—I'm losin, my grip.

Fitz William—What's the matter?

Dusty Rhodes—The last time I was here I put a cross on that gate, and now I can't recollect whether it stood for "10 cents" or "saw-buck."

The Power of the "Tip."

Mr. J. E. Defebaugh, editor of the *Timberman*, writing of his recent experiences in European railroad travel, says:

The passenger desiring privacy can easily secure a compartment to himself by judiciously tipping the guard, provided, of course, the train is not crowded. The way this is effected is simple. You tip the guard and he locks the door, and there you are. The same is true as to travel in France and Germany—the "tip" is universally understood, and however small, is acceptable. The "tip" will also unravel any mystery, however great. It is the "fad" among the European guards, conductors or brakemen to appear innocent or ignorant of what may be asked them in English, but their movements are accelerated and their understandings brightened by the equivalent of a few pennies.

I lost my baggage check—a bit of tissue paper *en route* London to Paris. I had nothing to show for my trunks. My knowledge of French was very limited, but I concluded to tackle the custom house in the English tongue and jingle some coin before their eyes in order to facilitate their movements. I had no sooner made it manifest that I had a few French coins to place at their disposal than a whispered conversation resulted in the conclusion that I was what I said I was and ought to have a change of linen from my "luggage." A small fee to each of the custom house officials and another to the *concierge* who put the trunks on a carriage for me, relieved my mind of embarrassment and again put me in possession of my property.

I tried the "tip" successfully on another occasion. Arriving at the depot at Frankfort by train at 10:40 P. M., and expecting to depart at 11:00, I at once sought sleeping car accommodations for my journey to Berlin. All the berths were sold, they said, but I entered the car all the same. I shied a few franc pieces at the "porter"; he smiled and chuckled and pointed me to an upper berth, at the same time gesticulating wildly, as much as to say, "You had better get in before the other fellow comes." I disrobed and climbed the ladder. Presently a Copenhagen physician, whose practical knowledge of English appeared to be limited to six words, but who presently demonstrated that he could snore in a number of languages, came in, turned the latch of our apartment, and proceeded to take possession of the lower berth. I expected soon to hear some one come to claim my berth, and I had not long to wait; but the door was locked, and the porter, who also served as conductor, fought my battle for me, and laid the other fellow out—on a blanket in the aisle—and then retreated victorously to recount his money. But my conscience refused to be quieted, and I lay awake all night, contemplating the punishment of the wicked, and listening to the idiot beneath me snoring his life away.

The Origin and Mode of Coal Formation.

The proceedings of the Institution of Civil Engineers for 1894 contains an abstract of an article on the origin of coal formation, by Adolphe Firket, published in the *Revue Universelle des Mines et de la Métallurgie*. The following is a translated abstract:

The vegetable origin of coal is indisputable and hardly contested. The substance is generally considered to have resulted from the accumulation of earthy plants or their debris. In some exceptional cases, marine algæ may have contributed to its formation; while in certain bog-head minerals and cannel coals, the origin of which is more obscure than that of ordinary coal, animal remains are associated with the vegetable matter that constitutes the greater part of the mass. Scientists are, however, by no means in accord as to the way in which the accumulation of the plants or their debris took place, some holding that the coal was formed *in situ*, others that it has resulted from the accumulation of drift; and, again, there are geologists who, while considering one of these two modes of formation as preponderant, attribute a slight influence to the other.

The author states and examines ancient and recent theories on this subject, more particularly those of the leading French authorities of the day, and indicates his preference for that of Mr. C. Grand' Eury, in spite of the vagueness which characterizes it, more particularly in respect of the bands that separate the seams of coal. Briefly stated, this theory is that coal is a sedimentary formation resulting from the slow and undisturbed deposition, by the agency of water, of bark, leaves and tegumental matter, together with the semi-liquid ulmic products of vegetable decomposition, these being accompanied by particles or debris of plants. At the coal epoch, vast shallow basins filled with fresh water existed, at the bottom of which plants could root themselves while their stems emerged. These plants were adapted for wet localities and could live even with their stems immersed in water several yards in depth. Even calamites could become fully developed under water. Upright trunks, rooted stumps and the stigmaria of the walls now represent them. The other parts of these plants *in situ*, as also the floating stigmaria of certain regions, have furnished only an insignificant proportion of the vegetable matter from which coal has been derived. This matter had its origin in swampy forests situated outside the areas of deposition. Under the constant influence of a high temperature, comparable with that of the torrid zone, and the action of excessive moisture and strong light, the growth of the coal plants was extremely rapid, as is indicated by the loose texture of the stems, the strength of which lies in the bark. These plants, being largely propagated by rhizomes, spread with very great rapidity. But their collapse and death were equally rapid, the circumstances that favored their growth promoting also their decomposition. The stems fell on ground more or less covered with water, and their interior parts generally underwent great alteration, which the bark and certain leaves resisted up to a certain point. The rain waters swept the debris into marshes, in which, before reaching the basins wherein it was finally deposited, it underwent in the water a maceration with the formation of ulmic products and a vegetable pulp containing, in suspension, bark, fragments of leaves and other vegetable matter, that is still distinguishable because it has undergone less serious alteration than the other portions of the plants. This theory, propounded by Mr. Grand' Eury in the year 1882, was slightly modified by him in 1887 and again in 1890, the deposition of coal at the bottom of great marshy lakes being admitted, without having recourse to the intermediary of marshes between the swampy coal forests and the basins in which the mineral was deposited. The author of the article agrees in the main with these views.

Communications.

Advancement of Knowledge of Train Braking.

Editor National Car and Locomotive Builder:

In looking over the book recently printed by the Westinghouse Air Brake Company, on the effects of brakes on railway trains, by Capt. Douglas Galton, I find an item which I think is very interesting. In the discussion before the Society of Mechanical Engineers, Mr. Haswell said that the results obtained were certainly somewhat surprising after the deductions drawn by the Royal Commission on Railway Accidents, to the effect that when wheels were skidded they retarded the force of the train more than when revolving. Captain Galton's experiments show the opposite, and that view of the case has been generally accepted ever since.

The point I would make is that the opinions of engineers however learned or eminent, on a number of questions relating to railway engineering, may be subject to a considerable modification when the data are obtained from careful experiments instead of being deduced from theoretical considerations only. As another case in point, the knowledge of the friction of different kinds of metals for brakeshoes is still very uncertain, and it is gratifying to know that we are about to obtain some certain knowledge of the subject from the elaborate experimental machinery which has been prepared by the Westinghouse company for the M. C. B. Association. The subject of simple and compound locomotives, both working under low and high pressure, will, we trust, soon be investigated on the plant at Purdue, and instead of the conflicting opinions and uncertain knowledge of the subject we hope that the systematic and accurate experiments to be made there will give us some valuable data, the accuracy of which cannot be questioned.

We appear to have reached a stage in railroad engineering where important questions of this kind are to be made subject to extensive and elaborate experimentation. It only seems strange now that work of this kind, commenced as long ago as 1878, should not have been followed up and extended to include other uncertain questions.

WM. FORSYTH.

Argentine Railroads.

Editor National Car and Locomotive Builder:

The following table shows the extent of railroads in operation in the Argentine Republic: Speaking in general, the financial situation of railroads of the Argentine is not prosperous, owing to the crisis in which the country finds itself at present. However, it will be noted by the mentioned list that many of them have a guarantee of 7 per cent. Until lately the possessors of titles of the guaranteed railroads were most alarmed on account of the Argentine government having suspended payment of the guarantee, owing to the state of finance. This state of affairs has now been definitely settled, and the government assures the payments due to guaranteed railroads every three months the sum of $3,000,000 (gold) until full payment of the total guarantees is covered, which amount is $14,000,000 (gold). The railroads which find themselves in a more prosperous condition are those established in the province of Buenos Ayres, and which produce, by the mile and weekly, the following sum:

	£	s.	d.
Railroad of the West	38	8	5
Railroad of the South	17	4	5
Railroad of Eurenada	38	6	3
		15	0
Railroad of Central Argentina	21	10	3
Railroad of Rosario	17	6	2

Of these lines of railroads those which have produced the best dividends are those of the Western Railroad, and which belonged formerly to the State of Buenos Ayres.

RAILROADS IN OPERATION IN THE ARGENTINE REPUBLIC.

Name of Railway.	Gauge of track.	Miles.	Total.	
Western of Buenos Ayres	5′ 6″	403		
Southern	"	1,398		
Ensenada	"	118		
Central Argentine	"	762		
Buenos Ayres & Rosario	"	909		
Western Santafecino	"	128		
Buenos Ayres & Pacific	"	*426		
Andian	"	Gov. 157		
Great Western Argentine	"	*319		
Villa Maria to Rufino	"	*130		
Bahia-Blanca Northwestern	"	*128		
Southern Santa Fé & Cordoba	"	195		
			Track 5′ 6″	5,073
Central Entre-Riano	4′ 8½″	*379		
Northeastern Argentine	"	*167		
Eastern Argentine	"	*99		
Primer Entre-Riano	"	*6		
Rural Steam Tramway	"	108		
			Track 4′ 8½″	759
Trasandian	3′ 3½″	*115		
Central Cordoba	"	*677		
Cordoba & Rosario	"	*180		
Cordoba Northwestern	"	* 94		
Dean Funes & Chilecito	"	Gov. 175		
Chumbicha to Catamarca	"	" 15		
Central Northern	"	" 247		
		1,533		5,832
	3′ 3½″	1,533		
Northwestern Argentine	"	94		
Santa Fé	"	*650		
San Cristobal to Tucuman	"	*235		
Ocampo to Paraná	"	21		
Florencia	"	14		
Central Chubut	"	*45		
				2,592
Cordoba to Malagueno	23½″	16		16
Total miles				8,440

NOTE.—The roads marked "Gov." do not belong to the Federal Government, but to the state or province in which they are located.

The roads marked * have a government guarantee of 7 per cent.

The Ferro Carril del Oeste (Railroad of the West) has recently completed the extension of its line from Bragado to Lincoln (65 miles), and is now constructing from Lincoln another line reaching Prido, distance 20 miles. There has been employed for this construction the remainder of the capital raised for the former. This same enterprise will give rise very soon to the building of the Central Depot in Buenos Ayres, the cost of which, estimated, is to be about $80,000 in gold.

The Argentine Central has just completed the construction of the Victoria line to San Tutonio (56 miles), making, with the direct line to Buenos Ayres and Cordoba 358 miles. With this new line there will be two which will benefit Rosario and Cordoba, and will also naturally benefit the public generally.

The Ferro Carril Sud (Southern Railroad) has just presented the plans of the new line to be constructed between Lobos and the 25th of May, 7·5 miles. As soon as they are appoved of, the works will be commenced.

Messrs. H. K. Porter & Company have provided the Rural Steam Tramway (108 miles) with small locomotives. This property belonging to Señor Tederico Larroze. The first six locomotives were constructed by Messrs. Porter & Company in 1889, and the last four this year. The result which they have obtained in the operation of this line has been very satisfactory indeed, and maintained the superior reputation of American rolling material in the Argentine. The average distance run by the locomotives each month has been 2.791 miles, consuming eight pounds of coal for each train mile. For freight trains, there has been consumed ten pounds for each train mile in a train of 24 wagons (of the works of Brillo & Company), the weight of which is about 108 tons. The line is not dangerous, but for such small locomotives there are some steep grades to pass. These locomotives have cylinders of 9 by 16 inches, with four coupled driving wheels, 36 inches in diameter. The entire weight of the engine in service is 32,000 pounds.

Wagons for Transportation of Cattle.—Owing to the importance of cattle transportation, which has taken great hold in the country, the Rural Society has asked the government to order the railroad companies to modify their cars in accordance with the requirements of this class of transportation, for this is made daily more difficult on account of defects in the cars used, which causes a considerable loss to cattle breeders. The principal cause is that the cars are not suitable for cattle, and thus causes them much suffering, and they arrive sometimes in the market, or ports, in such bad condition that their value has gone down 50 per cent. There have been offered many modifications for these cars, but none have been accepted. Mr. F. W. Barrow, General Manager of the Southern Railroad, who has gone to England, will pass over to North America to study up this point. JUAN J. ELORIDA.

LA PLATA, Argentine, June 30, 1894.

Traveling Engineers' Convention.

The second annual convention of the Traveling Engineers' Association will be held at Denver, Col., commencing Sept. 11. The Committee of Arrangements has issued the following circular relative to the place of meeting and the arrangements made for the sleeping car accommodations of the members attending:

Our headquarters will be at the Albany Hotel, corner of Seventeenth and Stout streets. Rates, $2 per day (American plan). All trains arrive at Union Depot, foot of Seventeenth street. Cable cars opposite depot pass the Albany Hotel entrance. Members desiring to stop at headquarters should engage their rooms in advance. The meetings of the convention will be held at the Elks Hall, 1515 Lawrence street. The general managers of all the principal railroads in the country were very thoroughly canvassed last year, and we do not think there will be any trouble about securing transportation for members and their families desiring to go to the convention if asked for in the usual manner. The Pullman and Wagner palace car companies will make a one-half rate to members and their families to and from the convention. When traveling in Pullman or Wagner cars please note the following: If traveling in a Pullman car buy a ticket to Denver, take a receipt from the agent that you purchased ticket of, and when you arrive at Denver, take your receipt together with your credentials to the District Superintendent located there, and you will receive a free pass for the return trip. If you travel in Wagner cars, buy your tickets both ways, taking a receipt for the same each way. Upon your return home, enclose your receipts together with your credentials to J. A. Spoor, General Manager Wagner Palace Car Company, 625 to 629 The Temple, Chicago, Ill., and one-half the money paid by you will be refunded. The Wagner cars are treated as Pullmans west of Council Bluffs, which feature please look out for, and take separate receipts to Council Bluffs and beyond. The credentials necessary for members to have to secure the reduced rates in sleeping cars, hotel, etc., is their membership certificates reading good until Sept. 1, 1894.

The following is a list of the subjects that will be reported on to the convention by committees:

"The true and false economy in caring for and the safe handling of the airbrake under all conditions; and when examining a fireman for promotion how much knowledge of the airbrake it is necessary for him to have to be considered fully competent to take a train out on the road?" Committee: R. D. Davis, T. A. Hedendahl, C. E. Weaver, C. F. Schraag, L. S. Putnam.

"What are the best means of saving coal and increasing or holding the mileage per ton at a desirable figure?" Committee: M. Mast, W. E. Chapman, J. W. Sheldon, Geo. H. Brown, P. A. Rossiter.

"Testing coal in actual service; what are the easiest and most accurate methods?" (Continued from last meeting.) Committee: J. M. Hutchison, W. J. Anthony, C. E. Shearwood, S. W. Simonds, M. J. Reams.

"What relation does a clean engine bear to the economical use of supplies?" Committee: J. W. Hall, J. B. Johnson, Chas. H. Hogan, C. W. Poole, P. E. Riley.

"How can traveling engineers improve the service when engines are double crewed or pooled?" (Continued from last meeting.) Committee: W. T. Simpson, P. Fraser, Wm. Conger, C. M. Brinsley, J. W. Mulford.

"On a uniform form of examination for firemen for promotion, and new men for employment." Committee: M. M. Meehan, J. E. Goodman, J. A. Hill, W. J. Anthony, J. W. Sheldon, W. T. Hamar.

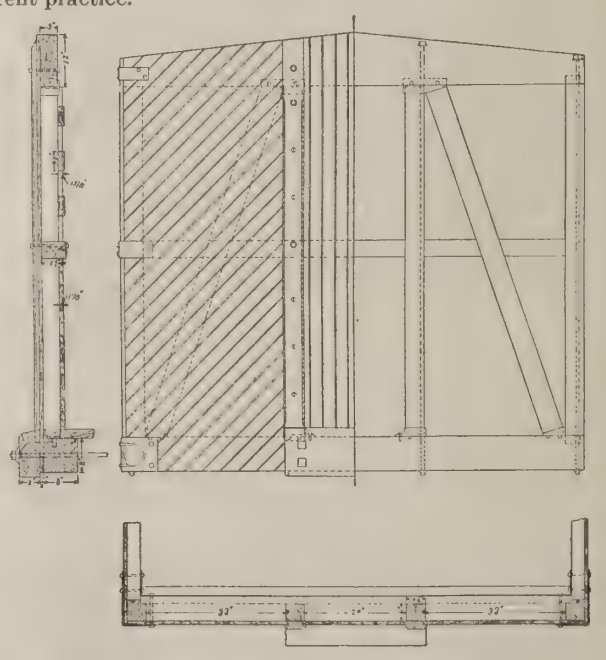
Improved End Construction of Box Cars.

The Southern and Southwestern Railway Club has undertaken the investigation of the causes for the bulging out of the ends of box cars. The report of a committee on the subject shows that the cars on grain and lumber hauling roads suffer the most in this respect, the damage being caused by the shifting of the lading. The end framing is declared to be weak and insufficient. Expatiating on this point the report says:

Freight cars have been strengthened and increased in capacity, by slow degrees, from 10 or 15 tons to 25 and 30 tons. The end framing has not been increased in proportion with other portions of the cars, it being too light altogether. There is not enough wood properly distributed to give much reinforcement to the end thrust of the load produced by the severe usage and service the cars are put to. It is evident that the end frames are exposed to much greater shocks and strains than the sides, and yet the end timbers are generally lighter. The usual practice in intermediate end posts and braces is to make them from 2 to 2½ inches thick, which is entirely inadequate to resist the thrusts of shifting loads.

In constructing the end framing the only apparent object seems to have been to truss the end sill, support the roof and prevent distortion of the superstructure. We find the most frequent practice of framing the end is with tenon and mortice; there is a tendency, caused by the working of the frame, to reduce the tenon and increase the mortice, causing instability. Water and moisture enter the mortices and rot the sills and tenons, and besides we consider the tenon insufficient to resist the pressure against the car ends. Where the body truss rods are placed near the lower edge of the end sills, the strains produced by the rods and the buffing of the drawbars on the deadwoods cause the sill to cant, which necessarily distorts the ends and is severe on the mortice and tenon. End girths are so notched and reduced that they give little if any strength to the posts or braces to resist end thrusts.

A number of drawings accompanied the report showing the common forms of box car end construction. The weaknesses of these were pointed out, and the following drawing was submitted as a proposed improvement on current practice.



PROPOSED CONSTRUCTION OF BOX CAR ENDS.

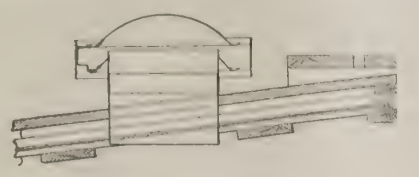
Referring to the construction illustrated, the middle end posts are 4 inches by 4½ inches. The belt strip is composed of 4-inch by 3⅝-inch stuff rabbeted to insert the short leg of a 2-inch by 4-inch T iron. This belt strip is fastened to the side belt rail, with angles inside and outside of the car. In the corners, at the intersection of the side and end plate, there is a cast or malleable knee (with a rib in the center) on the inside, and a wrought angle on the outside, taking the same bolts. The posts and braces rest on cast or malleable iron pockets, with shoes on the top and with flange 1½ inches high projecting above the bottom of the end plate on the inside. Strips 1½ inches by 4 inches are bolted on the inside of the corner and intermediate posts with ½-inch bolts or lag screws. The end framing is further reinforced by heavy pieces bolted and screwed to the outside of the middle posts and rabbeted to receive the sheathing, which is applied diagonally, to better brace and support the car framing. The deadwoods are extended above the top of the end sill, to better prevent the end post giving away at the end sill.

"Get off the earth, will ye?" shouted the rude urchin whose path had been obstructed by a kind-looking but queerly clad gentleman. He did not get angry. On the contrary he looked pleased. "Sech," he said, "is fame. Sonny, I'm kinder surprised thet ye knowed me, but it's ter yer credit thet ye keep up with whut's going on. It'll probably please ye ter know I'm expectin' ter git off the earth in about three more days—jes' ez soon ez I kin get one little improvement in my flyin' machine."

Standard Fruit Car, C., N. O. & T. P. Railway.

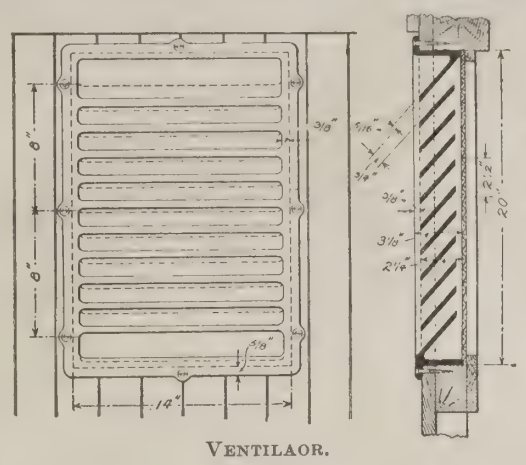
The accompanying engravings illustrate the general construction and some matters of detail of the standard fruit car of the Cincinnati, New Orleans & Texas Pacific Railway. The fruit traffic on this road has become of such importance that the best obtainable facilities for transportation are demanded, and it is believed by the officers of the road that in the construction of this car these are obtained. The car illustrated was built by the Elliott Car Company, of Gadsden, Ala., and was exhibited at the Columbian Exposition. Its capacity is 60,000 pounds. The length over the end sills is 34 feet, and the width over the side sills is 8 feet 6 inches. The side and intermediate sills are of Georgia pine, the side and center sills being 5 inches by 8 inches and the intermediate sills being 4 inches by 8 inches in section. The needle beams, body bolsters and draft sills are of oak. The needle beams are 14 inches by 5 inches, with the sills let in 1 inch at the top. The bolsters are 14 inches by 7 inches, and are stiffened by the strap and rod truss commonly used with this form of bolster, passing over the center sills and diagonally downward through the intermediate sills. The draft sills are 9½ inches by 5⅝ inches, and are securely bolted and keyed to the center sills, and butt against the bolsters. The longitudinal sills are reinforced by four truss rods 1⅛ inches in diameter, the outer rods lying just inside the side sills and the inner rods just outside the center sills, and passing through end sills, deadwoods and deadblocks. Upon the bolsters and between the sills are wooden blocks or spaces 4¼ inches in depth, over which are carried the truss rods, the rods resting on suitable cast iron blocks.

inch holes at intervals of about 10 inches. This permits of a circulation of air beneath the cargo, and the floor, being laid in sections and removable, can be taken out at any

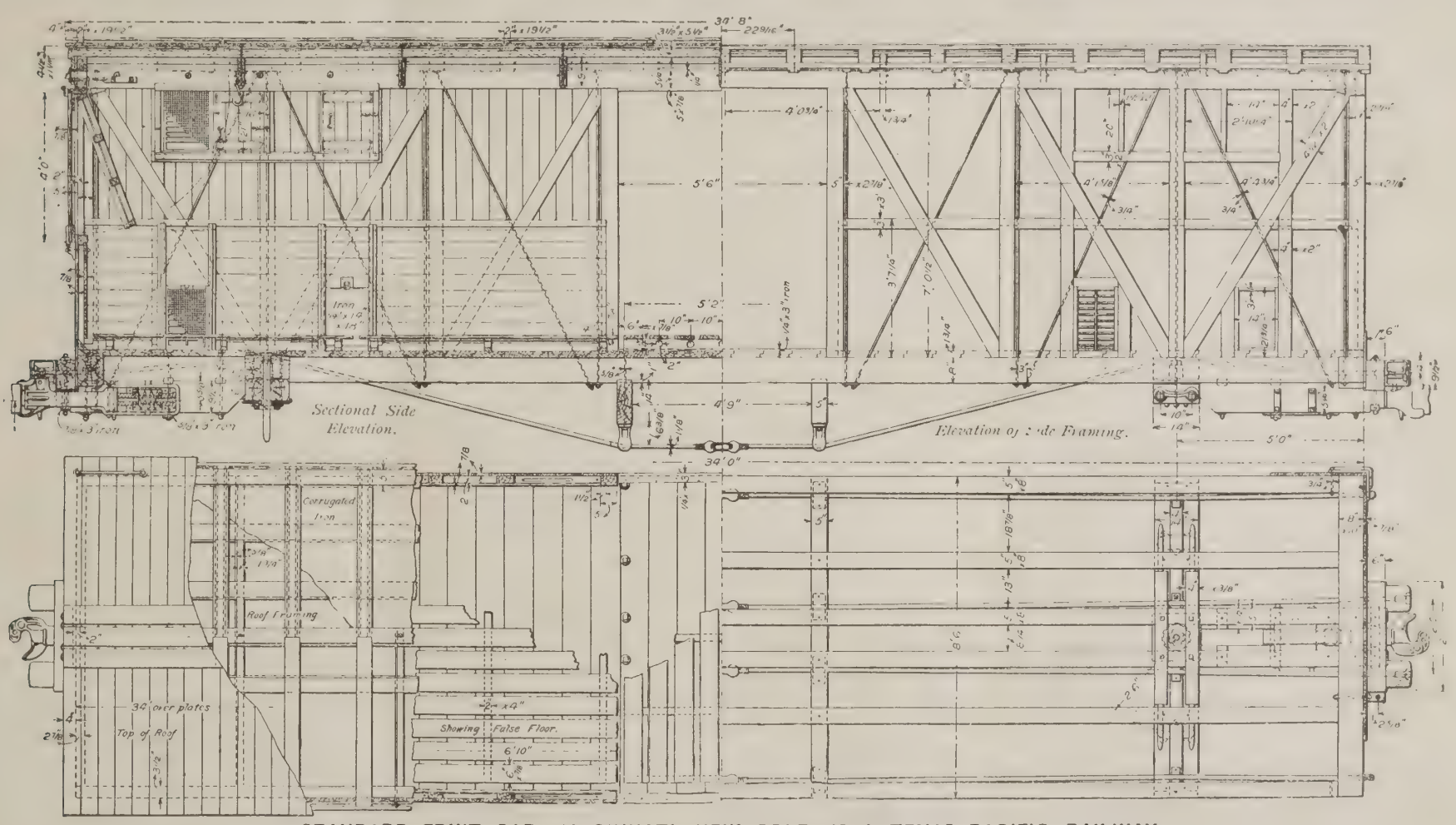


ROOF VENTILATOR.

time, if desired. The framing of the superstructure is somewhat lighter than common, the door and corner posts being 5 by 2⅞ inches in section, the remaining posts 4 by

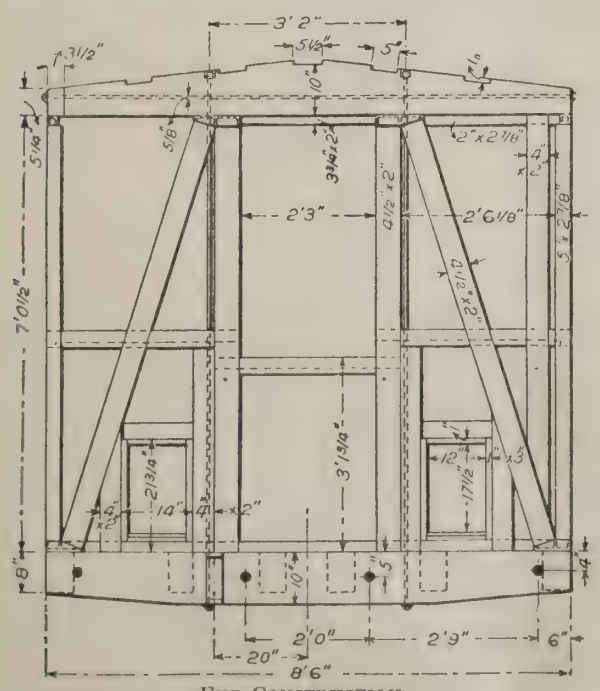


VENTILAOR.



STANDARD FRUIT CAR, CINCINNATI, NEW ORLEANS & TEXAS PACIFIC RAILWAY.

Yellow pine enters largely into the construction of the car, as the floor, side and end framing, and roof framing, and in fact all of the superstructure is of this material.



END CONSTRUCTION.

The flooring boards are 1⅞ inches thick and upon these rests a sectional false floor of 6⅞ by 1-inch boards laid upon 2 by 4-inch pieces placed on edge, in which are bored 2-2 inches, and the braces 4½ by 2 inches in section. The carlines and end plates are turned into the side plates and the plates drawn together by ⅝-inch transverse tie rods. There is a space of 2 inches between the sheathing and siding. The diagonal tie rods are of ¾-inch iron and the vertical tie rods of ⅝-inch diameter, both having taper heads which rest upon wrought iron washers set into the top of the plate their full depth. Cast iron washers are used on the lower ends. The side and end doors are of the usual grated form, the end doors opening inward, as shown in the general arrangement drawings. The car is mounted on two 4-wheel trucks, and is equipped with the Westing-tinghouse quick-action automatic brake.

Difference of Cost of Car Repairs in Eastern and Western States.

The following remarks, made at the last M. C. B. convention, in reference to the difference of cost of repairs in the Eastern and Western States, are worth being rescued from oblivion; so we republish them herewith.

The following proposition was made by Mr. J. H. McConnell, during the discussion of the rules of interchange:

In view of the fact that west of the Missouri River the price of labor and material is largely in excess of that paid for work and material in the Eastern States, the north and western part of the United States in making repairs to cars under the present M. C. B. prices do so at a loss. I would recommend Rule 26 be amended to read: "An additional price of 10 per cent. be allowed to M. C. B. price list for all labor and material furnished by railroads in the States of Kansas, Colorado, New Mexico, Texas, Arizona, Nevada, California, Oregon, Washington, Montana, Idaho, Utah, Wyoming and Nebraska."

West of the Missouri River we pay 25 per cent. additional price for labor beyond what you pay east of the Missouri River. We also pay a larger proportion for the material. Our car repairers are paid $2.25, carpenters $2.75 and $3. We are doing work out there at a loss. We do not ask for charity; all we ask for is justice, and what we want is to be placed on an equal footing with the people of the east. The people east are doing the work under the M. C. B. rules at a profit. We are doing it at a loss. We want to be paid and get cost for it. We are paying $8.75 for a wheel at Omaha and $11.75 at Portland. The Rio Grande road pays more for wheels than we do; the Southern Pacific pays more than we do. We pay $1.60 per 100 pounds for castings, and we use 13,000,000 pounds a year. At other places in the West the price runs from $1.75 to $2.25. The M. C. B. prices allow us to charge only $1.60 a hundred. We are furnishing material at less than it costs. Our axles cost $10.75, and we are obliged to furnish them at less than they cost. The Rio Grande, Southern Pacific, Northern Pacific and the roads in Texas are in the same situation as we are. Our bills against the foreign roads are more than the bills of the foreign roads against us. I think it is right and just that we should be compensated for the work we do. I understand in this section you can buy a wheel for four dollars and a half or five dollars. We cannot afford to run a wheel of that kind over our road, with the steep grades. We require a first class wheel and have got to pay for it.

Mr. Chamberlain: It seems to me the last speaker is asking for an advantage which none of us has. The object of placing these prices is that there will be no particular advantage in the different sections of the country. The prices are made so that no money will be made in the repairs of foreign cars after you have summed up the total for a year. We may be in a hole one month, but we will square ourselves the next month. If their work costs 25 per cent. more, every piece of work we do for them they are getting the benefit of 25 per cent. It seems to me the things balance. If they are repairing Lake Shore cars, the Lake Shore is repairing their cars, and they are doing it much cheaper than they could do it on their own premises. I think the rules are about right. I ought to be just as much relieved, owing to the duties on materials going into Canada.

Mr. Leeds: We pay mileage for the use of foreign cars; that is about the equivalent of the maintenance of our cars. We get mileage to compensate us for the use of cars while they are on other roads and a slight revenue. Do these gentlemen propose to pay us for the extra expense that we go to to maintain cars while on their road? If not, then I do not think there is any reason why they should ask us to send cars to them at a loss to ourselves.

Mr. Barr: If the M. C. B. prices are, as Mr. Chamberlain says, such that he does not make any money on foreign cars repaired, the conditions are all right; but the fact is, we all make a little something on the foreign cars we repair. There is no use in saying we do not. At points west of the Missouri River they lose a little money. I do not know but that it would be perfectly fair, as we intend to embrace this whole country in our arrangements, to allow them a 10 per cent. increase on the prices. We will make it on the foreign cars we repair.

Mr. Marden: With the prices that Mr. McConnell has mentioned I do not think he is any worse off than are the roads in the far east. If we want to get castings at $1.50 we have to send to Buffalo; our foundries in the east charge 2 and 2¼ cents a pound. In the majority of cases we are losing on the prices we have in the far east. As to prices for labor, our men run from $1.75 to $2.25—our limit is intended to be $2. I think the prices as we have them are equable for all of us.

Mr. McConnell: Our great trouble is in the matter of labor; we pay 25 per cent. more west of the Missouri River than east of the river.

Mr. West: Is it not true that their rates are also higher, both on passenger and freight? It would not do to make this distinction in favor of any one section: other sections would desire the same thing.

Mr. Marshall: If we start in to try to make varying prices for different sections of the country, we will have to make special concessions for a good many more places than the lines west of the Missouri River. The fact that the cars on the lines west of the Missouri River from the lines east, are repaired at a loss, is not for the benefit of the eastern lines. They are for the service of the lines in those States; they are in place of cars of their own which they would be required to have to do the business, if they were not using the foreign cars; it would cost them just as much to make repairs to their own cars as to foreign cars.

Force of Habit.—"You are a good example of what evil habits will bring a man to." "Yes'm," assented the tramp. "I've got so into the habit of lookin' fer work that even when I find it I can't stop to tend to it. I jist have to keep on lookin'."

Compound vs. Simple Locomotives.*

BY T. A. FOQUE.

Perhaps no subject has attracted more attention from those connected with the mechanical department of railroads in recent years than that of compound engines. We have been met by a demand for heavier trains, faster time, and above all for economy in the handling of traffic; and the application of the double expansion principle to the locomotive has helped to solve the latter problem. It does not come within the scope of this paper to enter deeply into the theory of the compound engine, and I shall confine myself mostly to the performance of some engines whose records I have; but for the benefit of the few, perhaps some short remarks may not be out of place.

In the ordinary form of locomotive we exhaust the steam from the cylinder into the atmosphere at a high pressure and a consequent loss of the heat necessary to raise the steam to that pressure. By the addition or substitution of a larger cylinder into which the steam shall pass after having done its work in the first, we get a greater expansion and utilize the heat given up in doing work. With the application of the compound theory, different designs of locomotives sprung into existence, varying with the ideas or ingenuity of the builders. In this country we have the two and the four cylinder types. When two cylinders alone are used they are placed in the usual position; when four are used, one high pressure and one low pressure cylinder are put on each side of the engine, one being above or ahead of the other.

The company with which I am connected has had in operation for some months 26 two-cylinder compound consolidation engines, and it is with this type that I shall have wholly to deal. For convenience we will divide these 26 engines into three classes, A, B and C.

Class A engines, 12 in number, have cylinders 21 inches and 31 inches by 24 inches, weigh 121,650 pounds on the drivers, and 13,700 pounds on the truck, the total weight being 135,350 pounds. The driving wheels measure 50 inches over the tires. The steam is exhausted from the high pressure cylinder into a receiver in the smokebox, thence through an intercepting valve to the low pressure steam chest and cylinder. By a special valve the exhaust from the high pressure cylinder may be diverted into the stack, the intercepting valve being then in such a position that live steam is admitted into the low pressure cylinder through a small branch pipe and reducing valve. We thus have a compound or simple engine at will, and the advantage of this will appear later.

Class B engines, ten in number, have cylinders 20 inches and 30 inches by 24 inches, weigh 112,230 pounds on the drivers, and 15,040 pounds on the truck, the total weight being 127,270 pounds. The driving wheels are 50 inches in diameter over the tires. In this class of engine the steam is always exhausted into a receiver in the smokebox, then through an intercepting valve it passes into the low pressure steam chest and cylinder, from which it is exhausted in the usual way.

Class C engines have cylinders 20 inches and 30 inches by 26 inches; weight 116,000 pounds on the drivers, and 15,800 pounds on the truck; total weight being 131,800 pounds. The driving wheels are 51 inches in diameter over the tires. In other respects they are the same as the class B engines.

The functions of the intercepting valve are alike in all the engines. In starting, live steam must be admitted to the low pressure cylinder, until sufficient pressure has accumulated in the receiver to equalize the total pressure in each cylinder. The intercepting valve, automatic in all its movements, then closes the live steam ports and admits the steam in the receiver to the low pressure steam chest.

The two simple engines, built to compete with the compounds, are also of the consolidation type, with cylinders 20 inches by 24 inches. They weigh about 112,000 pounds on the drivers and 13,800 pounds on the truck. In other respects they are like the compounds built by the same firms. The steam pressure carried is 180 pounds in each class, and the grate area, heating surface, etc., may be found in the appended table *E*. In the first column of the other tables the number of engines whose records were taken appears. My reasons for not including all will be apparent later.

In comparing the economy of compounds with that of simple engines, we should take engines of the same hauling capacity or tractive power. The greater the number of cars per train, the cheaper the cost per car mile, other things being equal. You have noted that the simple engines have cylinders 20 inches in diameter; with 180 pounds boiler pressure, we may expect but 29,370 pounds tractive power because of the great back pressure in the high-pressure cylinder. I am sorry not to be able to show indicator cards from the compounds, and for want of them I have assumed that the work done in each cylinder is the same, and we would then have for the tractive power of the class A engines 22,226 pounds, for the class B engines 20,350 pounds, and for the class C engines 21,615 pounds. Thus the tractive power of the 20-inch and 30-inch by 24-inch engines is 30.7 per cent. less than that of the 20-inch by 24-inch simple engines, and, as I will show later, their economy is not so great as that of the 21-inch and 31-inch by 24-inch compounds.

If we could have engines of the same class and tractive power, from what causes might we expect to find a saving by building them of different types? For the purposes of this article we may classify them under the heads of: (a car haulage, (b) repairs, (c) fuel consumption.

Car Haulage.—As may be expected, we find by referring to Table A, that on an average the simple engines haul more cars per train than the compounds. I have already explained why this should be. Of the compound engines the 21-inch and 31-inch by 24-inch engines stand first, the 20-inch and 30-inch by 26 inch engines second, and the 20-inch and 30-inch by 24-inch engines last, in the number of cars that they can haul. This order is carried out in practice, although the table herewith reverses it sometimes from causes dependent upon current traffic.

Repairs.—Perhaps nothing has caused more imaginary trouble with compound engines than repairs. We have looked for unequal strains and a consequent evil effect on the machinery. Excessive crosshead and cylinder wear on the low-pressure side was confidently expected. From our experience these evils do not exist, yet, paradoxical as it may seem, it is repairs that have lowered the records of our compounds. Improper work has been fruitful of expense. The design, when rightly executed, has proved good, but leaky flues and fireboxes have kept these engines in the shop when they should have been on the road. With any other class of repairs we could estimate the increased cost per mile because of such repairs. We know the actual shop expense on any engine, but who can tell the additional fuel burned because of a leaky firebox? It is a direct loss which we cannot estimate, and it is for this reason that I have selected for comparison those compounds which have been in the same condition as the simple engines. Table B shows the average cost of repairs per mile. For four months the average cost of repairs on the compounds was greater than on the simple engines, and during the other two months the reverse was true. A total average for each type of engine shows but little difference, and we can assume a fair cost of repairs as an indication that an ex gine was in condition for service.

Coal Burned per Car-Mile.—As previously stated, the cost of repairs has been indicative of the amount of coal burned, because of the nature of such repairs. I have compiled two tables, C and C 1. The first shows the fuel consumption per car mile for the competing engines, the second shows the average fuel consumption of all the compounds irrespective of the condition of the boilers. In the table C we find but two cases where the simple engines burned less coal per car than the compounds, and in one of these the number of cars per train was low. It is by a more economical use of the steam and a consequent economical use of the coal that we expect to effect a saving by compounding our engines, and so it is this table that will interest us most. With the two exceptions noted, 3.3% is the least amount saved, and 16.3% the greatest. This is not a bad showing, for even 3.3% of the yearly coal bill is a considerable amount, and the average is considerably above this. In six months' service, the best compound was 34.4% more economical in fuel than the poorest simple engine, and 8.1% more economical than the best simple engine. I have touched lightly upon these various points, and considered those which do not represent constant values. Wages are the same on each type of engines, and the cost of oil and waste does not vary materially, depending mostly upon the men.

The final cost per car-mile is shown in a separate table, and the average gain in favor of the compounds in general is a healthy one. The greatest saving is made by the 21-inch and 31-inch by 24-inch engines. There are three points about this design of engine as compared with classes B and C to be considered. First, they have a long valve travel. This is considered an essential feature of high speed locomotives, but the piston speed of an engine with a 50-inch wheel, running at 30 miles per hour, is more than two-thirds that of an engine with a 70-inch wheel, running 60 miles per hour, the stroke of each being the same, and we undoubtedly get a better distribution of the steam with the long travel. Second, the narrow fire-box. Here again we are uncertain. All of the engines steam freely, and I am not prepared to say which type of fire-box has been the most satisfactory. Third, the intercepting valve. There is no question about the superiority of this valve, controlled as it is by the engineer. The number of cars per train is limited by the number that can be hauled over the hills, and these engines have the advantage in that they can be instantly changed to the single expansion type. The hard pulls are not usually long. As compounds, the engine will take a train well up a grade, and then as simple engines easily take it over the summit. This feature admits of several cars more per train, and results in a consequent reduction in the cost per car. It is better than larger cylinders, the economy in running over most of the road more than compensating for the additional fuel consumed when working simple. Except in case of table C 1, I have not included all the compound engines, and the omissions may be charged to the two items, small mileage and extra repairs. When an engine has made small mileage, the monthly performance sheet is not accurate enough for comparison. The heavy repairs on these engines are not attributable to the compound feature, and therefore should not enter into our discussion.

Statistics do not make interesting reading, and I have endeavored to present in as brief a manner as possible a few figures taken from the actual record of these engines, and those who wish may make more extended reference to the table as their time will permit.

TABLE A.—CARS PER TRAIN.

Type of engine.	October.		November.		December.		January.		February.		March.	
	No. of engines.	No. of cars.	No. of engines.	No. of cars.	No. of engines.	No. of cars.	No. of engines.	No. of cars.	No. of engines.	No. of cars.	No. of engines.	No. of cars.
21″ + 31″ × 24″ comp'd.	9	27.83	5	29.65	5	22.59	3	20.87	4	22.86	9	27.38
20″ + 30″ × 24″ "	5	27.72	2	28.17	2	22.44	2	21.66	3	24.01	4	24.78
20″ + 30″ × 26″ "	3	25.76	2	29.97	2	19.65	1	18.96	1	22.11	3	24.11
20″ × 24″ simple	2	26.74	2	32.17	2	20.43	2	23.21	2	25.17	2	24.70

TABLE B.—REPAIRS PER MILE.

Type of engine.	October.		November.		December.		January.		February.		March.	
	No. of engines.	Cost in cents.	No. of engines.	Cost in cents.	No. of engines.	Cost in cents.	No. of engines.	Cost in cents.	No. of engines.	Cost in cents.	No. of engines.	Cost in cents.
21″ + 31″ × 24″ comp'd.	9	3.34	5	2.67	5	2.51	3	1.93	4	3.33	9	4.91
20″ + 30″ × 24″ "	5	1.67	2	1.76	2	2 25	2	1.92	3	3.21	4	2.88
20″ + 30″ × 24″ "	3	2.46	2	2.42	2	3.08	1	1.91	1	2.39	3	2.14
20″ × 24″ simple	2	1.45	2	2.40	2	1.92	2	2.63	2	3.72	2	2.98

TABLE C.—COAL PER CAR-MILE.

Type of engine.	October.			November.			December.			January.			February			March.		
	No. of engines.	Pounds of coal.	Per cent. saving.	No. of engines.	Pounds of coal.	Per cent. saving.	No. of engines.	Pounds of coal.	Per cent. saving	No. of engines.	Pounds of coal.	Per cent. saving.	No. of engines.	Pounds of coal.	Per cent. saving.	No. of engines.	Pounds of coal.	Per cent. saving.
21 inches + 31 inches × 24 inches compound	9	3.57	15.6	5	3.74	13.8	5	4.85	11.9	3	5.16	8.8	4	4 75	11.8	9	4.10	16.3
20 inches + 30 inches × 24 inches "	5	3.65	13.7	2	4.18	3.7	2	5 50	....	2	4.90	13.4	3	5 02	6.8	4	4.34	11.4
20 inches + 30 inches × 26 inches "	3	4.09	3.3	2	4.17	4.	2	4.83	12.3	1	5.83	.. .	1	5.04	6.4	3	4.42	9.7
20 inches × 24 inches simple	2	4.23	....	2	4.34	....	2	5.43	....	2	5.66	....	2	5.39	....	2	4.90	....

TABLE C 1.—COAL PER MILE.

Type of engine.	October.		November.		December;		January.		February.		March.	
	No. of engines.	Pounds of coal.	No. of engines.	Pounds of coal.	No. of engines	Pounds of coal.	No. of engines.	Pounds of coal.	No. of engines.	Pounds of coal.	No. of engines.	Pounds of coal.
Compounds	22	3.86	22	4.33	21	5.18	23	5.84	21	5.26	16	4.22
Simple engines	2	4.23	2	4.34	2	5.43	2	5.66	2	5.39	2	4.90

TABLE D.—COST PER CAR-MILE.

Type of engine.	October.			November.			December.			January.			February.			March.		
	No. of engines.	Cost in cents.	Per cent. saving.	No. of engines.	Cost in cents.	Per cent. saving.	No. of engines.	Cost in cents.	Per cent. saving.	No. of engines.	Cost in cents.	Per cent. saving.	No. of engines.	Cost in cents.	Per cent. saving.	No. of engines.	Cost in cents.	Per cent. saving.
21 inches + 31 inches × 24 inches compound	9	.89	18.4	5	.94	7.9	3	1.23	8.9	3	1.28	4.5	4	1.33	6.4	9	1.15	9.4
20 inches + 30 inches × 24 inches "	5	.93	14.7	2	1.02	....	2	1.34	.8	2	1.22	9.7	3	1.35	5.	4	1.16	8.6
20 inches + 30 inches × 26 inches "	3	1.01	7.4	2	1.00	1.9	2	1.34	.8	1	1.43	....	1	1.36	4.3	3	1.16	8.6
20 inches × 24 inches simple	2	1.09	....	2	1.02	....	2	1.35	...	2	1.34	...	2	1.42	....	2	1.27	....

TABLE E.

Type of Engine.	Consol. Comp.	Consol. Comp.	Consol. Comp.	Consol. Simple.	Consol. Simple
Diam. of cylinders and stroke	21″ + 34″ × 24″	20″ + 30″ × 24″	20″ + 30″ × 26″	20″ × 24″	20″ × 24″
Grate area, square feet	25.47	30.1	30.1	25.47	30.1
Heating surface, square feet	1,894	1,709	1,709	1,894	1,709
Diameter of shell, inches	62	58	58	62	58
Diameter of drivers, inches	50	50	51	50	51
Steam pressure	180	180	180	180	180
Valve	Bal. D.	Bal. D.	Bal. D.	Bal D.	Bal. D.
Valve travel, inches	6⅝	5½	5½	5¼	5¾
Outside lap, high pressure, inches	1	¾	¾	¾	¾
" " low " "	1	¾	¾	....	....
Inside lap or clear, high pressure, inches	⅜ clear	⅛ clear	⅛ clear	1/16 lap	1/16 lap
" " " low " "	¼ clear	1/16 clear	1/16 clear	....	....
Steam ports, high pressure, inches	1½ × 20	1½ × 18	1½ × 18	1¼ × 18	1¼ × 18
" " low " "	1½ × 24⅞	1½ × 20	1½ × 20	....	....
Exhaust port, high pressure "	3 × 20	3½ × 18	3½ × 18	3 × 18	3 × 18
" " low " "	3 × 24⅞	3½ × 20	3½ × 20	....	....
Firebox	Narrow	Wide	Narrow	Narrow	Wide

* Read before the Northwest Railway Club.

The Rights of the Scab.

The scab is a man who chooses to work when others choose to strike. For this exercise of his personal liberty and his own volition, he is anointed with an aromatic egg in the shape of an odious name being added to that given him by his mother. It is true that this scurrility makes no difference in his personal character. Putting a lion in a donkey's hide never yet changed the animal within, nor can mud thrown on a marble column make it other than it is. It is so with a man. Epithets cannot spoil him any more than a label on a bottle can make soda water of milk or brandy. The misfortune is, however, and it is just here where the cloven foot comes through the stocking, that the public do not always discern the distinction between an epithet and a man. This is human nature; it will join the hounds every time in pursuit of a lamb or a hare. It was a mob of this kind that crucified Christ, and would be as ready to do it to-day as they were 1,800 years ago. A brickbat never stops to reason, nor does a bludgeon wait for a jury.

Here lies the venom and ferocity of vocal abuse. It has killed statesmen and ended the career of some of the best and wisest of men; it has opposed reforms and bolstered up abuses, muzzled the mouth of truth and made music of lies. Rub this kind of garlic on preacher, prophet, statesman or public writer, and the usual ninety-nine fools in a hundred of population will hold their noses as the victim passes by. Better a wooden leg or a glass eye than a bad name. It sticks closer than a porous plaster, and the victim, though innocent as Noah was of drowning his neighbors, is under a ban from which it is as impossible to escape as it would be to crawl out of his skin.

What is known as a scab, in modern parlance, is not necessarily a scamp or a scoundrel. He may be as honest and manly as his neighbors, as true a citizen and as good a son, brother or husband as ever turned out of the divine workshop. What he eats he earns; what he buys he pays for, and no scurrility can make a dog of such a man as that. He has his personal liberties and rights, and they are his, as sacred and unassailable as those of any other men. A knife on the throat of these rights is social murder, whether committed by a spiteful neighbor or an industrial order. This is plain talking, but any man that can count his fingers can swear to its truthfulness.

If labor wishes to secure its own rights it must respect those of others, and if one can put on his coat and walk out of a workshop, another has an equal right to take off his coat and walk in. We recognize the value of unanimity in labor; we know that without cohesion it is powerless. We understand why men making a stand for what they honestly consider to be a just demand or remonstrance are more or less frustrated and in some cases excusably irritated by seeing others take up the hammer or the chisel they laid down; but with all this allowed, there can be no defense, either legal or moral, in denying another man his personal liberty or rights. Society would recoil from keeping a man out of a church door if he chooses to go in. We do not hang, burn or drown men nowadays for their religious opinions. We claim freedom at the ballot box and punish the men who obstruct it; in fact, all men are conscious of the danger involved in interfering with personal rights. It must be so recognized in all labor struggles; and labor unions will never be what they can and ought to be so long as violence is done to the non-consenting.—Fred Woodrow, in the *Age of Steel.*

A Hot Weather Story.

"The Atchison road reached Deming, N. M., in 1881, and it was a hot summer," said W. F. White, the Traffic Manager of the road, recently. "It had been hot right along for days in that steady, energetic fashion that would make a man wish for an hour in a Bessemer steel mill to cool off. The first construction train pulled into Deming on a day that was so scorching as to stand out even among those other blistering days. The train was made up of a long line of flat cars, and along the center of the cars ran a pile of steel rails a foot high. The rails had been in the full glare of an unblinking sun until they were about as hot as when they first came through the rolls at the mill.

"When the train came into Deming it was, of course, an object of great interest, and no one was more interested than a lot of Apache Indians. They were peaceful enough and filled with curiosity, and were quick to assert the birthright of the American Indian to ride free on a railroad train. The conductor in charge was something of a joker and saw an opportunity for some fun. He urged the Indians all to climb up on the flat cars and have a ride. The engineer was in the scheme, and, as soon as the Indians were on the cars, he backed his engine with a jerk. They could ride a bucking pony under any condition of unsteadiness, but this motion was new to them and the entire party sat down on the rails.

"Now, you must remember the summer costume of an Apache can be cut out of a pocket handkerchief with cloth to spare. Well, my idea of Indian stoicism was shattered. There were shrieks that added new notes to the regulation war whoop, and the Apaches left that train and started off across the hot sands in a way that would have turned us all gray if they had been coming toward us instead of running away. They undoubtedly to this minute remember that as the hottest day they ever knew."

Wind Mills for Generating Electricity.

Referring to the economy of generating electricity by wind power, *Electrical Industry* says: "The general public, hearing of a motor worked by wind power, are inclined at once to jump to the conclusion that the cost of generating electricity by these means must be nil, or at any rate much lower than where any kind of fuel is used. As a matter of fact, however, the first cost of such a motor is so high, that the sum represented by interest on the plant is far in excess of what it would be necessary to expend on fuel to obtain the same amount of power by means of a steam, gas, or oil engine. In order to provide a perfectly reliable supply, it is necessary to provide a motor capable of giving power very much in excess of that which is required for the lighting, as calculations based on the average rate of wind per diem are of very little use, because it must be possible to take advantage of high winds when they come. To do this, however, necessitates a very expensive plant, and the sum represented by interest on first cost of secondary cells, and their cost of maintenance is alone a very large item. In very exposed places, of course, a wind mill might prove an economical source of power, but these cases are few and far between; so that the consideration of wind as a source of motive power need hardly enter into the practical politics of electrical engineers."

Compressed Air and Cool Drinking Water.

A recent issue of the *American Machinist* contained a good suggestion in the form of an article by Mr. Frank Richards on the possibility of using compressed air to cool drinking water. As the suggestion is particularly pertinent to railroad shops we publish the following abstract from the article mentioned:

So many establishments, especially railroad shops, now maintain a constant supply of compressed air and use it for so many purposes that it is a wonder to me that it has not yet been used in such places for maintaining a constant supply of cool drinking water. It is possible that the air has been so employed, but, if so, we should have full information about it, and I certainly have not heard of it. Nothing need be said about the necessity of maintaining a constant supply of cool and pure drinking water wherever men are employed, and especially in hot weather. The expense, and especially the care and trouble required in looking after the ice supply, are familiar enough to all, and also the actual objections to the use of ice water; the fact that only an excessively and injuriously low temperature can be maintained by ice with any certainty, and the other fact that too much of the ice that is used everywhere contains and contributes to the water unwholesome and objectionable matter. The cost of the ice, the impurities contained in it, and the actual labor of handling and looking after it would make a compressed-air service for the same purpose cheap and welcome by comparison. If in any place a constant supply of compressed air is maintained, a constant supply of cool and pure drinking water is also always possible, without any attention as to maintenance and without other cost than the actual cost of compressing the air.

The arrangement required must readily suggest itself to any one familiar with the conditions of the problem involved. A vertical cylindrical reservoir should be provided and connected to the water supply. This reservoir would be constantly full of water, and while contained therein the cooling of the water would take place. The water should enter the reservoir at the top, and be drawn off at the bottom, and the draught pipe after leaving the reservoir should be as short as possible, so that the water after being cooled may not have a chance to warm up again. The cooling of the water would be accomplished by the passage of expanded air through a coil of pipe closely surrounding the reservoir, the air entering at the bottom of the coil, and escaping at the top. The air should be brought to the cock which controls the admission to the coil at full pressure, say 70 to 80 ponnds gauge, and at the temperature of the surrounding air. The compressed air, while under full pressure and before reaching this point, should have been allowed to deposit all the moisture it could get rid of by passing through a suitable chamber or air receiver *after* being thoroughly cooled. A receiver near the compressor, and through which the air passes before it is entirely cooled, serves to equalize the pressure against sudden fluctuations, but it does not get rid of the moisture. A chamber through which the air may pass after it is thoroughly cooled will do so. As the air comes to the coil under pressure, and at normal temperature, upon being released from pressure, and flowing into the coil at atmospheric pressure, and expanded to four or five times its previous volume, it is much lowered in temperature, and immediately begins to draw heat from the walls of the water reservoir which it encircles, thereby cooling the water contained in the reservoir. The air coil instead of surrounding the water reservoir, may be entirely within it, and directly in contact with the water. The latter is the better arrangement, but in either case the entire air coil and water reservoir must be inclosed in a thoroughly effective non-conducting jacket or covering.

Now, the getting of this coil and reservoir and all that, and rigging it up properly, is too great an undertaking, and one that few will be likely to undertake at first, so we have to suggest a way of doing it all with such material as is generally available, and which, because we have it handy, we generally assume to cost nothing. Take a 1¼-inch pipe 100 feet long—50 feet might be long enough—place it horizontally and connect one end of it to the compressed air supply with a suitable cock to control the escape of the air. Leave the other end of the pipe open and inclose the whole of the pipe, after passing the air-admission cock, in a thick non-conducting covering. If you have nothing better at hand take plenty of paper, winding it on layer after layer and covering the whole pipe. Then lead a ⅜-inch water pipe into the open end of the air pipe, and let it come out by a tee or otherwise at the other end of the air pipe, and you have the whole apparatus. The air in this case, as before, should be brought to where it is to be used thoroughly cooled and with all its water discharged. The instinctive call of humanity for cold water to drink is so absolutely universal that it must be correct and should be more adequately provided for.

We have received from the Correspondence School of Mechanics and Industrial Sciences, of Scranton, Pa., a circular giving detailed descriptions of its courses of study, methods of teaching, etc. These are adapted to the requirement of the large class of uneducated practical men whom the regular schools cannot help—those who either would not or did not have the opportunity to study when young, and who, now that they cannot quit work to attend school, are willing to do the next best thing, *i. e.*, study at home in their leisure hours. The instruction papers of this school are written by its own instructors, and these are adapted as far as possible to the requirements of workingmen who have not had educational advantages.

The Joseph Dixon Crucible Company, Jersey City, N. J., manufacturer of lead pencils, crucibles, stove polish and other graphite products, says that in times like these, when work is none too plenty, and the manufacturer is anxious for orders, there is great temptation to cut prices for the sake of getting a quantity of business, forgetful of the fact that the more business one does at a loss the slimmer will be the bank account at the end of the year.

There is neither money nor reputation to be gained in doing work for less than a fair price, and the very men who profit by beating the salesman down and by inducing him to enter their order at cut-throat competition prices, respect him less, and respect his house less, than if he had stuck manfully to the principle that first-class goods demand a fair price.

Good Advice from a Lunatic.

The following poem on steam boiler management has reached print in a curious way. Mr. Frrnk J. Kennedy, of the Ingersoll-Sergeant Drill Company, was adjusting an air compressor in a lunatic asylum within sight and hearing of some of the inmates. As he passed one of the grated windows a paper was thrust between the bars with the remark, "There, you boiler buster, read and ponder." The paper was a long pink bill form with these verses written in pencil upon the back. They are reproduced as written with a few slight corrections of orthography, etc. Nothing could be learned of the writer. The lines were published in the *American Machinist.* Though coming from a madhouse, the advice given in the lines is sound and covers the ground of safe boiler management admirably.

BOILER BUSTERS, BEWARE!

Much neglect won't be endured
By any boiler, *though insured*;
For unexpectedly, you know,
Some day she'll pop, and up she'll go.

Have all your boilers well inspected
And never let them be neglected,
And when a boiler needs repair
Do it at once just then and there.

Never force it beyond its load,
For 'twould be likely to explode;
Keep your water well in sight,
Never below the proper height.

Tubes and flues when they're kept clean
Economy in fuel mean;
And if from scale a boiler is free
It must do well, as you must see.

The masonry must be intact;
The draught is spoiled if that is cracked.
The grate bars should be clear and straight;
Remove all poor ones from the grate.

See that all valves are working right,
The blow cocks must be always tight.
Keep gauges and the gauge cocks clear,
And then low water you need not fear.

The safety valve should always blow
Whenever the steam gauge point doth show
The working load at which we deem
It's surely safe to carry steam.

Always fire up with greatest care—
There's such a thing as too much air.
Cracks and pockets are not a need;
Try to be regular with your feed.

Over all things have a care,
Never forget the boiler's wear.
Watch well for the unexpected
If from harm you'd be protected.

Let well enough alone. 'Tis true
It's a good rule when said in view
Of useless work, but then 'tis plain
It might in time a loss entrain.

Judgment is needed in any one
Who has a boiler plant to run,
A careless man in a fireroom found
May enter but not leave it sound.

A steady hand, a cool, clear head,
A watchful eye will him bestead,
His motions must be sure and quick
When troubles crowd upon him thick.

There's no time then to stop and think—
Things must be done as quick as a wink,
Or else much mischief may be wrought
Before he has the matter thought.

His thinking should be done before,
His plans considered o'er and o'er;
Make all provisions that you may,
You'll find it far the other way.

When danger threatens do not shirk,
But stand up boldly to your work.
'Tis yours to do the saving part;
Work then with all your strength and heart.

'Tis hoped you'll be appreciated,
But if luck and you should not be mated
You'll find at least great satisfaction
In being right in all your action.

The Brown & Sharpe Manufacturing Company, of Providence, R. I., resumed work in all departments of its establishment on Aug. 20. The works had been closed for two weeks in observance of the usual annual vacation.

Judge Swan, of the United States Circuit Court at Detroit, in a decision rendered Aug. 21, denied the motion for a rehearing in the Cody patent case, thereby affirming a previous decision of the same court in favor of the Consolidated Car Heating Company, of Albany, N. Y.

The works of the Falls Hollow Staybolt Company at Cuyahoga Falls, O., are running full time on orders for hollow staybolt iron from the leading railroads and locomotive builders of the country. Recent improvements in the works now enable this company to fill all orders very promptly.

The Berry & Orton Company, of Philadelphia, Pa., manufacturers of woodworking machinery, has just closed a large order from a railroad company in the South for two of its new heavy vertical hollow chisel mortisers. This company has recently published a new catalogue of the different kinds of band-sawing machines that it manufactures.

The Baltimore & Ohio Railroad has decided to equip all of the 548 passenger cars on its main line with the Gold Car Heating Company's system of steam heating. The order includes the Gold steam coupling with automatic gravity relief traps. This is one of the largest orders ever given to a steam heating company. The Gold system of car heating has also been adopted on the Western Maryland Railroad and on the Annapolis Short Line.

The Tanite Company, of Stroudsburg, Pa., has issued a new price list of the wide variety of emery articles it manufactures. These embrace everything in this line from emery flour to emery wheels. The Tanite Company has been engaged in the manufacture of emery articles since 1868, and its experience during the past 27 years enables it to produce articles of unsurpassed excellence and efficiency. The pamphlet mentioned contains a good deal of information about emery products, and a number of practical hints about emery wheels that should prove useful to all who are interested in tool grinding.

The Hoosac Tunnel.

A ride through the famous Hoosac Tunnel is thus described by a traveler who recently enjoyed the delightful trip from Boston to Troy over the Fitchburg Railroad:

The Hoosac Tunnel is nearly five miles long, and a passenger train occupies about 10 minutes passing through it. For several miles before the eastern portal of the tunnel was reached the country was beautiful, valley, hill and dale; very soon the outposts of the Hoosac Mountains began to tower far above us, and the train was anon plunged into deep shadows, the defiles became deeper, the surroundings more somber, as we neared that insurmountable wall of wooded mountains.

Suddenly we bounded into one of the most famous tunnels in the world. Like glow-worms, the electric lights shone on the walls of either side of the tunnel, flashing by and looking like a string of golden beads. The engine works heavily over the first half of the tunnel, for it is up-grade for nearly two and one-half miles, until the center is reached, then the track descends at the same grade to the western portal.

We are now at the very center of the tunnel, and can see all about us; the walls loom up clearly on either side; there is no daylight, to be sure, but the electric lights shine with a brilliant radiancy. In the center, the air shaft extends from the roof of the tunnel to the top of the mountain, 1,200 feet above, for ventilation. The bed of the tunnel slopes from the center toward either end for the purpose of draining it of all moisture that collects at that tremendous distance under the mountain range.

Emerging from the western portal it requires a moment for our eyes to become accustomed to the change, for we are now spinning along in the sunshine, past the green fields and the woods.

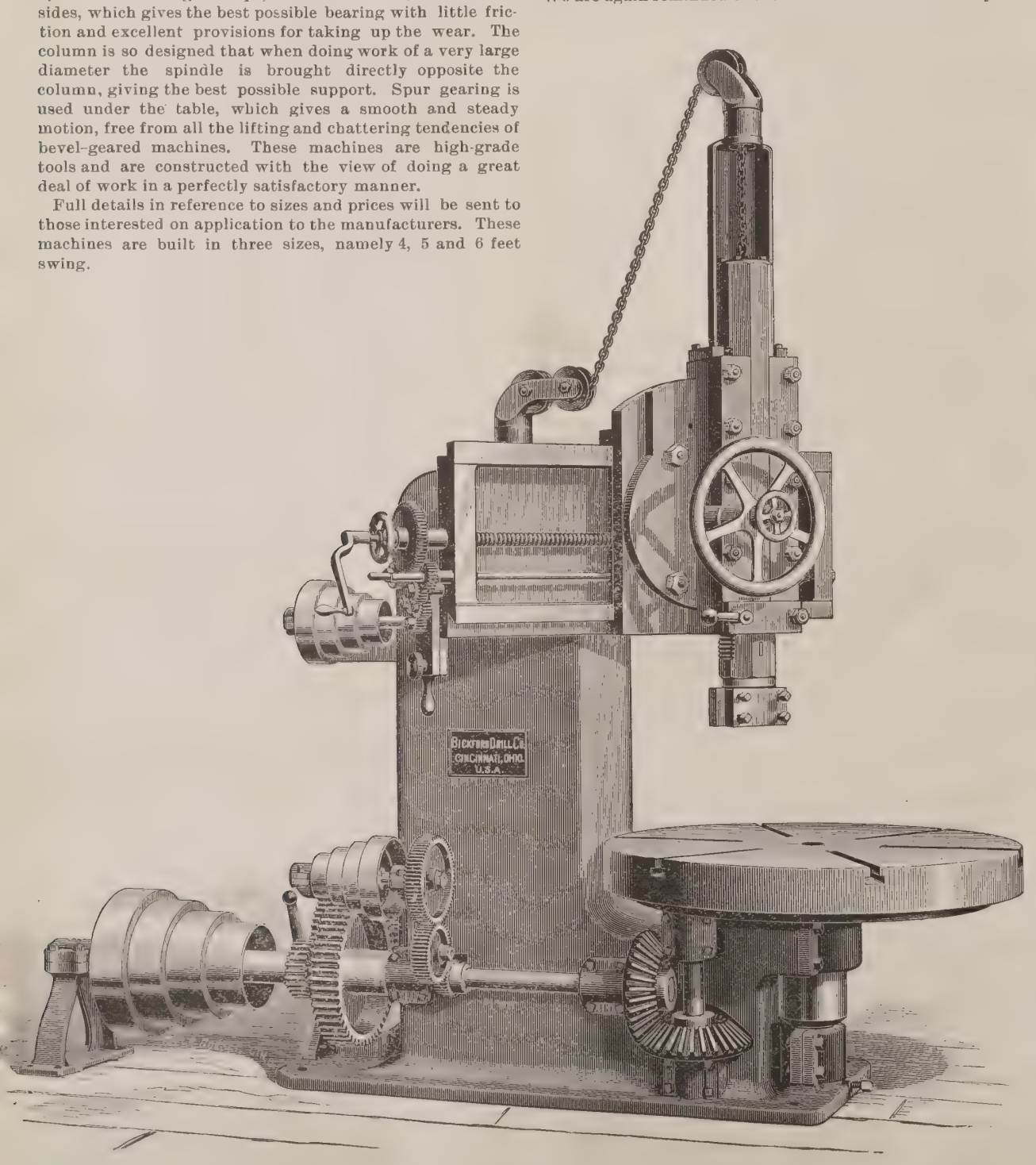
We look back from the rear car up at that mighty barrier, the tallest peaks of which seem to pierce the sky, and far down we see a hole, surrounded by an arch of stone, which, as we leave it, dwindles to a tiny spot.

The Bickford Boring and Turning Mill.

The boring and turning mill illustrated on this page is designed and manufactured by the Bickford Drill and Tool Company, of Cincinnati, O.

These boring and turning mills are of the single column pattern, and are among the most useful tools which can be placed into any machine shop. The work can be chucked on the table much easier than in a lathe, and after being placed on the table and resting thereon it can be wedged up and set in a shorter time. The center of the tool spindle can be brought to the center of the hole in the table, and then by using boring bars such work as flywheels, pulleys, truck wheels, etc., can be bored the same as on a special boring machine. By substituting the toolholder in place of the boring bar any casting may be faced, bored or turned as large in diameter as the swing of the machine and as high as the distance between the table and cross rail. The tool spindle is of octagon shape, with the bearing on alternate sides, which gives the best possible bearing with little friction and excellent provisions for taking up the wear. The column is so designed that when doing work of a very large diameter the spindle is brought directly opposite the column, giving the best possible support. Spur gearing is used under the table, which gives a smooth and steady motion, free from all the lifting and chattering tendencies of bevel-geared machines. These machines are high-grade tools and are constructed with the view of doing a great deal of work in a perfectly satisfactory manner.

Full details in reference to sizes and prices will be sent to those interested on application to the manufacturers. These machines are built in three sizes, namely 4, 5 and 6 feet swing.



BICKFORD BORING AND TURNING MILL.

Illumination of Passenger Cars.

The question of the efficient and economical illumination of passenger coaches is one which has commanded more than the usual amount of attention this year from railway officials, the press and the public alike, and especially so as several new concerns furnishing lighting equipment have entered the field and are competing for their share of the business. Probably no recent collection of facts and figures throws as much light on this much-discussed subject as the report of the Secretary of the Master Car Builders' Association, presented at their last Convention at Saratoga in June.

A careful study of this report brings forward the fact that a large number of the leading roads of the country have adopted the Pintsch light, and are proceeding with the equipment of their cars as fast as possible. The same is true of the Pullman and Wagner palace car companies, which have always been noted for their high standards and excellence of service, they finding that the Pintsch light, in addition to brilliantly and satisfactorily illuminating their cars, is a great saving in the matter of carpets and upholsteries, as the oil lamps will leak more or less and injure them.

Aside from the many excellent qualities of the Pintsch light, its rapid extension is doubtless explained in a large measure by the increase in the number of charging stations, there now being about 53, located in the principal railroad centers of the Union, and the work of the erection of additional plants is being pushed as fast as necessity requires.

The experience of the railroads with the use of electricity has been confined almost entirely to experimental service, and a number of the roads formerly using it have removed it from their cars on account of the great expense attendant upon its operation. But two roads report its use as at all satisfactory, and in this connection it is interesting, as well as significant, to note the recent adoption of the Pintsch light by the Columbus Central Railway Company, a trolley road of Columbus, O. This decision was reached and the change made by the officers of the railway company only after a thorough study of the matter, and after it had been proved by actual service that the Pintsch system furnished a much more reliable, brilliant and pleasant light than the electric current illumination, at about one-half the cost of the latter.

The report also shows that the oil lamp is still in use on a large proportion of the passenger cars of this country; but when we take into consideration the many disastrous and expensive fires originating from the oil lamps when trains have been wrecked, and also the fact that a well-lighted car creates a most favorable impression of the service of a road on the part of its patrons, it would seem as if the continuance of oil as a means of illumination of cars is misplaced economy. We are again reminded of the truth of this statement by the recent wreck on the Chicago & Grand Trunk Railroad near Battle Creek, Mich., in which case the coaches were equipped with the Pintsch light which was extinguished the instant the cars left the rails, thereby removing all danger from fire.

A Twist Drill Grinding Gage.

Grinding twist drills accurately is a difficult operation, and the proper speed or number of revolutions a drill should run is of great importance in getting the best and most economical results from the use of such drills. The Standard Tool Company, of Cleveland, O., has designed and put on the market a new grinding gage which enables operators to grind twist drills accurately. It is made of steel one-sixteenth inch thick. The angle of the gage is ground to exactly 59 degrees, which is the proper angle for the cutting edges of a twist drill. The angle on the gage is graduated so that the cutting edges of the drill can be measured and ground exactly the same length. The clearance of the drill can also be determined by holding the drill on the gage and revolving it toward the operator. The straight edge of the gage is a two-inch scale graduated by eighths of an inch, opposite each eighth mark is a number, which is the best speed to run a drill of corresponding size or diameter. One side of the gage is marked for boring steel and the other side for cast iron.

Mr. William C. Baker, manufacturer of the well-known Baker car heater, of 143 Liberty street, New York, has issued a pamphlet which describes and illustrates his recently perfected jointless safety vent for car heaters. It is announced that these safety vents are now being introduced as a substitute for safety valves on steam boilers.

It is estimated that the yearly passenger trips for all New York ferries exceed 170,000,000.

Our Directory

OF OFFICIAL CHANGES IN AUGUST.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Atchison, Topeka & Santa Fe.—Aldace F. Walker is appointed Receiver, vice J. W. Reinhart, resigned.

Atlantic Coast Line.—F. H. Fechtig is appointed Purchasing Agent, with office at Wilmington, N. C.

Baltimore & Lehigh.—General Manager W. R. Crumpton has resigned.

Boston & Albany.—N. Wales is appointed Superintendent at East Albany.

Buffalo, Rochester & Pittsburgh.—Charles E. Turner is appointed Superintendent of Motive Power.

Chicago, Milwaukee & St. Paul.—W. J. Underwood, Superintendent of the River Division, is appointed Assistant-General Superintendent of the Middle Division. D. L. Bush is transferred from the Hastings & Dakota Division to the River, Chippeway Valley & Wabasha Divisions, succeeding Mr. Underwood. J. R. Williams is transferred from the Iowa & Minnesota to the Hastings & Dakota Division. F. T. Fox, formerly Trainmaster, is appointed Superintendent of the Iowa & Minnesota Division.

Cleveland, Canton & Southern.—J. W. Wardwell is appointed Receiver.

Cleveland, Cincinnati, Chicago & St. Louis.—A. M. Stimson is appointed Purchasing Agent.

Cumberland & Pennsylvania.—P. L. Burwell, General Superintendent, has resigned.

Eel River R. R.—W. W. Johnson is appointed Receiver.

Georgia, Midland & Gulf.—M. A. Gray, Superintendent, has resigned and the office is abolished, the duties being assumed by General Manager C. W. Chears.

Great Northern.—Chas. H. Warren is appointed General Manager, vice C. W. Case, resigned. E. W. McKenna and J. D. Farrell are appointed General Superintendents of the Eastern and Western Districts, respectively. D. McLaren is appointed General Superintendent of Montana Central Railway. C. H. Jenks is appointed Superintendent Northern Division, vice C. C. Ponsonby, transferred. The jurisdiction of O. O. Winter is extended over the Wilmar Division, as Superintendent.

Houston & Texas Central.—James McGee, Master Car Builder, is appointed Acting Superintendent of Motive Power and Machinery.

Iowa Central.—General Superintendent J. P. O'Brien has resigned S. M. Rogers is appointed Purchasing Agent.

Lake Shore & Michigan Southern.—President John Newell died August 26th.

Lehigh & Hudson River.—E. M. Reynolds is appointed Purchasing Agent, with office at Warwick, N. Y.

Louisville, St. Louis & Texas.—General Manager J. K. McCracken has resigned and the office is abolished. A. M. McCracken is appointed General Superintendent.

Memphis & Charleston.—C. H. Hudson is appointed General Manager, and C. P. Minetree is appointed Purchasing Agent. Offices, Washington, D. C.

Missouri Pacific.—Russell Harding, Superintendent at Wichita, Kan., has resigned, and is succeeded by A. H. Webb.

Mobile & Ohio R. R.—The headquarters of H. W. Clark, Division Superintendent of the St. Louis Division, have been changed from Murphysboro, Ill., to East St. Louis, Ill.

New York, Lake Erie & Western.—C. P. Weiss is appointed Master Mechanic of the Bradford division, vice G. W. Conklin, resigned.

Ohio Southern.—R. L. Barret is appointed Purchasing Agent, with office at Cleveland.

Tennessee Coal & Iron Railway Company.—General Manager T. H. Aldrich and Superintendent P. R. Thomas have resigned.

Tonawanda Valley.—G. W. Conklin is appointed Superintendent.

Western New York & Pennsylvania.—John McGee is appointed Master Mechanic at Olean, N. Y.

Wiscasset & Quebec.—R. T. Rundlett is appointed General Manager.

Employment.

A Railway Supply Man is open to an engagement; extensive acquaintance among railway people, and is well known in the supply trade. Address "HUSTLER," care of the NATIONAL CAR AND LOCOMOTIVE BUILDER.

NATIONAL CAR AND LOCOMOTIVE BUILDER

OCTOBER, 1894.

CONTENTS.

It is announced that a new railroad is to be built from St. Louis to Norfolk, Va.

Car wheels have recently sold at ⅞ cent per pound, or $4.12½ for a 550-pound wheel.

The Elliott Car Works at Gadsden, Ala., have resumed work on several large orders after a long idleness.

New York Central has contracted for 500,000 tons of soft coal, to be delivered on cars at Buffalo, at $1.38 per ton.

The Southern Pacific has recently ordered three six-wheel switch engines of the Schenectady Locomotive Works.

The car shops of the Carlisle Manufacturing Company, at Carlisle, Pa., have been opened after nearly a year's idleness.

Since April 1, the New York Central has laid 60,000 tons of new rails between New York and Buffalo, at a cost of $1,250,000.

It is stated that arrangements have been made to ship 100,000 tons of bituminous coal this fall to Brazil from Philadelphia.

The Elliott Car Company, of Gadsden, Ala., has secured an order for 10,000 car wheels, on which work has already been commenced.

The shops of the Northern Pacific at Brainard, Minn., had been idle since July, but started up early in September with over 400 men.

During a collision of freight trains on the New York, Lake Erie & Western, Sept. 11, a brakeman was killed and 18 cars were wrecked.

The Michigan Peninsular Car Company has an order from the Toledo & Ohio Central for 100 coal cars, which was placed during August.

The Fall Brook Coal Company has ordered two 8-wheel passenger engines, and three consolidation freight engines, of the Schenectady Locomotive Works.

The shops of the West Shore Railroad, at Frankfort and other points, which have been running on eight hours time, are to make 10 hours a day hereafter.

The employees of the Pittsburgh, Shenango & Lake Erie had their wages cut 10 per cent. last January. These have now been restored to the former basis.

The Illinois Central road has ordered a large number of fruit, box, coal, stock, furniture and refrigerator cars of the Haskell & Barker Car Company, of Michigan City, Ind.

The Swiss Federal Council has approved the scheme for a Jura-Simplon railway tunnel through the Simplon, to cost $10,900,000. The plan is to be submitted for the approval of the Italian Government.

Grand Master Sargent, of the Brotherhood of Locomotive Fireman, has expressed the opinion that "the Debs sympathy strike in Illinois gave organized labor a blow from which it will not recover in 10 years."

A stage was held up seven miles north of Congress, Ariz., Sept. 10, by two masked highwaymen. Six passengers were in the coach. They were relieved of all their valuables, the bandits securing $500 in coin.

Fire destroyed the passenger and freight depots of the Queen & Crescent route at New Orleans, Sept. 23. A large amount of merchandise and six box cars were also destroyed, the damage reaching about $20,000.

The Russian Government has decided upon the construction of a line of railway from Samarcand to Khokand via Khodschend. It is expected that the line will give a great impetus to the cotton trade of Asiatic Russia.

It is announced that the car shops of the Northern Pacific at Edison, near Tacoma, Wash., have been reopened with a force of about 350 men. The shops have been closed since the strike in July. At that time about 275 men were at work.

Eight persons were killed and 30 others seriously injured by the wrecking of an express train from Paris to Cologne, near Noyon, Sept. 9. The wreck was caused by the express train striking some freight cars that had been pushed from a siding on to the main track.

The old Erie car works, at Erie, Pa., were set on fire Sept. 24 by an incendiary, and entirely destroyed. The works were built 30 years ago, but had been in only partial operation during the last few years. The loss is estimated at $250,000; insurance, $65,000.

Last year there were 300 carloads of dried apricots shipped east from California, but this year there will be between 1,000 and 1,200. Each carload contains 24,000 pounds, so that the estimated supply this year will be from 24,000,000 to nearly 29,000,000 pounds.

Advices from St. Louis state that the right of way has been purchased for a new belt line road, to be known as the St. Clair, Madison & St. Louis Belt Railway. The road is to run within a radius of 25 miles of St. Louis. The work of laying the tracks in Missouri will be begun at once.

A $2,000,000 fire at Portland, Ore., Sept. 23, destroyed the Pacific Coast Company's elevator, the coal bunkers of the Northern Pacific Terminal Company and the Oregon Railway & Navigation Company's wharf, 400 feet long, and the steamboat *Willamette Chief*. Three men lost their lives in the fire.

The report of the Denver & Rio Grande Railroad Company for the fiscal year ended June 30, 1894, has just been published. It shows a reduction in earnings of 30.5 per cent., in expenses 24.8 per cent. and in net earnings 37.9 per cent. The gross earnings were $6,476,043, and the net earnings were $2,503,492.

The Ohio Falls Car Manufacturing Company, of Jeffersonville, Ind., resumed operations on August 27, after a year's idleness, with a force of 1,500 men. The company has been awarded a contract to build 700 cars for the Pennsylvania Railroad, most of which are to replace those destroyed during the late strike.

The Madison Car Works, of Madison, Ill., have resumed operations with about 600 men. Its first work will be to build 100 coal cars for the St. Louis & Eastern road. A reorganization of the company has been effected with M. Ramsey as President; C. D. McClure, Vice-President; Paul A. Fusz, Second Vice-President and Treasurer; A. P. Brigham, Secretary.

The Pennsylvania Railroad moved 129,091 freight cars over its main line during August. This was next to the largest monthly movement in the history of the road. There passed eastward 2,120 trains, with 65,266 loaded cars and 1,261 empty cars, a total of 66,427; and westward there were 944 trains, with 11,314 cars and 51,314 empty cars, a total of 62,564.

There is a row on between a minority of the stockholders of the Chicago South Side elevated railroad and the management. The minority represents about $2,700,000 of the $7,500,000 total capital stock of the company. The charge is freely made that the elevated road, which was projected as a rival of the South Side cable lines, is being run in the interest of the surface roads.

A ship that arrived in New York Sept. 15 from Venezuela brought news of a disastrous flood which swept down from the mountains in that country early in September, and destroyed part of the railroad running between Porto Cabello and Valencia. The flood came pouring down the dry watercourses, and in seven hours swept away the roadbed and bridges for 15 miles.

As illustrating the present excessive freight rates for goods exported to Central and South America it is reported that a narrow gage locomotive, bought at that city for $3,575, was recently delivered at Samaca, Colombia, for $3,595, with $10,904 charges against it. The iron work for four cars, costing $494.48, reached its destination with a bill of $1,610. A turbine wheel worth $708 cost $3,760 when carried within 153 miles of Samaca.

The railroad across the Isthmus of Tehuantepec, 192 miles in length, has been completed and train service established. The Mexican Government, which has practically built the road, proposes to expend $4,000,000 additional in terminals. It is thought that the new line will endeavor to dominate rates on the isthmus, controlled since 1855 by the Panama Railroad Company. The new road makes a saving of 1,182 miles from New York to San Francisco by water, and fully three days' time.

William Law, a badly misnamed individual and a recently discharged employé of the West Pennsylvania Railroad, was arrested Sept. 13 for attempting to wreck a train at a sharp curve between Butler Junction and Sligo Station. He had rolled a large rock on the track directly in front of the approaching train. His object is supposed to have been revenge for having been discharged. The rock was broken into fragments, and the train passed over in safety. This was Law's second attempt to wreck a train on this road.

Referring to the double end locomotive built for the Nara Railway of Japan by the Baldwin Locomotive Works, and illustrated in our last issue, we have received some further information concerning the road named. The Nara Railway runs from Kioto to Nara, a distance of about 26 miles. Some extensions of the line are contemplated in the near future. The engine will burn bituminous coal, the usual price of which in the vicinity of Nara has been five to six yen ($2.50 to $3) per ton. Probably the present price of coal is somewhat in excess of these figures.

A light engine on the Delaware & Hudson came into collision with an opposite bound freight train near Schnectady, N. Y., September 15. The light engine was backing up, and had its tender wrecked and torn off. The crews of both engines jumped before the collision and escaped injury. After the collision, the light engine started off ahead toward Schnectady and run through that city at a high rate of speed, but fortunately flew past all the street crossings without doing any harm, and run to Duanesburg, eleven miles, before its steam was exhausted.

The United States Consul at Cartagena, Colombia, has informed the Department of State of the completion and formal opening for traffic of the Cartagena-Magdalena Railroad. This road is an American enterprise, and runs south through the Republic of Colombia for about 60 miles to the town of Calomar, on the Magdalena River, and is expected to revive the former commercial importance of Cartagena, which is said to have been one of the best harbors on the South American coast.

A freight train on the New York Central Railroad, consisting of 68 cars, half of which were oil tanks, broke in two near Buffalo, recently The two parts of the train came together with great force and one of the oil cars exploded, the oil having been ignited by a brakeman's lantern. The other oil cars caught fire in rapid succession and there was a series of explosions. One tank was blown 1,000 feet. The train crew succeeded in saving 20 box cars; the others, loaded with merchandise, were burned.

Two years ago experimental shipments of California fruit to England were made with unsatisfactory results. Last year the shipments were omitted, but they were resumed this year, when three shipments of about nine carloads each, averaging over ten tons for each carload, were made, but with still worse results. The fruit was sent by special freight trains from Sacramento to New York, and was transferred to fast steamships there, and sent from Southampton by special train to London, where it was found on arrival that it was overripe and could not be sold.

St. Louis has long been known as the "Future Great." It has already achieved greatness in many ways and keeps adding to its laurels. A couple of years ago the now widely adopted system of carrying the United States mail between the main and branch postoffices of cities on street cars was first tried experimentally in St. Louis. Now a street car with electric motor attachments has been fitted up as an ambulance for carrying hospital patients, and if the experiment proves successful it is intended to establish a street-car-ambulance service throughout the city.

The New York and Chicago and the North Shore limited trains of the New York Central have been consolidated and now run as follows: Leaving Grand Central Station, New York, as the "North Shore Limited," every day at 4:30 p. m., and arriving in Chicago, via the Michigan Central, at 4:30 the next afternoon, in time to make connections with through trains of all the Western lines. Leaving Chicago, via the Lake Shore, every day at 5:30 p. m., and arriving at the Grand Central Station, New York, at 6:30 p. m., in time for dinner and a full evening in the second city of the world.

Master Car Builders' Committees for 1895.

The Secretary of the Master Car Builders' Association has announced the following list of subjects and committees for the coming year:

Interchange of Cars.—To suggest how cars in interchange may be maintained equitably to owners and operators with least expense and detention—Pulaski Leeds, J. N. Barr, Samuel Irvin, J. W. Marden, E. D. Nelson, J. H. Rankin, L. Packard.

Road Tests of Brakeshoes.—To conduct and report upon a serious of comparative tests of different brakeshoes in service, with as complete data as possible—R. H. Soule, A. E. Mitchell, Jos. Townsend, W. S. Morris, W. H Lewis, Samuel Porcher, S. A. Crone, J. W. Marden, J. C. Barber, G. W. Rhodes, A. M. Waitt, W. L. Hoffecker.

Laboratory Tests of Metal for Brakeshoes.—To conduct and report upon laboratory tests of different brakeshoes, with as complete data as possible—S. P. Bush, D. L. Barnes, J. W. Cloud.

Lubrication of Cars (continued).—To pursue its own recommendations as to tests for oil lubrication, and to consider the economics of journal bearings as suggested in its report, if feasible—A. M Waitt, W. H. Thomas, I. E. Wood, F. A. Stinard, W. K. Carr.

Airbrake Tests.—G. W. Rhodes, Geo. Gibbs, E. A. Williams, S. P. Bush, A. S. Vogt.

Airbrake and Hand-Brake Apparatus (continued).—To consider the questions raised in its report, and to include the standard levers and all other questions of importance pertaining to the subject—E. D. Bronner, Pulaski Leeds, James McGee, Wm. McWood, W. P. Siddons.

Automatic Couplers.—To advise what changes may be desirable in the standard size of M. C. B. automatic coupler shanks, and recommend a standard yoke or pocket strap for rear end attachment to cars—J. M. Wallis, R. D. Wade, T. G. Duncan, A. E. Mitchell, Wm. Garstrang, Thos. Kearsley, J. T. Chamberlain.

Mounting New and Second-Hand Wheels.—To report upon the best method for mounting new and second-hand wheels so that they shall be properly located upon the axle—J. N. Barr, Wm. Forsyth, Thos. Sutherland, G. L. Potter, T. J. Hatswell, John Hodge, J. H. McConnell.

Passenger-Car Ends and Platforms.—To consider what improvements may be made in the construction of passenger-car ends and platforms for increased strength in ordinary service and in emergencies—E. W. Grieves, C. A. Schroyer, T. A. Bissell, F. D. Adams, M. M. Martin, J. J. Hennessey, Samuel Porcher.

Coal-Car Sides.—To suggest best methods of construction and staying of the sides of 60,000 pounds capacity coal cars with high sides—R. E. Marshall, R. P. C. Sanderson, R. C. Blackall, R. McKenna, Samuel Higgins, La Mott Ames, G. W. West.

Railroads and Madness.

In this country the first construction of railways was opposed by some sagacious minds which were perturbed by the thought of the consequences that might ensue if a cow should happen to stray upon the line. It appears, however, that in Germany the projectors of the first lines had to face a more terrible possibility than even the extinction of the bovine race. They were warned, and that in all seriousness, that their undertaking would indubitably have the effect of spreading insanity among the traveling public. Among the papers of the Nuremburg Railway Company—the first to construct a line in Germany—has been found a curious protest from the members of the Bavarian Royal College of Medicine. This document declares that all the traveling in vehicles drawn by locomotives should be prohibited in the interests of public health. Such a rapid motion, it is pointed out, cannot but produce in the passengers the mental affection known as *delirium furiosum.* Even should the passengers themselves be willing to run this terrible risk, it is, nevertheless, the government's duty to protect the public. To the mere onlooker, moreover, the thing is positively dangerous. A mere glance cast at a locomotive traveling at a very high speed is enough to produce the same mental derangement in the beholder. Even if passengers are to be allowed to ruin their mental powers, it is, at least, absolutely necessary (says the Bavarian *Faculty*, in conclusion) that a 10-foot wall should be built on each side of the line throughout its entire length, so that the flight of the iron horse may in no way unsettle the public eye and mind.—*Westminster Gazette.*

Annual Report of the N. Y., N. H. & H. R. R.

The twenty-third annual report of the New York, New Haven & Hartford was issued Sept. 13. It shows a shrinkage in business caused by the general business depression, and cites reasons why the regular dividend of 10 per cent. was reduced. The menace to its interests by the electric roads is noted, and also the danger of life by the permits to these roads to cross the steam roads at grade. Some of the figures of the report are as follows: Earnings, etc., from passenger department, $14,858,828; from freight department, $10,423,547; from rents, $295,009; total gross earnings, from operations, $25,576,884; less operating expenses, (7.11 per cent.), $17,932,709; income from operation, $7,664,175; income from other sources, $109,480; total income, $7,753,655; total deductions from income, $5,379,978; balance of income applicable to dividends, $2,373,677; total dividends paid, $3,631,292; deficit for 12 months, $1,257,614.

A review of the California fruit crop by Secretary Lelong, of the California State Board of Horticulture, shows that the orchardists lost $1,000,000 by the great railroad strike, which prevented the shipping of much fruit and caused low prices for pears and peaches by glutting the markets.

The Firemen's Convention.

The Brotherhood of Locomotive Firemen held its biennial convention at Harrisburg, Pa., Sept. 10 to 20. In his address the Grand Master, Mr. Frank P. Sargent, expressed the opinion that the subordinate lodges should be required to punish members who incite a strike or participate therein except as provided by the laws of the organization. He recommended that after a strike has continued 10 days the Executive Board shall have power to decide any dispute which may arise between the local committee and the executive on the question of declaring the strike at an end. He also recommended that a new editor be chosen for the *Locomotive Firemen's Magazine* in place of Eugene V. Debs, but defended the latter because he had been elected to the position after he had emphatically stated at the Cincinnati convention that he was no longer in sympathy with the present policy of the Brotherhood.

The report of the secretary showed a balance on hand of more than $77,000, after paying $921,000 for disability claims and $115,000 in behalf of the strikers on the Ann Arbor and Lehigh Valley railroads, and about $100,000 that has been expended in the last two years out of the general fund in other matters in the direct interest of the Brotherhood in keeping up its general expenses, which make a total of about $1,125,000 expended in the last two years. The membership suffered a small decrease during the past two years, having reached at one time more than 28,000, and being now a little less than 27,000. The constitution of the Brotherhood was changed to compel every member to belong to the insurance department, and to be insured therein for at least $500.

In reference to sympathy strikes the following resolution was adopted:

On the question of defining the position our members shall take in a strike where they are not directly interested, we recommend the following:

Whereas, There has been a disposition on the part of members of the Brotherhood of Locomotive Firemen in certain localities to disrespect and ignore the agreements with their employers by going on strike in direct violation of the constitution and by-laws of the order, and a total disregard for the interests of their employer and the welfare of the Brotherhood, and,

Whereas, Such action is at all times condemned by this body as irrational, fanatical and illogical, and injurious to both employer and employe; therefore be it

Resolved, That it is the sense of this convention that such action on the part of our members be denounced, and that in the future we shall insist that they live strictly up to the laws of the order and the contracts under which they are working at all times and in all places, and we emphatically declare that when we enter into an agreement with any railroad company we will follow such agreements to the letter in accordance with the laws of the order. And we further demand on the part of other labor organizations that they do not interfere with members of the Brotherhood of Locomotive Firemen while working under such contracts, and it is the sense of this body that, so long as we are not asked to perform work outside of our particular line of duty, we will comply with any agreements entered into with any railroad company.

Frank P. Sargent was reelected Grand Master, and W. S. Corter, of Tyler, Tex., was elected to succeed E. V. Debs as editor of the *Magazine.*

Master Car and Locomotive Painters' Convention.

The 25th annual convention of this association was held at the Genesee House, Buffalo, N. Y., on Sept. 12 to 14, President William J. Orr presiding. The attendance was 91, the largest in the history of the Association. Secretary McKeon (N. Y., L. E. & W.) presented his annual report, which gave the membership as 163, being an increase of 13 since the last report. A list of the subjects that were to be discussed at this convention was published in the September National Car and Locomotive Builder. Referring to "What methods and materials produce best results in painting passenger cars that are badly cracked? and is there any method by which cracks in old paint can be obliterated without burning off?" Mr. J. Pitard (Mobile & Ohio) stated in his report that paint cracks extended through both paint and varnish, and that there is no feasible method by which they can be permanently obliterated except burning off. These views were indorsed by the meeting. It was also demonstrated that even if paint cracks could be thoroughly filled up to a surface, the expense would be fully that of burning off and repainting the body of the car.

In reference to "What style of woodwork finish of passenger cars is the most desirable from a painter's standpoint?" Mr. J. G. Keil (Chicago & Alton) declared in favor of sheathing with single boards 2 inches or 2½ inches wide, and with grooves about $\frac{1}{16}$ inch deep, and edges rounded; he said that the narrow strips will shrink but little, while a 5-inch board with a groove through the center will shrink just double and will leave a place for the varnish to run into. He said that the life of paint on sheathing as compared to a panel car is two years longer; the car is easier painted and there is no trouble in repairing, as with panel cars.

The election of officers for the ensuing year resulted in the choice of the following: President, W. T. Leopold (C. Ga.), Savannah, Ga.; First Vice-President, C. E. Copp (B. & M.), Lawrence, Mass.; Second Vice-President, George R. Cassie (L. S. & M. S.), Adrian, Mich.; Secretary and Treasurer, Robert McKeon, Kent, O. Mr. McKeon was re-elected for the 20th year, and the members presented him with a diamond pin.

Iron and Steel Production in 1893.

According to the annual report of the American Iron and Steel Association for 1893, just published, the production of iron ore in the United States in 1893 was 11,587,629 gross tons, against 16,296,668 tons in 1892, a decrease of 4,709,036 tons. The shipments of iron ore from Lake Superior mines in 1893 amounted to 6,060,492 tons, against 9,069,556 tons in 1892, a decrease of 3,009,064 tons. Our imports of iron ore in 1893 amounted to 526,051 gross tons, against 806,585 tons in 1892. The imports in 1893 were the smallest since 1885.

The production of pig iron in the United States in 1893 was 7,124,502 gross tons, against 9,157,000 tons in 1892, a decrease of 2,032,498 tons. This decrease was almost entirely in the second half of 1893, the production in the first half being 4,562,918 tons and in the second half only 2,531,584 tons. The production of pig iron in the first half of 1894 was 2,717,983 tons, which was but slightly in excess of that in the second half of 1893.

The production of Bessemer steel ingots in this country in 1893 was 3,215,686 gross tons; in 1892, 4,168,435 tons. The production of all kinds of rails last year was 1,135,458 gross tons, against 1,551,844 tons in 1892. Tin plates and terne plates to the amount of 123,106,707 pounds were produced in 1893, compared with 42,119,192 pounds in the preceding year.

Convention of Trainmen.

The Brotherhood of Railroad Trainmen held its annual convention at Baltimore, Md., Sept. 23 and 24. A large number of the members of the Brotherhood of Locomotive Engineers, Brotherhood of Locomotive Firemen, Order of Railway Conductors, Order of Railway Telegraphers and the Switchmen's Mutual Aid Association were present and attended a secret meeting to discuss the subject of the federation of those unions.

The Brotherhood of Railroad Trainmen was originally organized as the "Brotherhood of Railroad Brakemen," at Oneonta, N. Y., Sept. 23, 1883, with 13 members, employees of the Delaware & Hudson Canal Company. It was known by its first name until January 1, 1890, when, on account of the number of its members who had been promoted to various positions in the train service, the more fitting name, Brotherhood of Railroad Trainmen, was adopted. The grand lodge headquarters are located at Galesburg, Ill. Sept. 1, 1894, it had 556 subordinate lodges in the United States and Canada. Its membership is about 28,000, and is made up principally of conductors, brakemen, train baggagemen, yardmasters, yard foremen and switchmen.

Its insurance department pays $1,200 for the loss of one one hand or foot, or portions of each, when such loss renders the insured unfit for train service, and pays $1,200 at death. It had in force, Sept. 1, 1894, policies of assurance amounting to about $24,000,000, and has paid $2,610,468.64 in deaths and disability claims during the last 10 years.

Wreck in the Hoosac Tunnel.

A broken driving-spring hanger caused a bad wreck in the Hoosac Tunnel, on the Fitchburg Railroad, Sept. 8. A freight train stopped in the middle of the tunnel and about 1,000 feet east of the central shaft. The ascending grade of the tunnel had been surmounted and the stop was made to replace the broken spring hanger. As the portals of the tunnel are protected by an absolute block system which only allows one train bound the same way in the tunnel at the same time, no flag was sent back by the standing train. On the approach of a following east-bound freight train, the operator at the west portal changed the block signal from red to white, and permitted the train to pass into the tunnel. A passing train on the opposite bound track had left the tunnel full of smoke, and the following train crashed into the standing train at full speed. The engine and a number of cars were wrecked, two brakemen were killed and two firemen and an engineer were badly injured. The tunnel was blocked by the wreck for many hours.

Comfort for Debs.

On Sept. 24, Judge Ross, of the Los Angeles Federal Court, sentenced Gallagher and Buchanan, A. R. U. strikers, to eighteen months' imprisonment in the county jail and to pay a fine of $5,000 each. The men were among those who attempted to intimidate non-union men on the Southern Pacific during the late strike. On the same day Judge Knowles, of Butte, Mont., found six A. R. U. leaders guilty of contempt of court, interference with the movement of mails and interstate commerce on the Union Pacific, and sentenced them to imprisonment for thirty days in the county jail and to pay a fine of $100 each. This news ought to make E. V. Debs feel very comfortable.

The Burlington & Missouri River R. R., of the C., B. & Q. system, has built a new 10-stall roundhouse at Sheridan, Wyo., on its Northwestern extension. It is reported that a considerable amount of new machinery is to be purchased for the repair shop at that town.

Foreign Railroad Impressions.

Mr. H. C. Du Val, the private secretary of President Depew of the New York Central, recently returned from a European trip. Speaking of the railroad accommodations he had enjoyed, or, rather, endured while abroad he said:

"If any one wants an argument against government control of railroads, all he will have to do is to make one trip from the interior of Germany to the English Channel. The cars are old, stale and musty. There are no proper facilities for health and comfort, and the thing most needed on the Continent to day is a good strong competition among the railroads for passenger traffic. We actually had to get out of our carriage at one place and implore the guard to put us into another. The air was so foul and sickening that we had to go somewhere else. The washing facilities consisted of an old tin pitcher in a very small closet, over which was a lead-colored wash basin. There were no towels or soap, and no chance to get a glass of drinking water. This was on the road's fastest and 'swellest' train, and between the two aristocratic cities of Baden-Baden and Paris. We wouldn't put cattle into such a train in this country.

"The railroads in France are in worse condition than those in Germany owing to the fact that the government is just about to assume control of them and they have been allowed to deteriorate. The differenee between the railroads there and here is something marvelous. There are no dining cars or dining stations."

Second and Third Class Swedish Passenger Car.

The line and photo engravings on this page show the general arrangement, and interior and exterior views of a second and third class passenger car that is one of a number of similar cars recently built for the Hernosand-Solleftea Railroad, of Sweden, by the Skaba Car Works, of Christiania, Norway.

The car measures 57 feet 1 inch over the end sills, or over the buffers nearly 61 feet. It measures 9 feet 10 inches over the side walls, and 12 feet 6 inches from the rail to the top of the deck. There are four second class and four third class compartments, and a toilet-room. The total seating capacity is 70. The total weight of the car is about 22 tons, and the cost, exclusive of axles and wheels, about $4,000.

A SWEDISH PASSENGER CAR.

The interior of the second class is finished in teak throughout. The seats are upholstered in Brussels cloth. The car is built of oak and the body is covered outside with $\frac{1}{16}$-inch iron sheets; the windows have two glasses in each sash, and the car is warmed by direct steam obtained from the boiler in the conductor's car. The car is equipped with lamps, which are so arranged that they can also be used for candles. The platform gate is of wrought iron. The car is mounted on two four-wheeled trucks, having 6 feet 6 inches wheel base and steel-tired wheels. The trucks are constructed like those used under the passenger cars of the Norwegian State Railroads, and are made entirely of iron, except the truck bolsters, which are made of wood.

Central Railway Club.

The first meeting of the season of this club was held at the Hotel Iroquois, Buffalo, N. Y., on Sept. 26. Mr. Morford's paper on "Terminal Yards" was discussed. Committees reported on the following subjects:

"Best construction and practice in locomotive driving boxes, including consideration of the comparative merits of solid bronze boxes compared with cast iron or cast steel with bronze lining, and with cast iron or cast steel with ribs of bronze having soft metal strips.

"The best practice and recommendations as to maintaining passenger equipment in good condition between successive shoppings for general overhauling."

The Eucalyptus.

The eucalyptus was not known to Europeans until the end of the last century. Dutch explorers discovered it in Australia, but to the French is due the honor of introducing it to the world. It was the French botanist Labillardière who first examined it scientifically while accompanying the expedition which was sent out early in the present century to find La Perouse. The expedition landed on the coast of Tasmania, and there beheld large forests of eucalypti.

There are a great number of species of eucalypti. That known as the "blue gum"—the *Eucalyptus globulus*—has been known to attain a height of 400 feet and a girth great enough to contain four men on horseback. The resinous eucalyptus has a thick and easily detached bark, which is used by the Australians for roofing their huts. From its trunk oozes a red sap, rich in gum and sugar. If the tree is tapped like the maple it will yield as much as 50 gallons of this liquid. Its leaves, when subjected to distillation, produce an oil very similar to oil of cajeput. The fruit is used in Australia as a spice.

The leaves, flowers, fruit and bark of the eucalyptus are filled with glands containing this oil, which has a pleasant and penetrating balsamic odor. The odor is so strong as to impregnate the air in the neighborhood of the tree. The various preparations of eucalyptus are supposed to have antiseptic and antifebrile properties. In throat inflammations physicians sometimes advise sprays or inhalations of "eucalyptol." In Italy faith in the tree is so strong that people make rosaries of the berries, which they wear around their necks.

It is now asserted, however, that the value of the tree as a destroyer of fever-producing germs has been greatly overestimated. It is even said that not a single instance of health improvement by means of the plant has been satisfactorily established. In Italy it has been cultivated on a very large scale, particularly in the neighborhood of Rome, without accomplishing any results convincingly favorable.

An English View.

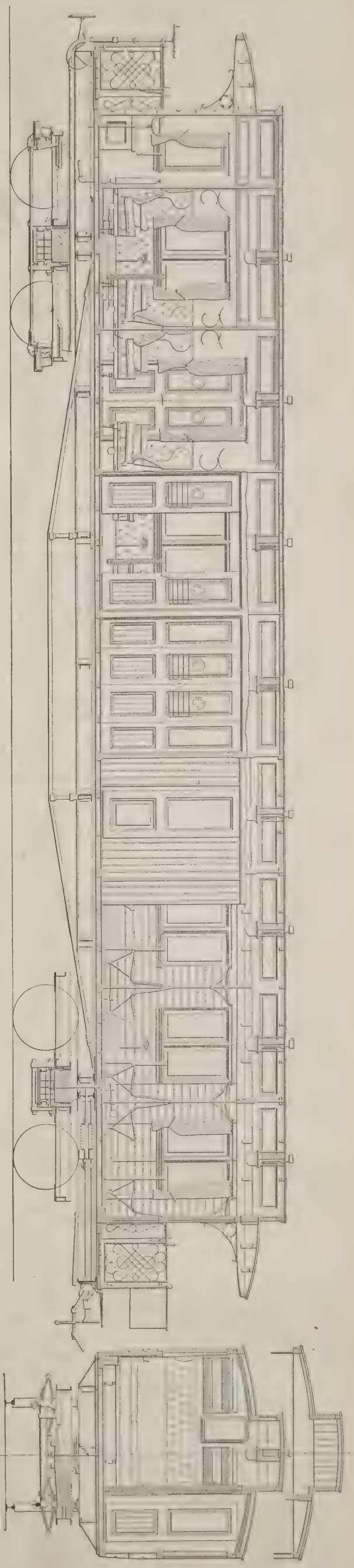
As illustrative of the dense ignorance of some of our English cousins respecting this country and its affairs, combined perhaps with some willful misrepresentation, the following item published by the New York *Tribune* is pretty good:

A religious journal of Leeds, England, publishes the following remarkable bit of American news: "A big revolution is now going on in the United States of America, and there is little doubt that the Government will be defeated. The dictator, Debs, has been driven from his palace, and he and his mistress are now hiding in the mountains. The greatest trouble has been experienced in the capital of Chicago, where Grover Cleveland has obtained complete control. The railroad at that place has been torn up and thrown into the Mississippi River, and the stockyard has been razed to the ground."

The Youngstown Car Works have shipped 76 flat cars to Havana, Cuba.

Work has begun on the reconstruction of the Boston & Maine repair shops at Salem, Mass., which were recently destroyed by fire.

The Cleveland, Cincinnati, Chicago & St. Louis road has ordered 44 passenger cars of the Barney & Smith Manufacturing Company, of Dayton, O. The West Side Metropolitan Elevated Railroad, of Chicago, has ordered 55 passenger cars of the same company.



Second and Third Class Passenger Car for the Hernosand-Solleftea Railroad, of Sweden.

Car Shop Economy.—II.

BY JAMES F. HOBART.

(*Continued from page* 134, National Car and Locomotive Builder *for September.*)

A system which would pay well in a large shop is not always desirable in small car works. Particularly is this apparent in the ironworking departments of the shop; the blacksmith shop, especially, not taking kindly when small to elaborate "systems." But in large, and even moderately large, shops, a good system (perfected division of labor) yields a large return.

Box-Car Iron Storage.—Smith shop economy commences with the receipt of and storage of the iron. Many roads use old box cars for storing iron, both wrought and cast. While a well-planned iron shed is much to be desired, a box car makes an iron-rack not to be despised by any means. One end of a car fitted up with square boxes, or pigeon-holes running half the length of the car, makes a good arrangement for keeping rod iron, both round and square; also for piping, boiler tubes, and all other rod metals.

A car fixed up with rows of compartments on either side answers very well for the keeping of castings, but there is nothing which even approaches in economy a well-appointed storehouse for this purpose, where all the iron will be under one roof, and where it can be readily got at by the storekeeper. The box-car method will do for small shops, but it don't pay for large concerns. Too much time is lost in getting at things, putting them away, locking up, etc.

Some large shops have no better place for castings than open platforms built up out-of-doors, where the iron is exposed to snow, ice and rain all the year round. It seems strange that men who make even a pretention to economy will countenance such things; but they do, for seeing is believing. Next to the open platform abomination for castings (and some concerns keep finished bolts so, too) is the open-end shed for bar and rod iron.

The Contract Foundry System.—Upon the subject of castings, and foundry practice in general, it is not the office of this discussion to speak, further than to say that a good system of contracting has its advantages when applied to railroad foundry work. Under such a contract, the railroad company would furnish the plant, iron, coal, power, etc., and the contractor will furnish the brain and muscle work. Then, in case castings are lost, both parties lose. The railroad company loses the coal, power, interest on first cost, and wear and tear of plant, while the contractor loses the time and labor of putting up the molds, pouring, and breaking up the defective castings. The system has some disadvantages, but as stated, it also has some good points.

Stock-Getting System.—The matter of getting stock from the storeroom in sheds to the blacksmith is a much greater problem than it appears at first sight. Evidently nothing is more simple than to let a smith go out of the shop into the storeroom and pick out a rod of iron, shoulder the same, walk back to his forge and go to work on his job. It *is* simple, and nobody but a simpleton would permit such practice. It is demoralizing to the whole system of shop economy. It is a waste of time, coal, iron and energy.

For instance: A smith needs 4 feet of iron to make an eyebolt of. He goes to the storeroom, leaves fire burning, striker waiting (if he don't send the striker and loaf himself while the man is gone) and strolls out to the storeroom; In looking for a suitable piece of iron he pulls two other pieces out of the particular rack in which that size belongs. These pieces he throws on the ground—too much work to put them back in the rack again. So they are thrown down for somebody else to put back. But "somebody else" never does any work around car shops. When the smith finally selects a piece of iron he takes one 6 feet long, instead of 4, in order to be sure and have iron enough. The extra 2 feet of iron is cut off, stood up back of the forge to be handy for some other job (which never comes), and there it stands for months. Time is lost in handling it over, picking up as it falls down, until finally the piece of iron is thrown into the scrap heap.

A Proper Messenger Service.—There should be, between the iron-store house and the smithy, a well organized messenger service, much the same as described in the first paper (National Car and Locomotive Builder, September, page 134) between the storehouse and wood shop. No smith should be obliged to go for anything, not even his pay. That forge of his costs money to run when it is idle as well as when it is doing useful work, therefore it should be made to work during every minute possible. Not a very elaborate messenger service will be required, a couple of well-grown boys can do it all and help the storekeeper a good deal besides. In connection with the messenger system, there should be a method of ordering so arranged that a demand or requisition for each bit of iron or steel may be signed by the proper person before going to the storekeeper. As no order will be honored without that signature, a check is at once put against the wasteful use of metal, and the ordering of wrong kinds purposely or accidentally. Under such circumstances a piece of iron just long enough to do the work is sent in and charged to the order to which it belongs, and no stock will be wasted.

Tracks and Tools.—A narrow gage track should connect the storehouse and the smithy; in fact, the track should run the entire length of the latter, perhaps with one, perhaps with two tracks, according to the demands likely to be made upon its capacity. I have seen large shops where a wheelbarrow or a two-wheeled truck was the only means of transportation in and around the smith shop. And sorry enough was the work made by both wheelbarrow and truck in trying to get 200-pound loads of iron, with tools, iron and half finished work strewn along the pathway. A three-rail track is the best, then light cars and standard trucks can be run into the shop if necessary, and both heavy and light work conveniently handled.

Arrangement of Tools.—Right beside the car track should be located a shear or cutting up tool. But if she shop is a large one a rod-cutter may profitably be located in the stockroom and driven by electricity or compressed air if too far from the main shop for convenient belt service. But wherever the rod-cutter is located, be there one or more, put a pointing machine right beside each and every one of the cutters. It is poor economy to make smiths point rods by hammering, and no bolt is perfect without being pointed. Some bolt machines make better heads if the blanks are pointed before being put into the machine. And let the pointing tool be a good one.

Cutting up Stock.—Poor economy is the rule in many shops in this part of the work. Too much light stock is cut up on the heavy, slow-moving shear. Too much is cut by hand and too much is also cut under the steam hammer. Some shops have quite elaborate cutting-off tools for use with the steam hammer, and a heavy tool is frequently seen cutting off one-quarter and three-eighths iron, while two or three smiths are standing around waiting for a chance to get their work under the hammer.

Stock can be cut up well under the steam hammer, and good work can be done with almost any cut-off arrangement from three plain pieces of square cold iron, to elaborate spring shears; but it don't pay. Just realize that a cylinder full of steam is used for every bit of iron cut off, and some idea of the wastefulness of such rod cutting may be obtained. Steel should always be cut from the rod with a saw. Small cheap automatic (when once started) cold sawing machines are in the market, and one or more prove a decidedly good investment in any shop, no matter how small. One of these saws can be started on a bar of steel from one-eighth to four or five inches in diameter, and the little machine will cut it through smoothly and clear, stopping as soon as the piece is cut off. It is a great saver of steel and time.

Smokeless Forges.—Shop economy requires that forges should be used which do not cause much smoke. All sorts of contrivances have been tried—blowers, ventilators, smoke-pipes, etc.—to remove smoke and keep the air of the smithy clean, but they all fail to hit the mark. The best way to keep smoke out of the shop is not to make it, in the first place. Drafts and local air currents cause a good deal of the forge smoke, and if a plain piece of boiler iron be bent up like the letter C and placed around the fire on top of a forge the local currents are prevented, the smoke and gas go straight up, and considerable of the smoke is burned. A shop having each forge fitted thus is much more free from smoke than where flat, completely open forges are used.

Bending-Machines and Forms.—Several simple lever machines, or "rigs," for forming bends in small rods or bar iron should be distributed among the blacksmiths, and care taken in giving out the work, so that, if possible, all work requiring bending should go to the smiths having the tools mentioned. The saving in time and in quality of work between hand and machine bending is considerable. The bending of braces, eye-bolt ends and coupling-pin lifters may be quickly and easily performed by a little machine, or rather a jig, which fits on top of the anvil and is held by a pin and a cotter through and below the hardy hole. The bending of coupling and chain links is also done in an expeditious manner by one of those little machines, which cost little, may be made in the shop, but do save many times their cost every year.

Piece Forging.—In most kinds of manufacturing, where the perfection of labor division is found, hardly a single part or portion of the work is finished at a single operation or by a single machine. The same principle of labor division may be advantageously carried much further in the blacksmith shop than is practiced at present. Certain parts of a forging can be done to advantage by different men, each one using only one set of tools and then passing the work along to the next man who has around his anvil only the tools necessary for the next separate operation. By dividing up the work in this manner, more time and expense are saved than may be thought possible at first sight. When a smith has several forgings to make of the same kind, but requiring various forging operations, he usually carries all the pieces through one operation at a time, laying one piece aside when finished, taking up another, and in turn laying that aside. When he commences the next operation the pieces must be reheated. All the heat put into them in the previous operation has been lost. By passing from one smith to another for each operation a saving is possible besides a much increased speed of manufacture.

Steam Hammers.—It is well understood that the steam hammer effects great economy in the smith's shop, but the question has not received the attention it demands. Usually, one or two hammers—big enough to do the heaviest work likely to come along—are put up in the smithy, then that department is considered extremely well equipped in that line. So far, so good; but it does not go far enough. A man forging a one-eighth-inch bit of metal under a 10 or 20 ton hammer, is no unusual sight, while perhaps the next minute will find the same hammer hammering a billet made out of three car axles welded together. More division is needed in the steam hammer line. Put in more of them. Set up some light hammers for the small work. Don't use a 12-inch cylinder full of steam to strike a one-pound blow. Put in one or two light steam hammers, then add a power hammer or two, a Bradley or some other good belt-driven concern. It don't cost much to run one of these tools, and they do as good and as much light work as can be turned out on the big hammer. And they will do more. When light blows are required, the belt-driven hammer will strike ten blows to the big hammer's one, and the ten blows cost less than the one.

Tool Racks and Stands.—Go into the smith's shop some day and estimate how much time is lost by all the men in hunting for, selecting and getting out the tools needed for doing certain work. The average blacksmith is worse than a boilermaker as regards tools. The latter keeps his in a nail keg, the former in a pile under the bench, and it is a job to sort the ones needed. Provide racks for tools; they save time. See that the tools are kept in the racks; that saves more time.

Oblige each smith to make for his own use a little contrivance of round iron, which can be attached to the anvil block, one end of the iron being driven therein, the other end into the ground or floor. Tools being used on the job in hand should be stood upon end, leaning them against the little iron contrivance above referred to. A good deal of time will thus be saved in picking up tools at the very time when wanted the most, *i. e.*, when the hot iron is cooling on the anvil while the smith is clawing around on the ground trying to get hold of a flatter, a fuller or a cutter.

Lost Time and Loafing.—A source of very heavy expense in a good many smith shops is the laziness or want of life evinced by the smiths. Many a time I have watched car-shop blacksmiths (and some others, too) at their work when it seemed as if their sole aim was to strike as few blows as possible on the iron, and to get it cool enough to replace in the fire with as little labor as possible. Good work cannot be hurried, but railroad shops have no need of professional time-killers as blacksmiths. The piecework system is about as good a cure for this evil as any physician can prescribe.

Pension Old and Faithful Hands—Occasionally old men are seen at work, or rather at "time killing," who have outlived their usefulness in the shop. These men are a source of considerable loss. They are necessarily slow and moderate in their movements, and actually do very little work. They have passed a lifetime in the company's employ, and no foreman will discharge one of them, nor should he. The men have been faithful and have given the best years of their life to the company, and the corporation should continue their pay as long as they want it. But their presence in the shop is not productive of economical work. They are slow, and the other workmen unconsciously adopt as theirs the pace of the old men, thus reducing greatly the efficiency of the whole gang of smiths. The old men should be retired on a pension, equal to the pay they receive. Then their places should be filled with new blood, with "hustlers," and the output of the shop will be greatly increased.

(TO BE CONTINUED.)

A Train Wrecked by a Tornado.

On the afternoon of Sept. 12 a west-bound passenger train on the Iron Mountain Railroad met with an unusual disaster at Charleston, Mo. The train had just reached the city limits when the passengers and crew noticed the approach of a funnel-shaped cloud which was dealing destruction to everything in its path, uprooting trees and hurling missiles before it. The train and the tornado met, and the wind lifted the cars and landed them 20 feet from the track, almost turning them over. Two persons were killed, and 11 injured.

Almost immediately after the wreck occurred flames were discovered in the rear car of the train, in which several passengers, including a mother and child, were imprisoned. A brakeman named Cartwell acted promptly and with good judgment. Battering the door in with a piece of wood, he entered and succeeded in extinguishing the fire by hand grenades. Aside from the wreck, the damage done by the tornado was slight. Its path was not over 30 yards wide, and it did not extend more than a mile.

Twenty-five miles of the Congo Railroad, forming the first section between Matangé and Kengé, are now completed. The work has cost $100,000 a mile. The line will be 93 miles long in all, and will connect the immense waterways above Stanley Falls with the sea.

The Schenectady Locomotive Works have just finished two 59-ton passenger engines for the Boston & Albany Railroad. The cylinders are 19 by 24 inches, and the boilers are 60 inches in diameter, and carry 180 pounds steam pressure. Each has 298 tubes 11 feet long. The fireboxes are 40 inches wide and 90 inches long, and the grate surface is 25 square feet. The driving wheels are 69 inches in diameter, and the tenders carry 4,000 gallons of water.

Dynamometers Cars of the Paris, Lyons & Mediterranean Ry.

The *Revue Générale des Chemins de fer* contains an article written by E. Chaball descriptive of two dynamometers cars built at the works of the above named road for measuring the amount of traction or compression exerted at one end of the car. Two were constructed in order that both might be used in the same train, one being coupled to the engine and the other in the center of the train, the two portions of the train thus differing only in the special arrangements, such as the lubricating oil, etc., that it is desired to compare, the speed, atmospherical conditions, and the profile of the line being precisely the same for both portions; and it is in this way that the Paris, Lyons & Mediterranean Railway Company have determined the relative value, in so far as the resistance to traction is concerned, of bronze and pure metal axle-bearings of the one part and of the various lubricating oils on the other part. The amount of traction measured by the dynamometer car at the head of the train gives the resistance of the whole train, and that measured by the center car gives the resistance of the second portion of the train, the difference between these two amounts being the resistance of the first portion.

The cars are mounted—like the great majority of the company's stock—on three axles; the two outer axles having exterior journals, the wheels of which are fitted with compressed-air brakes, the center axle, which is used for registering purposes having interior journals and no brakes. The carriage frame is divided into two compartments, one containing the registering appliances and the other a workshop, both compartments being lighted by gas.

The cars have been constructed with a "Chevalier and Rey" coupling at one end, similar to those used by the Paris, Lyons & Mediterranean Railway Company, and are coupled in precisely the same way as the ordinary carriages. The author states that the "Chevalier and Rey" couplings realize the two following conditions: 1st. The pressures on the two buffers are always equal; 2d. Once the coupling is made, and a certain pressure produced, the pressure in course of running can never descend below the initial pressure; it remains equal to it after there has been traction, and it becomes higher if there is compression between the two vehicles.

The coupling consists of a large buffer-spring, of which the shackle is fixed to the back of a balance-mechanism, and on the extremities of which the two buffer rods act; the draw-hook is connected to the front of the balance-mechanism by a rigid rod on which is fixed a vertical frame containing two dynamometrical springs. One of these springs registers the force of traction, and the other that of compression, each consisting of six plates clamped together. They have a flexibility of 0.7 of an inch per ton, and can sustain a maximum force of 10 tons. To this frame the pencil is connected, which registers exactly on the paper the forces of compression and traction by means of mechanical contrivances which the author describes in detail. For registering the speed and the unrolling of the paper, one of the axles is prolonged outside the wheel of the car, and carries a box containing a shaft supported on two bearers, and provided with an endless screw actuating by means of a helical wheel a vertical shaft which enters the interior of the car. The transmission is made in such a way that the paper is unrolled 6.30 inches per mile that the car runs.

By means of another pencil, connected with a clock, the time is registered; and by means of an electric current, the engine-driver, by pressing a button as kilometer-posts, stations, or other points on the line are passed, actuates a pencil which makes a mark on the paper; or by means of a mirror outside the car inclined to the man in charge at an angle of 45 degrees, he himself can register these points without the intervention of the engine-driver.

The wind is also registered by means of a wind gauge, mounted on the roof of the car, which communicates its rotary movement to a shaft, which is so arranged that every time a car has traveled a kilometer in relation to the wind, an electric current passes which displaces a pencil similar to that which registers the time, and the time corresponding to the interval between two marks made by this pencil is accordingly that which the relative wind occupies to run over a kilometer. The direction of the wind is also registered by a vane mounted on a vertical shaft by means of which the angle made by the wind with the axis of the car is registered.

The author states that these cars have been used a great number of times, and have thoroughly answered the purpose for which they were made; in consequence of the results obtained by their use, the Paris, Lyons and Mediterranean Railway adopted pure bronze bearings, and an oil consisting of 90 per cent. of colza oil mixed with 10 per cent. of mineral oil. They have also been successfully used in determining the influence of curves of small radius on the resistance of trains to traction.

A dispatch from Ha-Noi, the capital of Tonquin, says that an unsuccessful attempt to wreck a train from Langson was made by pirates on Sept. 20. They stopped the train, killed the Chinese engineer and kidnaped a railroad conductor and an employe of the railroad. The pirates were driven off and were afterward pursued by a body of French troops.

Improved Reverse Lever Quadrant, Wabash Railroad.

The engravings presented herewith reproduce working drawings of an improved reverse lever quadrant and reverse lever latch adopted on the Wabash Railroad about a year ago. The arrangement was designed by Mr. J. B. Barnes, Superintendent of Motive Power and Machinery of the road, to whom we are indebted for the drawings and for the information concerning the manufacture of the quadrants, and the economical results in coal consumption obtained by the improvement in practice. The quadrants are made at the Springfield (Ill.) shops of the company, which are under the supervision of Master Mechanic S. W. Jeffery. They are made of a single bar of wrought iron 1½ inches by 2¼ inches, and case hardened after the teeth are cut. The teeth are spaced ⅜ inch apart, measuring from center to center. The base of each tooth is ¼ inch in cross section, which tapers to ⅛ inch at the top. The latch is made of either wrought iron or cast steel, and is also case hardened. It has five teeth of the same dimensions as those in the quadrant.

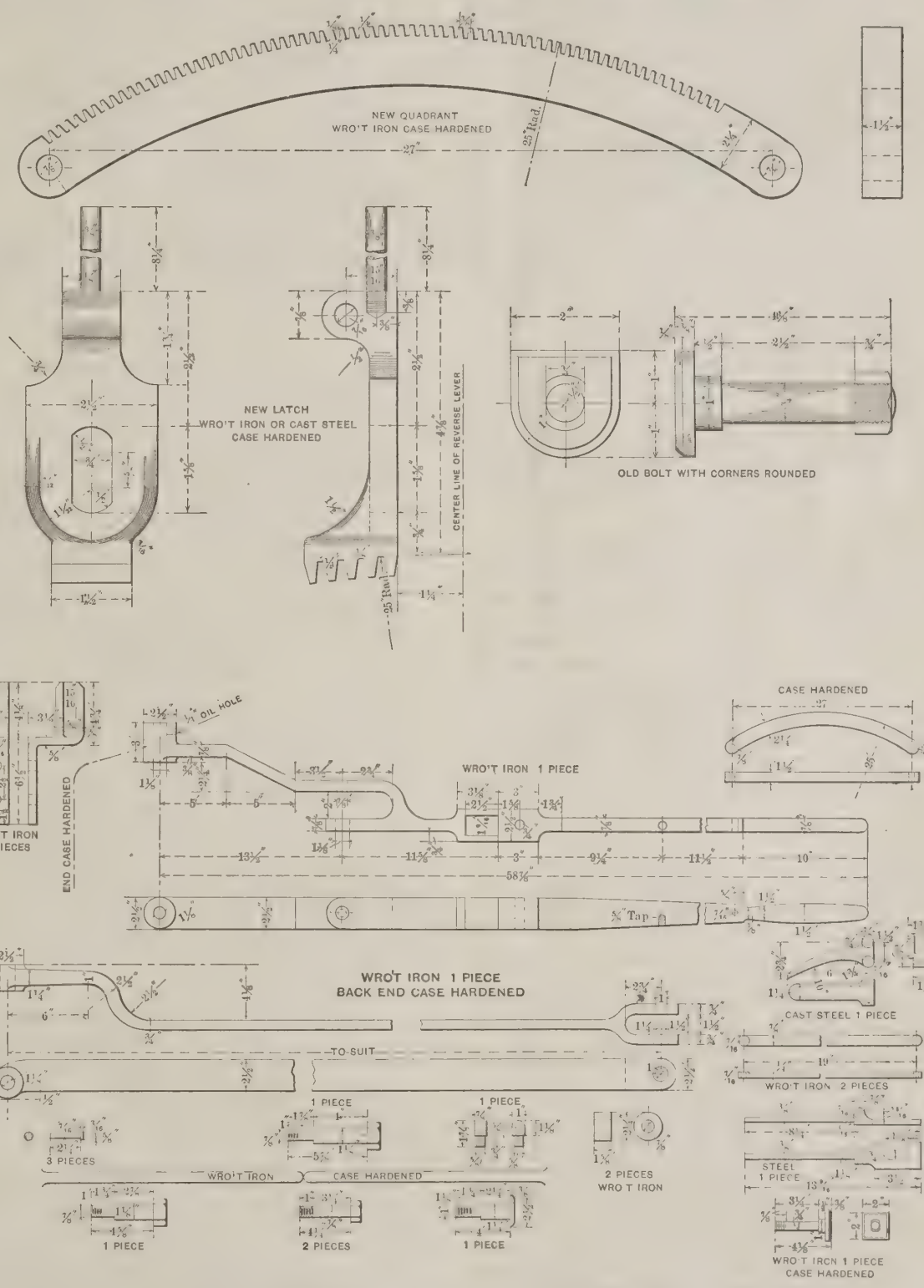
"Five engines for four months in 1893—23.2 miles to one ton of coal.

"Five engines for four months in 1894—37 miles to one ton of coal.

"Showing the remarkable difference of 13.8 miles per ton of coal in favor of the new quadrant. This difference can not all be claimed for the improved quadrant, for all enginemen had been instructed to use every effort to increase their mileage per ton; the average miles per ton of coal for 1893 being 23.31, as against 23.81 for 1894. This being for the whole road, our fiscal year ending June 30."

Five dollars covers the cost of the material and workmanship of one of these quadrants and a suitable latch.

Philadelphia & Reading engine 694 hauled a train of six coaches recently from Camden to Atlantic City, 55½ miles, in 52 minutes. The engine is one of the Vauclain type of compounds turned out by the Baldwin Locomotive Works. The fastest portion of the run was made between Williamstown Junction and the meadows, a distance of 37 miles, which was covered in 30 minutes.



Improved Reverse Lever, Quadrant and Latch, Wabash Railroad.

The reverse lever is made of wrought iron, and its construction and dimensions, as well as those of all the details of the lever, latch and quadrant, are very plainly shown in the drawings. In manufacturing these quadrants they are cut on a small milling machine. A template quadrant is used which is firmly secured so as to turn from the central point; to this template quadrant is a latch; the operator merely bolts the quadrant blank to the template and the machine feeds the cutter through the quadrant; he then moves the quadrant one tooth in the latch and proceeds as before. By this method all quadrants are cut exactly alike. The machine is run by an apprentice at 10 cents per hour, and the time for cutting one quadrant is four hours. For cutting the latch one-half hour is required.

Speaking of the results obtained on the road by the use of these quadrants, Mr. Barnes says: "We have quite a number of our engines equipped with this quadrant, and the monthly performance sheets show quite a decided improvement in fuel consumption over the old style. Taking five engines which have had the new quadrant the longest time, we glean the following averages from the performance sheets:

Northwest Railroad Club.

The first meeting of the Northwest Railroad Club will be held this season in October, instead of September as usual, on the regular day of the month. The discussion will be upon Mr. Foque's paper upon "Compound Engines," published in the September NATIONAL CAR AND LOCOMOTIVE BUILDER. The advisability of holding meetings alternately in St. Paul and Minneapolis will also be considered.

Pennsylvania made over half the total production of pig iron last year.

An Irishman asked a Scotchman one day "Why a railway engine was always called she?" Sandy replied: "Perhaps it's on account of the horrible noise it makes when it tries to whistle."—*Pearson's Weekly.*

Patrick O'Leary died in Chicago, Sept. 15, aged 75 years. His claim to fame laid on the fact that he was the husband of the Mrs. O'Leary that owned the cow that kicked the lamp that burned the shed that started the great Chicago fire in 1871.

The Traveling Engineers' Convention.

The second annual convention of the Traveling Engineers' Association met in the Elks Hall, at Denver, Colo., Sept. 11. President C. B. Conger, Road Foreman of Engineers of the Chicago & West Michigan, made an address in which he said:

"Let us aim to keep pushing ahead; now that as an association we have got under way in good shape as the result of concerted effort, that fact must not be lost sight of; our combined efforts must be systematized so they will bring about the best results with the least work. Do not think we will run out of subjects for discussion. There is always something new coming up to be looked after. By the time we have gone over the most important ones they will be ready for us in new shape or with new difficulties with the old methods.

"We have got to keep up with the times and be just about one lap ahead of the perfected devices, so we can understand what trouble they had while perfecting them, as the old faults are likely to crop out again. If the troubles we have with new devices to be used on locomotives and the successful remedies applied could be generally known, it would save lots of trouble and expense in experimenting on the same lines followed by other traveling engineers. No matter what else you do, don't get into a rut or leave any of your men there even if it is pretty good walking in some other man's tracks. In the march of progress we can follow the pushing, intelligent man of an inquiring turn of mind and not get far away from the main road to success. But the road may be followed in Indian file, treading in each other's footsteps; the narrow path gets worn down so far below the surface of the surrounding country that we can't see out at the side and notice those who are passing us—getting promoted. The locomotive engine has not reached the limits of its improvement yet. Our master mechanics are making them better every year, and we must keep up by corresponding improvement in the manner of handling them and getting work out of the machinery. "There is no doubt that there has been a great improvement in coal records per mile in the past few years; we can't see it always on the performance sheet, because it is swallowed up by the heavier tonnage of the train pulled by the same engine and higher speed made by all trains. If the higher speed and heavier trains of to-day as against 10 years ago are taken into consideration, we could compare the performance sheets of the two periods with more satisfaction. In the development of our present railroad facilities, the cars were made larger, carrying more load; then engines had to be made larger to pull them, speed increased up to the safety limit, air brakes put on so as to stop in these limits, time to be used for stops almost eliminated from the card, and the question arises. Has the skill required to handle the equipment increased? We think it has in a high degree, and our officers look to the traveling engineers to do their best to help out the skill and the intelligence of the enginemen, so in every way to increase the efficiency of it right along. It can be done. The enginemeu who are with us need these educational advantages; let us help them to gain them. Encourage the man who learns something out of a book or by instruction from those who are better informed, who have gained their knowledge by experience. When this young man meets difficulties he will be already half prepared to overcome them.

The report of the Secretary was presented, and showed an increase of 21 active and 9 associate members during the year. One active member was lost during the year by death and two members had been dropped. The present membership represented 108 active and 26 associate members.

The report of the Treasurer showed that the finances of the association were in good shape. Messrs. Clement E. Stretton, of Leicester, Eng.; J. M. Barr, of the Chicago, Milwaukee & St. Paul, and C. P. Cass were elected associate members. C. A. Dixon of the Burlington, G. N. Wells of the Wisconsin Central, W. G. Devine of the Rio Grande Western, F. Selgrath of the Rio Grand Western, J. Kerchberger of the Union Pacific, D. Meadows of the Michigan Central were presented for active membership.

A paper was read from Mr. C. E. Stretton on the difference between English and American locomotives in "cinder throwing." Another paper was read by Mr. George Royal, Sr., on injectors and lubricators, which gave particulars of their invention and perfection. President Jeffery, of the Denver & Rio Grande, addressed the convention and commended its objects.

The first report on subjects presented to the convention was on "The true and false economy in caring for and the safe handling of the air brake under all conditions; and, when examining a fireman for promotion, how much knowledge of the airbrake is it necessary for him to have to be considered fully competent to take a train out on the road? The report said that far less attention than even ordinary prudence demanded had been given the airbrake, for to this mechanism we look for safety, the most important qualification to be considered in the operation of our railways. Some of the faults of its treatment are that the braking power on cars is reduced below the demands of good practice to avoid flat wheels. The advantages of an air-pump governor are denied some engines, resulting not in economy as desired, but damage to rolling stock. Air-pumps are used when in wasteful condition. While it is a recognized fact that the different appliances partaining to an engine or train require occasional care and attention, air-brakes when once attached to a car or engine are expected to perform their proper functions with no care so long as they will do their work. The traveling engineer should have authority to give requisite instructions, with power to enforce them, without the formality of appealing to his superior officers.

Firemen examined for promotion should be able to follow the performance of the compressed air from the pump throughout the brake apparatus, and should understand the pump well enough to intelligently report its needed repairs, and know the difference between the pump being stopped by the governor and by lack of oil. He should also know the cause of the pump heating, and the effect of water in the reservoir, and he should understand the proper handling of of the brake in service. The committee consisted of Messrs. R. D. Davis, T. A. Hedendahl, C. E. Weaver, C. E. Schraag, L. S. Putnam.

"What Relation Does a Clean Engine Bear to the Economical Use of Oil and Supplies?"

The committee on this subject consisted of Messrs. J. W. Hall, J. B. Johnson, Chas. B. Hogan, C. W. Poole and P. E. Riley.

There were replies from 38 roads to the committee's circular of inquiry relative to this subject. Considering these represent current practice, over half the roads wipe their engines clean at stated periods, nearly all giving preference to passenger engines, freight engines next, and switch engines last. Coal oil is generally used to loosen dirt and grease. It is generally believed that more oil and waste are used on dirty engines, that more wiping is needed on pooled engines, ane that a clean engine prompts economy and improves discipline among enginemen. This condition is also conducive to economy in oil for lights, repairs, and in the life of wearing part. It also facilitates inspection. The average cost of wiping an engine clean is given as 41 cents. The committee concluded its report by saying:

Clean flues and grates give greater heat and effect a saving of coal. Clean boilers when kept well washed, so they will not prime (which is often lost sight of in rush of business), effect a saving of valve oil, also less valve-rod and piston packing is required. Close attention to smoke arch, nozzles and other front end work, more especially keeping nozzles well cleaned out, makes a very perceptible showing on the coal pile. We could follow to any length, and from every point of view the conclusions must and would be the same. From the correspondence received on the foregoing subject it is plainly evident that practice differs greatly on railroads throughout the country. Nevertheless, a clean engine is a good object lesson, and teaches neatness, and this leads to economy.

What Are the Best Means of Saving Coal?

The committee on "What are the best means of saving coal and increasing or holding the mileage per ton at a desirable figure" presented a report of which the following is an abstract:

Questions one and two were answered by 36 members, and the replies show that two hours are usually allowed for raising steam on engines in roundhouses, and that hostlers are generally instructed to keep light fires in engines waiting for trains so as to avoid popping, and that such instructions are obeyed.

Q. While on the road do your firemen exercise the necessary care in firing the engine to avoid blowing off steam?

Thirty-one answered yes. Five report that firemen disobey instructions, expecting their seniority will enable them to hold their jobs.

Q. Do your firemen observe the shutting off points along the road?

Twenty eight answered yes, Eight answered as a rule they do not.

Q. Why do you bank fire against the flue sheet?

Ten report bank fire against flue sheet to protect flues, and to keep cold air out of the flues, and to keep up uniform expansion of flue sheet. Your committee would suggest that the practice is good. It protects the flues, saves the brick arch, and saves boiler work.

Q. Do you find the brick arch a medium for saving coal?

Thirty-two report the brick arch a medium for saving coal. One reports no, because firemen throw coal over the top of the arch. One reports no, not unless flues are kept clean. Your committee is somewhat inclined to think that the last two answers to questions are commendable to the convention for a few practical hints on stopped flues, and poor firing of engines, especially those equipped with brick arches.

Of 35 roads replying, six pay coal premiums to engineers and firemen to induce economy; 29 do not; 16 oppose it; six say it makes firemen dishonest; ten favor it, six have tried it, and four have done so with good results.

Q. Does your company employ a traveling fireman?

Twenty-eight report no traveling firemen. Five report that they employ traveling fireman.

Q. If you do not pay premiums what course do you pursue to encourage engineers and firemen to save coal?

Ten report, by posting performance sheet in roundhouse for engineers and firemen. Five report: We expect engineers and firemen to work with a spirit of emulation.

Your committee is of the opinion the engineer is not sufficiently drawn into this question. It is apparent to the committee that the engineer should assist the fireman in saving fuel. A good fireman may show a poor record with a poor engineer. The engineer may be in the habit of pumping his engine with his injector working at full range, where the injector will supply the boiler at fine range. Such engineers will come into the roundhouse and report to the engine dispatcher that he don't think "that fellow can keep her hot." Other engineers may not keep their piston packing and valves in first class condition, valves and piston blowing several days before reported. You are all aware valve and piston packing blowing will make an extra large hole in the coal pile. Other engineers may be in the habit of working 16 inches of steam after the train is in motion, where 12 inches of steam would do better. Passenger engineers can assist much by working their engines at high expansion as soon as possible after the train is started. All these kinks, if practically carried out, would bring a smile to the fireman and dollars to the company.

Q. How many miles do you allow in switching and construction service per hour?

Twelve report six miles for switch engines, and eight miles for construction. Eighteen report eight miles for switch, 10 miles for construction engines.

Q. What number of miles do you consider it practical for an engine to run before overhauling as regards fuel consumption?

The answers to this question do not indicate the following of a uniform practice, owing to bad weather on many roads. The number of miles run before flues are removed on account of incrustation ranges from 35,000 to 175,000, as reported from 22 roads. One reports, no trouble with mud or scale; we use a boiler compound. Your committee would suggest that in their opinion it is a great financial gain to remove flues when lime coated. The incrustation on the flues is a non-conductor of heat, therefore a waste of fuel while using such flues.

Q. Are your engineers called to a strict account for a loss of time on freight and passenger? If so, give the minimum time lost that will call for a statement.

Thirty-two report: Engineers must explain cause of delay of 2 to 5 minutes on passenger, and 5 to 15 minutes on freight.

Q. Is 10 minutes on passenger train or 30 minutes on freight train considered by your management worth a ton of coal?

Thirty-four report: Must make the time regardless of coal consumed.

Q. What front end do you use, extension or short?

Thirty-two report use extension front with good results, have no trouble on the road, have less fire claims, hold up steam to the last mile. Two report best results with short 18-inch extension.

Q. Have you any engines built with firebox on top of frame? If so, what results do you notice as compared with standard box?

Eighteen reporting have engines with firebox on top of frame, burn less coal, steam better, have more heating surface.

Your committee finds that black smoke is an evidence of imperfect combustion. A good brick arch, when properly cared for, is a very valuable aid to economical combustion. The great mass of hot bricks helps to maintain the temperature of the firebox even, and is often the means of raising gases to the igniting temperature before they pass into the flues. Projected as it is into the middle of the firebox, it lengthens the journey of part of the fire gases and acts as a mixer of the elements that must combine to effect combustion.

Messrs. M. Mast, W. E. Chapman, J. W. Sheldon, George H. Brown and P. A. Rossiter formed the committee on this subject.

A report was presented on "A form of examination of firemen for promotion, and new men for employment," and on "How can traveling engineers improve the service when engines are double-crewed or pooled?" We will publish a synopsis of these in our next issue, when we hope to be able to give the essence of the discussions on these subjects.

The election of officers for the ensuing year resulted as follows: President, C. B. Conger, of the C. & W. M. Railroad; First Vice-President, R. D. Davis, Illinois Central; Second Vice-President, George H. Brown, of the Chicago, Milwaukee & St. Paul; Secretary, W. O. Thompson, of the Lake Shore; Treasurer, D. R. McBane, of the Michigan Central

The Executive Committee was instructed to correspond with a like committee of the Air Brake Men's Association with the view of having it meet at the same time and place as the engineers next year.

The convention adjourned Sept. 13, to meet at Pittsburg, Pa., in September, 1895.

Echoes from the Master Car Builders' Convention.

Some very interesting, instructive and occasionally amusing things are said during the sessions of the M. C. B. annual convention that do not gain general publicity, because at the time immediately succeeding the conventions the technical papers have more than they can do to properly present full reports of the proceedings, and by the time the secretary's report is issued the matter is deemed too old for publication in the papers. The following discussion relative to passenger cars destroyed occurred at the last convention, and is worth reading.

During the discussion of the rules of interchange Mr. Waitt made the following proposition:

There is one addition I would like to make to the rules It will be an advantage to have it clearly defined. I recommend we add this: "In settlement for passenger cars destroyed, depreciation due to age shall be estimated at four per cent. yearly depreciation; provided, however, that allowances for depreciation shall not in any case exceed 60 per cent. of the new value."

Mr. Mitchell: Last year we lost five cars, and we made a settlement with the insurance company. The insurance company insisted on six per cent. Through an insurance broker we discovered that some had settled on the basis of three per cent. We insisted on three per cent. and got it. As some of the best companies, among them the London, Liverpool & Globe, have settled on the three per cent. basis, I think we ought to make it three per cent. instead of four. I make that amendment.

Mr. Leeds: I think some price ought to be established. Thirty years ago cars cost double what they do to-day, and they are built in better manner now. Sixty per cent. of those old cars would buy a new car; better than they ever were.

Mr. Barr: Three per cent. is all right, generally; but where we get most injury in interchange of passenger equipment is in the case of sleeping cars, and three per cent. would not cover the depreciation in that case. They get out of fashion; that is the principal depreciation in sleeping cars. I am satisfied with three per cent. for everything else.

Mr. Bissell: I do not think it would be wise to adopt a rule of that kind. Our company is not a party to this rule and therefore is not affected by it. Take a car ten years old, and suppose we have had that car in the shop just before it was destroyed, and have put it in perfect condition—taken off the bottom lining and stripped off the outside, replaced every defective timber; dressed the car in modern style, put in new end sills; put in the composite frame; put an iron plate between the timbers, making it a great deal stronger; put in new platform; new chairs, electricity, hot and cold water, new style of closets and new trimming. I have got to put on the insurance paper that that car is ten years old; while the fact is it is worth twenty per cent. more than when it was built. Is the age any criterion of the value? The only rule we can go by in settling for passenger cars, and especially sleeping cars, is simply by the rule of equity and the condition of the car at the time we make the settlement. There is no rule of percentage that would be equitable. This especially applies to passenger cars, where the equipment is kept up in the best shape; and if you settle for the car, on the basis of the age of the car, it would work injustice.

Mr. Barr: In view of what Mr. Bissell says, I withdraw my second to the amendment. I feel strongly tempted to amend and put a percentage of appreciation on these cars, instead of depreciation. However, I don't like to be radical. (Laughter.) The fact of the matter is, I think we might just as well let this matter alone, and whatever cases come up settle between us.

The motion and amendment were both lost.

A power-building designed for the occupancy of 64 different small manufacturing concerns is under construction at Pittsburgh, Pa., in which no belting, shafting or pulleys will be used. A complete system of electric motors will be installed on each floor, the power for which will be supplied by a 250 horse power steam-driven electric generator located in the basement.—*Engineering Magazine.*

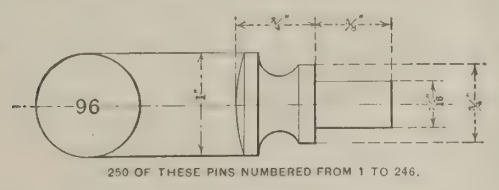
The *Electrical Engineer* publishes an illustrated description of what it terms "the smallest electric railway in the world." This outfit has been built for the delectation of a youth of seven summers at Belwood Minn., who is his own general manager and motorman. The track is 600 feet long and 14 inches gage, and is equipped with a motor-car and two trailers. The engine is a two horse power petroleum motor.

A Big Four passenger train was stoned at the Pan Handle crossing south of Anderson, Ind., Aug. 25, and badly damaged. The engineer had just slowed for the crossing when a stone crashed through the headlight. Simultaneously stones were thrown into the sleeping, baggage and day cars, breaking the glass and causing consternation among the passengers. No one was hit. Those who threw the stones are believed to be tramps who were not allowed to ride on the freight trains.

An Engine Service Bulletin Board.

The following engraving shows the general arrangement of a bulletin board in use in the office of Mr. Jacob Johann, Superintendent of Machinery of the Chicago & Alton Railroad, at Bloomington, Ill. It is an ingenious arrangement for recording the location and condition of all the engines on a large railroad. Each engine on the road is represented by a pin in this board, bearing its number and a tag the shape and color of which show its type and condition. The tag also gives in figures the cylinder dimensions, and, by letters information, about its brake equipment.

The board is made of clear, thoroughly dry ¼-inch pine, and is matched, pinned and glued together; the pin-



250 OF THESE PINS NUMBERED FROM 1 TO 246.

holes are 7/16 inch in diameter, and the face is painted a very light green tint (almost white) with all lines and letters in drop black.

The accompanying table illustrates a form of record of renewals of engine details. If an engine receives any of the parts named, the date is entered opposite the name of the part and beneath the number of the engine. The table simply shows the arrangement, and stops with the space for engine No. 4. As actually arranged the spaces are extended to provide for the record of 240 locomotives, the number of engines in use on the road. This record is easily kept and is extremely easy to consult.

The Master Blacksmiths' Convention.

The second annual convention of the National Master Blacksmiths' Association was held in Pittsburg, Pa., early in September. The organization is made up of railroad blacksmiths and has about 70 members. There were 42 members present at this meeting. The purposes of the organization are purely educational. The members assemble to profit from an interchange of ideas touching on ironwork in car and locomotive construction. Visits were made by the members to various manufacturing plants in and near the city, and a number of interesting papers were read. The papers were on "Electric Welding," "Hydraulic Forging and Beveling," "Proper Material for Making Side Rods-Crank Pins and other Motion Work," and "The Best Methods of Welding and Best Results."

Unknown Woods.

Many of the finest woods in existence are yet unknown, or only slightly known, to the manufacturers of wood in the civilized world. The woods of Central and South America are, perhaps, the most remarkable as well as the least known. In the yet untouched forests of this continent are many woods far finer than any of those now in use. These woods range from pure white to jet black in color, and many of them are most beautifully marked and veined. Some of them are so hard that they turn the edges of axes, chisels and other tools, while the band saw cuts them only slowly. In the Columbian Exposition there were many displays of little known woods, and the finest of them were those from Argentine Republic, Brazil and other South American countries. Some of these southern woods yielded to the teeth of the band saw, not the ordinary sawdust, but fine powder, fine as the finest flour, so hard were the woods. Some of them burnt but slowly. Others possess qualities that keep them free from insects. Some of them seem to be practically indestructible by air and water. All along the eastern slopes of the Andes, up to the snow line on those great elevations, throughout all the great river valleys, and in some of the wide areas of level country in South America are great forests of fine woods that are specially fit for the finest cabinet and furniture work, and also for shipbuilding, carpentry and other industrial arts in which wood is the "raw material." These great forests are now an unknown quantity in the commercial world, but they will come rapidly into the knowledge of men and into industrial use when once the railroad has reached them. Before many years, it is safe to predict, the South American and Central American republics will be threaded by railroads, and then those wonderful woods will be drawn upon to supply the demand for new and fine woods in all the civilized countries.—*The Lumber World.*

New Union Station at St. Louis.

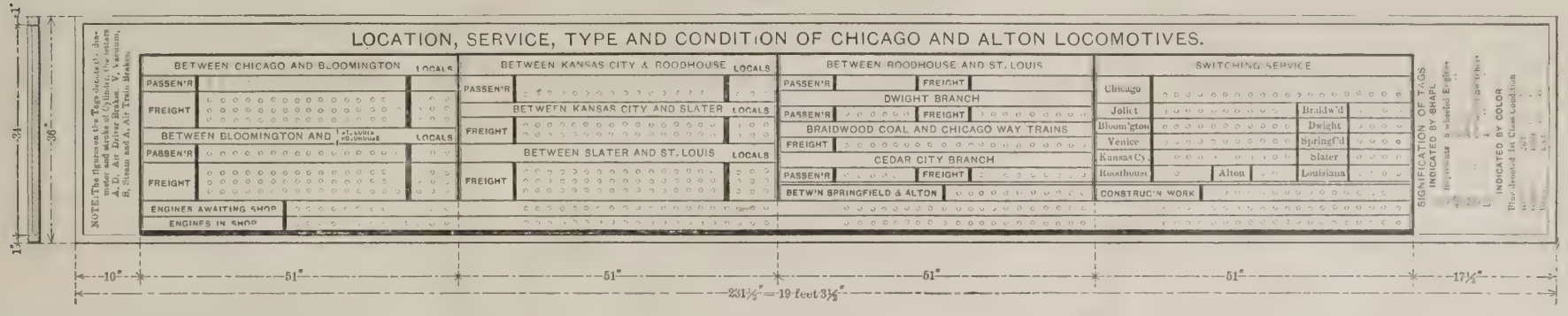
The largest railway passenger station in the world was opened to the traveling public in St. Louis, Mo., Sept. 2. It is a very handsome structure and is of impressive proportions and unique in its general design. The architecture of the main building is patterned after the Romanesque school, the exterior in view having a front of solid Bedford stone, set off with towers and turrets of various heights. There are terraced approaches from the east and west to the main entrance, which is as massive as it is impressive in appearance.

It is 600 feet wide and 630 feet long. It has 30 tracks, and furnishes accommodations for 21 railroads. The roof of the trainshed forms an arch of 600 feet radius, is 700 feet long, 30 feet high on the sides, and has a height of 100 feet from base to center span of arch, forming five spans in the width, three of these being 145 feet and the other two 92 feet. The grand waiting-room measures 60 feet from floor to ceiling, and in length and breadth is 60 by 120 feet. It is handsomely decorated, and is lighted by 3,000 incandescent lamps. The station contains 10 miles of tracks and cost $2,000,000.

Natural Fireproof Timber.

M. Basiaux, who is traveling in South Africa, has written a note to the Geographical Society of France, in which he refers to the discovery of "fireproof" timber. The tree is found in the Northern Transvaal, and the wood, which is a sort of ebony, is so excessively hard that it cannot be cut or worked in the ordinary manner, except when green. When mature and dry it resists every known tool, and either blunts or breaks the finest tempered steel. It is almost impregnable against fire, as it required a fortnight's constant burning to reduce the trunk of one of the trees to ashes. The wood, although heavy, is still considerably lighter than iron and steel. If the tree should be found to exist in any quantity, and a discovery is made of satisfactory means of working it, doubtless it will find extensive use in the arts.—*The Timberman.*

The first meeting for the season of the New York Railroad Club was held Sept. 20. Mr. W. W. Wheatly read a paper on "How can the present methods of rating trainloads be improved?"



RECORD OF RENEWALS, CHICAGO & ALTON RAILROAD.

Locomotive Numbers.	1	2	3	4
New Engine Built				
General Repairs				
Ordinary Repairs				
New Boiler				
New Back End				
New Fireboxes				
New Firebox Side Sheets				
New Door Sheets				
New Back Head				
New Wagon Top				
New Crown Sheet				
New Flue Sheet				
New Smoke Arch				
Flues				
General Boiler Repairs				
New Cylinders				
Cylinders Bushed				
New Cylinder Heads				
New Back Fr mes				
New Front Frames				
Repaired Frames				
New Driving Axles				
New Driving Wheels				
New Driving Wheel Tires				
New Driving Boxes				
New Driving Box Brasses				
New Driving Wheel Hub Plates				
New Driving Springs				
New Main Roads				
" " " Brasses				
New Side Rods				
" " " Brasses				
New Crank Pins				
New Cross Heads				
New Piston Heads				
" " Rods				
" " Packing				
New Steam Chests				
New Guides				
New Shoes and Wedges				
New Equalizers and Stands				
Driving Wheel Tires Turned				
New Valves				
New Valve Seats				
New Valve Yokes				
New Links				
New Rockers				
New Reverse Lever and Quadrant				
New Eccentrics				
New Foot Boards				
New Cab Seat Support				
New Running Boards				
New Cab				
New Pilots				
New Pilot Draw Head				
New Extension Draw Head				
New Smoke Stack, Saddle and Base				
New Smoke Stack				
New Steam Pipe				
New Exhaust Pipe				
New Sand Box				
New Metallic Packing				
New Safety Valves				
New Whistle				
New Bell				
New Bell Frames				
New Checks				
New Injectors				
New Lubricators				
New Head Lights				
New Jacket				
New Air Pump				
New Lagging				
New Engine Truck (Complete)				
" " " Wheels				
" " " Axles				
" " " Boxes				
" " " Springs				
" " " Equalizers				
New Tender Frames				
" " Tanks				
" " Trucks				
" " Wheels				
" " Axles				
" " Boxes				
" " Springs				
" " Draw Head				
Painting Engine and Tender				
Varnishing and Retouching				
New Driver Brake				

The Illinois Central Railroad is experimenting with an electrical apparatus for killing grass and weeds.

On Sept. 3 the Pennsylvania Railroad Company unloaded 604 cars, or 18,000 tons, of bituminous coal at Greenwich Point, Pa., being the heaviest day's business in soft coal in the history of the company.

August's fire loss of the United States and Canada, as computed by the *Journal of Commerce*, aggregates $10,432,800, which is a decrease of nearly $3,000,000 from the figures of the corresponding month of 1893.

The latest invention of the watch-making industry is the applicaiion of phonography. A Geneva watch-maker, M. Sivan, has replaced the ringing machinery of watches and alarms by circular plaques of vulcanized India rubber, upon which are engraved a series of words, which are spoken as by a phonograph when the vibrating point passes over the plaques.

In Australia great loss and inconvenience is experienced in telegraph construction by the depredations of the natives, who have not only a fondness for the wire for bracelets, ear and nose rings, etc., but a fatal weakness for the porcelain insulators, which they fashion into arrowheads and occasionally make a target of the lineman.

"Are yez goin' to stroik, Mr. Dolan?" asked a fellow workman.

"Faix, an' Oi may, some day."

"When'll that be?"

"Whin the agitators is willing to pay me as much wages fur me toime as th' other fellys will."—*Washington Star.*

The traveling engineers who went to Denver in September managed to have a little pleasure along with their work after their convention. The Denver & Rio Grande officials treated them to a special train, which took them to Leadville, Glenwood Springs and other places of interest in the Rocky Mountains. There was so much to see that they were kept busy from 8 A. M. Saturday until 5 P. M. the following Tuesday, Sept. 18.

The Czar of Russia is branching out in the sawmill business. He is building a trifle of 250 sawmills with public moneys, and he will rent them to operators who have not the means to build mills. Is not this a good opening for some of our great machinery houses? American sawmills are the best made, and it would seem that effort on the part of our manufacturers ought to result in selling a good deal of machinery to the agents of the Czar.—*The Lumber World.*

A constable chained one of the driving wheels of the locomotive of a Baltimore & Ohio mail train to the track at Mount Sterling, O., Sept. 18. The trouble was the result of a suit against the Baltimore & Ohio company to secure the payment of $500 claimed for the accidental killing of two horses. The constable was determined that the train should not escape his legal process, and all entreaties of the trainmen to be released were without avail. The conductor telegraped for instructions and received the curt message: "If the chain is not too strong, go ahead." Of course the chain was not "too strong," and the train went ahead.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

A GOOD SIGN.

That the times are improving is evident from the number of new subscriptions received at this office. We have received orders for over 100 new subscribers to commence with our October paper.

THE LABOR PROBLEM.

There is no doubt that what is commonly known as the labor problem is one of the chief (if not the chief) questions that confront civilization at the present time. This question as generally understood refers particularly to the state of contentment among the "working people," or those who perform manual labor for wages. Properly, the question also refers to all who work for wages, whether with the hands or the head. The elements of discontent become established when the wage worker arrives at the belief that his share of the profits of the enterprise is an inadequate compensation for his services. This belief is often based on fancy, misunderstanding or misrepresentation. The discontent resulting may take any one of several forms, such as seeking more satistactory compensation in the present employment, or seeking more satisfactory employment elsewhere; or by a combination of all the employés of an occupation trying to force satisfactory terms by simultaneous cessation of work. This is the strike. Up to this point there has been no trespass of privilege or of law. The strike, in its simple form, is a reasonably fair test of the justness of the questions at issue between the employer and employed. In such a case wage workers other than those on strike decide the controversy by supporting either those on strike by not supplanting them, or supporting the employer by serving for the terms rejected by the strikers. The "labor question" would be of slight importance, and would receive little attention, if labor disputes were peacefully settled in this way. They would generally be considered as probably fairly settled. But, as we know too well, strikes are not conducted in the simple way just considered. Usually the first effort to supplant a striker is a signal for disorder and violence, which may grow to destructive intensity unless quelled by the officers of the law, and if this action is weak or tardy the trouble may grow into an insurrection against the government, as recently experienced in this country. It is this violence that has made the labor question one of serious contemplation to all who believe in orderly and lawful government. Within the limits of the United States the existing laws are ample to control the matter in the interests of the public good for the present, and in the future as far as its probable conditions can be foreseen. These laws provide for the protection of property, and of individuals who wish to exercise their legitimate right to work when work is offered for a satisfactory compensation.

This paper has before declared its belief that the proper enforcement of law will finally educate the "working people" to a clear conception of the personal rights of all individuals, and that the full recognition and protection of these rights, guaranteed by the Constitution and upheld by common law, will eventually cause the end of strikes, because of the hopelessness of their outcome. If the process does not fully accomplish this, it will at least reduce the strike to its simple form, free of violence, and as such it will cease to be a matter of much general concern; for with conditions of employment that are unsatisfactory to some and are acceptable to others the natural law of supply and demand will deal, and, for all the practical purposes of civilization, deal justly. There is much to do in the world, and there are many fields of employment, some of which are much neglected. The law named is as wide in its scope as human endeavor, and its operations will always act to regulate every possible phase of industrial aud commercial activity. By its action the needs of different fields of employment will be met by causing workers who cannot find satisfactory conditions in one field to seek and find these in another, and by causing employers to offer conditions that will secure the amount and quality of help required.

This review of the situation shows that there is no cause for apprehension of either present or future disarrangement of existing industrial conditions by the actions of discontented workers, as laws human and superhuman will act to prevent it. The fact of this being true is no reason why consideration of the subject should be dismissed, however, as there is another important phase of the matter than those considered. The law allowed of the Merchant of Venice a pound of flesh nearest the heart. Happily the spirit of Shylock has but a small and ill-favored place in society. Law is necessary for its existence, but this being established the general inclination is toward leniency. So while laws guard the present conditions of industry and there can be no reasonable fear of serious disturbance, the general wish is for improved conditions and greater content among wage workers, and many who are in positions to do so strive to promote improvement in these respects.

There can be no doubt that the interests of an employer (whether he be the employer of one man or of many thousands) require that those who serve him do so in a spirit of friendliness and goodwill. The highest efficiency of service in any employment cannot be attained except through the spirit of loyalty by employés for the interests they serve. The world is now being given a great object lesson, in the war between Japan and China, of the truth of this. It teaches the efficacy of loyalty and earnest effort as illustrated by the Japanese, and is showing that nothing else is equal to these qualities in advancing the interests of a cause in which they are enlisted.

Recognizing the truth of this some large employers of labor who have made the subject here briefly touched a special study, have proposed plans for promoting content among employés, and enlisting their best efforts in the interests they serve. The most recent and prominent of these, and one that pertains particularly to railroad service, is the proposition of Mr. O. D. Ashley, President of the Wabash Railroad. Its policy is that of promotion from the ranks when possible, according to ability and meritorious service, and the establishment of a system of life insurance and pensions, to the benefits of which employés would be entitled without contributing to the fund necessary to provide them, such fund being donated by the employing company; the idea of the proposition being that the expectation of reward for meritorious and continuous service would promote content and loyalty, and secure improved service. Speaking on this subject at the banquet of the Western Railway Club recently Mr. G. W. Rhodes, Superintendent of Motive Power of the Chicago, Burlington & Quincy Railroad, expressed views agreeing in the main with Mr. Ashley's proposition.

This phase of the labor problem is well worth the serious consideration of all employers, and it appears that some system that holds out a reasonable inducement to employés for steady and careful service has in it the elements that will probably prove most successful in promoting harmony and in securing all the other objects desired.

AN ECONOMICAL DEVICE.

We illustrate on another page an improved close notched quadrant which has been adopted on the Wabash Railroad as a standard detail of all new engines, and of all that pass through the shop. For the second time we are able to give some definite and authoritative information respecting the possible economy of fuel to be accomplished in service by this improvement.

Two years ago we published a record sent us by a master mechanic on the Southern Pacific showing two cases in which the substitution of a close notched for a wide notched quadrant effected an improvement of six and twelve miles per ton of coal, respectively, on engines of that road.

The record of five Wabash engines for four months before and after the substitution of close notched for wide notched quadrants shows an improvement of 13.8 miles per ton of coal in favor of the new quadrant This was an economy of 32.15 pounds of coal per engine-mile. Assuming that the engines made 3,000 miles per month each, the saving of coal effected in the period named would be (32.15 × 15,000 =) 482,150 pounds, or 241 tons. Coal costs the Wabash but $1.10 per ton on the tank, so the money value of the saving was (141 × 1.10 =) $265. The new quadrant cost $5 per engine, or $25 for the five engines, so the improvement on these engines paid for itself in about 12 days; and at the end of the period named, 4 months, it had paid for itself and earned $240 to attest the good judgment of the man that made it. One dollar and ten cents is an unusually low price for coal, the average price throughout the country being near $2, so most master mechanics would be safe in adopting this improvement, for they would save as much money as was saved on the Wabash if the thing only worked half as well.

COURTESY.

Courtesy is a virtue that is not practiced in this country as much or as generally as it should be. There is more of it needed in the railroad service, and especially by the employes that come in contact with the patrons and passengers. The discourteous trainman is a source of not only discomfort and offense to travelers, but of financial loss to the company that employs him. Who has not met the "fresh" brakeman, and received as an answer to a civil question a "smart" or actually insulting reply?

A master mechanic who is well known and highly esteemed for his good sense, recently speaking of this matter, said: "Josh Billings has said 'there is no disease that a mule has that cannot be cured with a club.' This same remedy will apply to fresh brakemen." Certainly some remedy as effective as a club should be applied to trainmen who have so little regard for the prosperity of their road as to intentionally offend or insult its patrons. Those who travel much see many instances of this; but the situation is not discouraging, as a noticeable improvement has been effected in the last few years, probably because superintendents have given the matter attention. There is yet room, however, for wide improvement.

Example is a powerful educator. Men in subordinate positions are prone to emulate the example of superiors. What follows? Simply that the example set by officers should be good. A railroad officer should be everything that the best interests of his company require, and practical, common-sense, every-day courtesy should properly rank among his essential attributes. This is not always the case, and when it is not a straight line of loss can be traced from the officer to the employé, to the work, and to the "strong-box" of the company. The contents of this "strong-box" are to a railroad what the "coal pile" is to a locomotive—its source of life. It is a well-known fact that the anatomy of a locomotive is so delicately adjusted and so sensitively interdependent that the ultimate result of the slightest change in its mechanism is a saving or wasting effect on the "coal pile." It is also a fact, not so well recognized, but quite as true, that the ultimate effect of courteous or discourteous treatment of employés by officers is a saving or wasting effect on the "strong-box."

Agreements regulating the pay and treatment of enginemen on many roads contain this clause:

"All officers and enginemen will observe strict courtesy of manner in their intercourse with each other."

There was a cause for the adoption of this quoted paragraph which does not need elaboration here. The truth is that many who walk in the higher grades of railroad employment, as well as those who occupy the subordinate positions, need to cultivate the refinement of manner known as courtesy. It is a practical question of economy and efficiency of service. A most successful superintendent of motive power, of our acquaintance, is as courteous a gentleman as one will meet in a lifetime, and he is equally so with all men. In his department there exists an unexcelled *esprit de corps*, and an enthusiasm for improved service rarely seen on other roads. Another of our acquaintance is apt to reply to perhaps the just complaint of an employe: "If you don't like your job, why the hell don't you quit?" The contrast is sharply drawn, but it is from life, and as a comparison is no stronger than a contrast of the results obtained by these officers in handling men.

That Rule taught by an unpretentious Teacher, "As ye would that others," etc., is golden in its wisdom, and golden results will follow its practical observance. "Put yourself in his place" is a legend that should, figuratively, be pasted in every hat and be the constant inspiration of our treatment of others. The occasions are rare when discourtesy is justified among the workers in any business or occupation. Courtesy is a lubricant that dispels friction and makes things run smoothly. It prompts the soft answer. It gives encouragement to those who need encouragement. It lightens labor and promotes loyalty. It is the music of manner, and of this it is said:

> "For the tired slave, song lifts the languid oar
> And bids it aptly fall, with chime
> That beautifies the fairest shore
> And mitigates the harshest clime."

A GOOD RESOLUTION.

About the most manly declaration of a principle recently announced by any society of wage workers in the world is that made in the resolution adopted by the recent biennial convention of the Brotherhood of Locomotive Firemen, denouncing as "irrational, fanatical, illogical and injurious to both employer and employee" the disposition of its members in some localities to ignore agreements made with the railroad companies that employ them, and to strike whenever the fancy

seized them. This disposition was a most discouraging feature of the sympathy strikes following the boycott of Pullman cars, and it destroyed the confidence and friendship of many railroad officers who had done a great deal to improve the condition of the employees under them.

In railroad service probably more than in any other line of employment, the wages of the employees engaged in the different branches of the operating department are regulated by schedules which are the result of conferences and agreements between representatives of the owning companies and the employees. On nearly every American railroad the pay of these is regulated by schedules so established. The law would hold the company of any road to such an agreement if any of its terms were evaded or violated, but as labor unions are not incorporated and have no recognized legal existence, it is impossible to compel their members to live up to their agreement to perform their usual duties for the stated rates of compensation, and to give due notice of any intended departure from the terms of the agreement. In the strikes referred to the most shameful violations of such agreements were made by engineers, firemen and switchmen, the men on some roads not even notifying the company of their intention to strike, but deserting their work at times and in ways such as to cause the greatest possible damage to the company and to the patrons of the road. In authoritatively condemning the dishonorable action the Firemen's Brotherhood takes a stand that commands respect, and if time shows the sincerity of its action it will be made to feel this in its future dealings with railroad officers.

The continuation of the discussion of postal-car features, begun in our September issue, is necessarily omitted from this issue.

There has been a notable increase in the construction of electric railroads during the last few years. Many of these parallel existing steam railroads and enter into serious competition with the latter for freight and passenger traffic. Public sentiment in thickly settled communities is actively insisting on the obliteration of grade crossings by the steam railroads, and yet the local authorities in several States are permitting new electric railroads to cross the former at a level. This is simply inviting disaster, and one annual railroad report recently issued very sensibly calls attention to the inconsistency.

One important result of the recent great railroad strike and its accompanying lawlessness, is the issuing of sweeping general orders providing for the concentration of the United States Army near the great railway centers. This shows that the government intends in the future to be prepared for very prompt action in case of insurrection. The movement is a wise one, as possible internal insurrection is about the only foe of peace we need to fear in this country, and in case of its occurrence a prompt show of vigorous force will exert a powerful quelling influence and prove the stitch in time that will save nine.

Quoting in our last issue from the report of a committee of the Southern and Southwestern Railway Club on the subject of box-car ends, we caused the report to read: "Freight cars have been strengthened and increased in capacity, by slow degrees, from 10 or 15 tons to 25 and 30 tons." The report actually read: "From 10 to 15 tons to 25 and 30 tons." The construction of the sentence is unusual, and led to the mistake. Referring to our description of the illustration we published of the proposed construction of box-car ends, we said: "Strips 1½ inches by 4 inches are bolted on the inside of the corner and intermediate posts," etc. The dimensions named should have read 1½ inches by 4½ inches. This was a typographical omission not noticed until pointed out by the author of the report.

The force and destructive possibilities of air in rapid motion were given a most unusual demonstration in the wrecking of a passenger train on the Iron Mountain Railroan in Missouri, Sept. 12, as related on another page. Air, being invisible and impalpable, is with difficulty conceived by many to be an actual substance. Its action in the case here referred to will doubtless help to impress the fact on many. The usefulness of the hand fire grenade also received demonstration by this accident, as by the prompt use of several grenades a fire which started in the rear car of the wrecked train, and threatened the destruction of the whole train and of a number of imprisoned passengers, was quenched at the beginning, and the railroad company was spared a great financial loss, and humanity the painful shock of another holocaust of railroad travelers.

Tank cars are being found useful for other purposes than carrying oil in bulk, for which they were originally intended. As announced some time ago, the wine producers of France are utilizing this method of transporting the tempting liquid from the towns of the interior to Paris. Doubtless the method would prove economical and satisfactory in this country, for the long-distance shipment of wine from the Pacific to the Middle and Atlantic States. Up to the present time California wine growers have had various objections to the use of tank cars for this purpose, but the demand for native and especially California wines is growing very fast in the East, and as the excellence of the home production becomes better known and appreciated the demand will increase, and the consumption of imported wines will decrease. This will call for cheaper methods of transportation, and the tank car will doubtless prove the logical solution of the problem. These cars have lately been proposed for a new use in the Southern States, that of the transportation of molasses in bulk. There is no good reason in view why the proposition cannot be made practically and commercially successful.

Literature.

A copy of the first issue of the *Aluminum World* has been received. This is a new paper that will be devoted to the growing interests of aluminum manufacture. Its subscription price is $2 per year in America, and $3 per year in foreign countries. Single copies cost 20 cents. The paper is published at 14 Lafayette Place, New York City. The first issue of the paper contains a number of interesting articles on the production and uses of aluminum by competent writers.

The Illustrated Technical Magazine, Monthly. Price per copy 6d. Subscription (including postage to any part of the world), eight shillings per annum. Publishing office, 22 St. Andrew street, London, E. C.

The publishers of this new magazine announce that they intend to produce a journal to embrace popular and interesting descriptions of current engineering matters, with as much practical and useful shop experience as possible in the limit of 64 pages. The main endeavor of the magazine will be to popularize engineering subjects. This is a laudable aim, and it should receive popular support. The first number contains numerous interesting articles, some of which have liberal illustrations.

Standard Dictionary of the English Language. Vol. I., A to L. Half Russia binding. Pages 1,060. Price $7.50. By subscription only. Funk & Wagnalls Company, 18-20 Astor Place, New York city.

The dictionary named above is to be published in two volumes in order to be more easily handled. A single volume edition will also be issued when the work is complete. The first volume is now on sale and treats of the words from A to L—about 150,000. The work is very complete and up to date, and has a number of improvements over the older dictionaries. A policy of expunging obsolete words has been carried out in its preparation, and all the new living words are given. Obsolete, foreign, dialectic and slang words are given place only if in such general use as to make this desirable. One of the commendable features of the work is the placing of the etymology of words *after* instead of before the definition. To the average person consulting a dictionary this is a great convenience. In giving the definition of words the most common meaning, the present preferred meaning, is given first. This will prove a help to many in the choice of words. Special attention has been given to plainly indicating the proper pronunciation of words, and disputed pronunciations and spellings have in most cases been decided by a committee of 50 philologists. The dictionary is the first to undertake to reduce to a system the compounding of words. Our current literature shows great confusion on this point. The pictorial illustrations number nearly 5,000 for the entire work and are of excellent quality, some being full-page groups in colors. These are of unsurpassed excellence.

These are a few of the principal features of this complete and splendid dictionary. It gives more definitions of technical terms than any other general dictionary, this being a special feature, the editors employed in giving them having been selected from the various occupations that would give them accurate and practical information of the use of such terms. "Locomotive" may be cited as an illustration. Besides the full definition of the word, there is given a liberal sized drawing of a locomotive showing a side elevation and half plan, with a section through the firebox. All the parts are numbered and correctly named. The full work will contain 280,000 words and terms. This is 155,000 more than in Webster's International, and 80,000 more than the six volumes of the Century Dictionary. According to our judgment the *Standard* is a dictionary that will satisfactorily meet every requirement of English-speaking people.

It is said that the smallest piece of painting in the world has recently been executed by a Flemish artist. It is painted on the smooth side of a grain of common white corn, and pictures a mill and a miller mounting a stairs with a sack of grain on his back. The mill is represented as standing on a terrace, and near it is a horse and cart, while a group of several peasants are shown on the road near by. The picture is perfectly distinct, every object being finished with microscopic fidelity, yet by careful measurement it is shown that the whole painting does not cover a surface of half an inch square.

American Society of Railroad Superintendents.

The 24th meeting of the above named society will be held at the Hotel Brunswick, New York City, on Monday, Oct. 15, 1894, at 10:30 A. M. Mr. Willard A. Smith, of Chicago, will speak on the subject of "Railway Education." Standing committees will report on the following subjects:

(*a*) On Roadway, D. B. McCoy, Chairman.
(*b*) On Machinery, J. F. Divine, Chairman.
(*c*) On Transportation, F. K. Huger, Chairman.
(*d*) On Signaling, W. G. Wattson, Chairman.

The following have been selected as topics for discussion.

(*a*) Is there sufficient reason for discontinuing the use of white or clear light as a safety signal in American railway practice? If so, what color can be substituted to mean "safety," and what to mean "caution"?

(*b*) What principles are to be recommended for fixed signals, especially for block signals and interlocking, that will promote uniformity in installation, simplicity in operation and clearness in signification?

(*c*) Is the use of derailing switches in terminal yards to be recommended?

(*d*) What principles and methods have been found, in your experience, most effective, in order to obtain trained, reliable and loyal employees in the operating department?

(*e*) Experience in the application of the Standard Code of Train Rules in cases of doubt or difficulty.

(*f*) Special instances of economy in the handling of freight service.

Locomotive History.

The following letter, relative to the history of the earliest locomotives sent to the United States from England appears in a recent issue of *Engineering* (London), from Mr. Clement E. Stretton:

For many years past it has been known that the chief trouble in obtaining the true locomotive history has always been that the early engines often were built with the same names, and that a number of engines also had their names changed. The subject of the "John Bull" locomotive sent to America in 1831 has been a puzzle to the American engineers; some persons have claimed it for the Mohawk and Hudson Road, and others have been equally certain that it went to the Camden and Amboy Railroad. After careful investigation of the difficulty, I have been able to satisfactorily clear up the matter by obtaining proof that there were two engines of this same name in America in 1831. I have now before me the copy of the working drawing from which one "John Bull" was built at Stephenson's works in 1831; this engine was sent to the Mohawk and Hudson Railroad (now a part of the New York Central). It was in every way similar in appearance to the well-known "Samson" class then in use in England, and it had the *square* firebox.

I have also before me another set of working drawings from which, at the same date, the same firm constructed another engine; this was sent to the Camden & Amboy Railroad (now a part of the Pennsylvania system), and when it left Newcastle-on-Tyne it was named "Stevens," but on its arrival in America the name was at once changed to "John Bull." This engine was of the usual Stephenson design, but with one very important exception, namely, that it had a *round* firebox, this firebox having been specially ordered and insisted upon by Mr. Stevens when he gave the order for the engine. When at the Chicago Exhibition last year I very closely examined the engine shown by the Pennsylvania company, and since my return home have compared the details with the old working drawings of the engine ordered by and named "Stevens," in 1831, and there is most convincing proof that the "John Bull" at Chicago was the real old engine with the round firebox which was supplied by Stephenson & Company to the Camden & Amboy Railroad in 1831.

In reference to the above Mr. Theo. N. Ely, Chief of Motive Power of the Pennsylvania Railroad, informs the NATIONAL CAR AND LOCOMOTIVE BUILDER that the locomotive known in this country as the "John Bull," and exhibited at the Columbian Exposition by the Pennsylvania Railroad Company, was shipped from Liverpool July 14, 1831, to "Edwin A. Stevens, Esq., for the Camden & South Amboy Railroad & Transit Co." The freight was £19 sterling—$92.34. Mr. Ely states that he cannot say authoritatively whether this locomotive was called the "Stevens" before leaving England. It is probable, however, that Mr. Stretton's assertions are correct.

The Albany *Herald* relates that a little son of John Bethune was leading a cow to pasture, and when he reached the woolen mills he tied the cow to the coupling pin of a freight car while he went inside to speak to his father. Unfortunately for the cow a locomotive backed upon the switch while the boy was inside, and coupled on to the car and started up the track. The bovine was not noted as a sprinter, but she was forced up the track at a 2:17½ gait. A farmer who was passing saw the predicament, and managed to signal the engineer to stop, otherwise there must have been a spurt of speed on the part of the cow unheard of before by any bovine, or a broken neck, for the boy had tied her securely with a stout rope. As it turned out, she is alive and well, and holds the record of the world for that sort of a race.

Commencing Sunday, Sept. 9, compartment cars, containing 2 drawing rooms and 7 state rooms entirely separate from each other, were added to the service of the Pennsylvania Limited trains between New York and Chicago. The drawing rooms contain a section and one lower berth, the state rooms one section. Both have complete and individual lavatory arrangements. In these cars the passengers may enjoy all the privacy of a hotel room, and travel almost as much secluded as in a private car.

Personal.

Mr. L. H. Sherman has resigned as Master Mechanic of the Mexican National at Santiago, Mex.

Mr. E. T. Horn has been appointed General Manager of the Macon & Northern, with headquarters at Macon, Ga.

Mr. D. E. Barton, formerly Master Mechanic, has been made Master Car Builder of the Erie & Wyoming Valley Railroad.

Mr. Theodore Nickerson, formerly General Purchasing Agent of the Mexican Central, died suddenly at Boston, Mass., Sept. 12.

Mr. E. W. Jackson, Vice-President and General Manager of the Mexican Central, has tendered his resignation, to take effect Dec. 1.

Mr. Robert Dewar has been appointed Master Mechanic of the Mexican National at Santiago, Mex., vice Mr. L. H. Sherman, resigned.

Mr. S. Gano, Jr., has been appointed General Manager of the Addyston & Ohio River road. His headquarters will be in Cincinnati.

Mr. S. Bradley, General Foreman, has been made Acting Master Mechanic of the Mahoning division of the New York, Lake Erie & Western.

Mr. Albert Griggs has been appointed Assistant Superintendent of Motive Power of the Chicago & Eastern Illinois, with office at Danville, Ill.

Mr. A. A. Bradeen has been appointed Division Master Mechanic of the Lake Shore & Michigan Southern at Cleveland, O., vice J. S. Graham.

Mr. James H. Brown, General Manager of the Annapolis, Washington & Baltimore, died at Annapolis, Md., Sept. 14, after an illness of several months.

Mr. E. W. Knapp, locomotive foreman of the Mexican National at Monterey, Mex., has been appointed Master Mechanic of that road at Acambaro, Mex.

Mr. H. D. Norris has been appointed Purchasing Agent of the Flint & Pere Marquette, with headquarters at Saginaw, Mich., to succeed Mr. E. F. Weld, resigned.

Mr. S. D. King, formerly Purchasing Agent of the Erie & Wyoming Valley, has been appointed Superintendent of Motive Power of that road, with office at Dunmore, Pa.

Mr. F. G. Lauer, foreman of locomotive repairs of the Buffalo, Rochester & Pittsburgh at Rochester, N. Y., has been appointed Master Mechanic of the road at that place.

Judge Ariel Standish Thurston, of Elmira, N. Y., a direct lineal descendent of Captain Miles Standish, of Plymouth settlers fame, died at West Braddock, Pa., Sept. 23, aged 85 years.

The board of trustees of the Field Columbian Museum, of Chicago, has appointed Mr. Willard A. Smith honorary curator of the transportation division of the department of industrial arts.

Mr. S. T. Crapo, formerly assistant to the General Manager of the Flint & Pere Marquette, and lately acting General Manager, has been given the full title of General Manager of that road.

Mr. George C. Smith, formerly Assistant General Manager of the Missouri Pacific, has been elected President and General Manager of the Western Railway of Alabama, with headquarters at Atlanta, Ga.

Mr. W. E. Symons has resigned his position as Division Master Mechanic of the Atchison, Topeka & Santa Fe at Raton, N. M., on account of ill health, and has started on an extended trip to recuperate.

Mr. D. W. Caldwell, President of the New York, Chicago & St. Louis, has been elected General Manager of the Lake Shore & Michigan Southern to succeed the late John Newell, who was President and General Manager.

Mr. Samuel C. Stickney, who has been acting General Manager of the Chicago Great Western since the retirement of Mr. J. M. Egan, was on Sept. 14 chosen General Manager of that road, with headquarters at St. Paul, Minn.

Mr. James A. Keegan has been appointed Master Mechanic of the Cincinnati and Sandusky divisions of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Delaware, O., succeeding Mr. J. H. Berry, resigned.

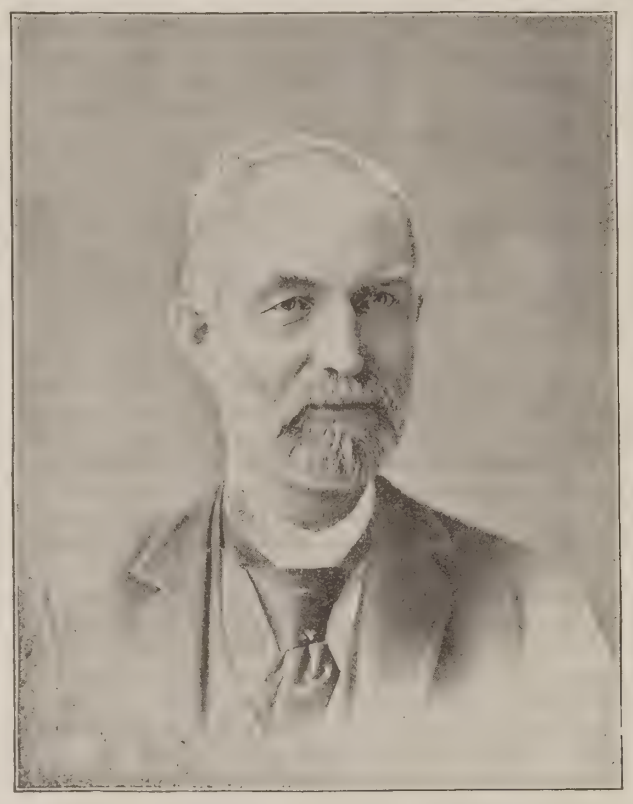
Mr. W. H. Thomas, formerly Superintendent of Motive Power of the East Tennessee, Virginia & Georgia, has been appointed Assistant Superintendent of Motive Power of the Southern Railway, with jurisdiction over both the Eastern and Western systems. His office will be at Washington, D. C.

Mr. H. M. Laird has been appointed Master Mechanic of the Southern Iron Car Line, with headquarters in Atlanta, Ga. Mr. Laird has been connected with the Nashville, Chattanooga & St. Louis Railway for the past 17 years, and has held the position of chief inspector and foreman of the shops in Atlanta for the past three and a half years.

Mr. E. M. Roberts, Superintendent of Motive Power of the South Carolina & Georgia Railroad, has resigned. Mr. Roberts is a very active member of the Master Mechanics' Association, and has done a great deal of efficient committee work for that association and for the Southern and Southwestern Railway Club. He occupied the position he has just resigned since 1891. Before that he was with the East Tennessee, Virginia & Georgia Railroad as Master Mechanic.

Mr. F. D. Adams, Master Car Builder of the Boston & Albany Railroad, celebrated his golden wedding on Sept. 4. Mr. and Mrs. Adams received their friends at their home at Newton, Mass. The anniversary presents were numerous and handsome. The one which is said to have pleased Mr. Adams the most was that of the executive committee of the Master Car Builders' Association. This is a finely bound russet seal volume, the leaves of which are of parchment bearing in gold embossed and ornamented letters the greeting and congratulations of the members of the committee.

Mr. James N. Lauder, Superintendent of Motive Power of the Old Colony Railroad, now a part of the New York, New Haven & Hartford Railroad, died at his home in Concord, N. H., Sept. 28, after a severe illness. Mr. Lauder was 57 years of age. He was a past president of the American Railway Master Mechanics' Association, and the founder of the New England Railroad Club, of which latter he has been until now the central figure. He spent all the years of his manhood in railroad work, having entered the service as an apprentice when a boy and thenceforward remaining always associated with the motive power and rolling stock department. For meny years he was with



JAMES N. LAUDER,

Late Superintendent of Motive Power, Old Colony Railroad.

the old Boston, Concord & Montreal, thence with the Mexican Central, and finally, since 1883, with the Old Colony, with which road his name will always be chiefly associated. He was a man of fine appearance, tall and well proportioned, and gifted with fluent speech. Being well read and entertaining liberal views and positive convictions, he commanded attention and respect whenever he rose to address a meeting of associates, which he frequently did. The rolling stock under his charge attests the progressiveness of his views. In his death the railroad fraternity loses a highly valued member, and railroad interests an intelligent and indefatigable worker.

Mr. R. D. Wade, formerly Superintendent of Motive Power of the Richmond & Danville R. R., has been appointed Superintendent of Motive Power of the new Southern Railway Company. Mr. Wade was born at Taunton, Mass., in 1835, and began his railroad service when 18 years old as a machinist in the shops of the Alabama & Tennessee River Railroad, at Selma, Ala. After working there a year he went to the Greenville & Columbia Railroad, where he worked as a machinist and engineer four years. In 1864, when 29 years old, he became Master Mechanic of the road, and held the position 12 years, or until 1876, when he went to the Richmond & Danville in the same capacity, where in 1881 he became Superintendent of Motive Power. The absorption of that road by the new Southern Railway Company brought him into the service of that road, and he was chosen for the head of its mechanical department. His record as a motive power officer is a guaranty of the excellence of the choice.

An unsuccessful attempt was made to wreck a Missouri, Kansas & Texas passenger train on a trestle, near Muskegee, Mo., Sept. 16.

Second Annual Banquet of the Western Railway Club.

The second annual banquet of the Western Railway Club took place on the evening of September 18 at the Union League Club, Chicago. We take the following account of the meeting from the *Railway Review*, of Chicago:

After the discussion of the viands provided for the occasion, the more formal proceedings were opened by the retiring president, Mr. William Forsyth, who, in a few well chosen words, suggested that the value of the club to its members would be enhanced if the mechanical engineers, of which he was one, were not allowed to do all the talking, and the further idea that the degree of progress attained by the mechanical department of the railways was largely due to the interchange of thought had in the meetings of their own and kindred clubs.

At the close of his remarks Mr. Forsyth introduced the new president, Mr. George Gibbs, who contented himself with a brief retrospect of the history of the club, particularly as to the growth in number and importance of subjects discussed and the increase of membership, and suggested that if the club was to continue to prosper the value of the discussions participated in must at least be kept up to the present standard. At the close of his remarks he introduced Mr. Willard A. Smith, president of the *Railway Review*, to whom was assigned the topic of "Railway Education." Mr. Smith laid particular emphasis on the educational value of the transportation exhibits at the World's Fair and its influence throughout the world. He also showed the necessity for the dissemination of information concerning the operation of railways and their relation to sociology, to business and all the great interests of life, claiming that the possession of such knowledge by the public as well as by the employes would prove a most effectual bar to the influence of agitators who seek to stir up enmity between them in order to enhance their own interests. In closing he emphasized the necessity for a better understanding between the various degrees of employés in order that harmony may prevail.

Mr. Smith was followed by Mr. Godfrey Rhodes, to whom was assigned the lessons growing out of the recent strike. Mr. Rhodes was inclined to think that severe methods in the way of discipline were not provocative of the best class of service, but that if the men could be made to feel that their personal welfare and possible provision for the future had a place in the policy of the company by which they were employed, it would be much more difficult for agitators to induce them to strike. Particularly would this be the case where a man was sufficiently well paid to enable him to save money and put it into a home. Under such circumstances there will be little danger but that the interests of the company would in turn be carefully fostered by the men.

Mr. Barr was the next speaker, having for his topic, "The Influences of Railroad Clubs," first among which he noted as contributing to an ability to talk, a fact which, although he did not say it, was, to those who have been associated with him in the Western Railway Club, fully demonstrated by the speaker. He also pointed out the tendency of interchange of thought and experience to broaden the views of those who were thus associated, and the further point that through such associations and the knowledge of individuals growing out of it, much friction that would otherwise occur would be avoided. Referring to the technical schools, he thought that if such schools could be furnished with the proceedings of the railway clubs, they would perceive that scientific formulas did not constitute all that was necessary in an education; and that the ability to analyze iron did not necessarily fit a man to describe the exact material that was best for all purposes.

Mr. W. F. Merrill, General Manager of the C., B. & Q. road, followed Mr. Barr. In the course of his remarks he took occasion to speak of the superiority of American over German locomotives, which had been referred to by previous speakers, and stated that he attributed some of the superiority to the necessity put upon the mechanical departments of the railroads for accomplishing results at the lowest possible outlay. This necessity had, he said, stimulated the very best efforts of the mechanical men, and they consequently turned out a better product than would have been the case had they had more money at their command.

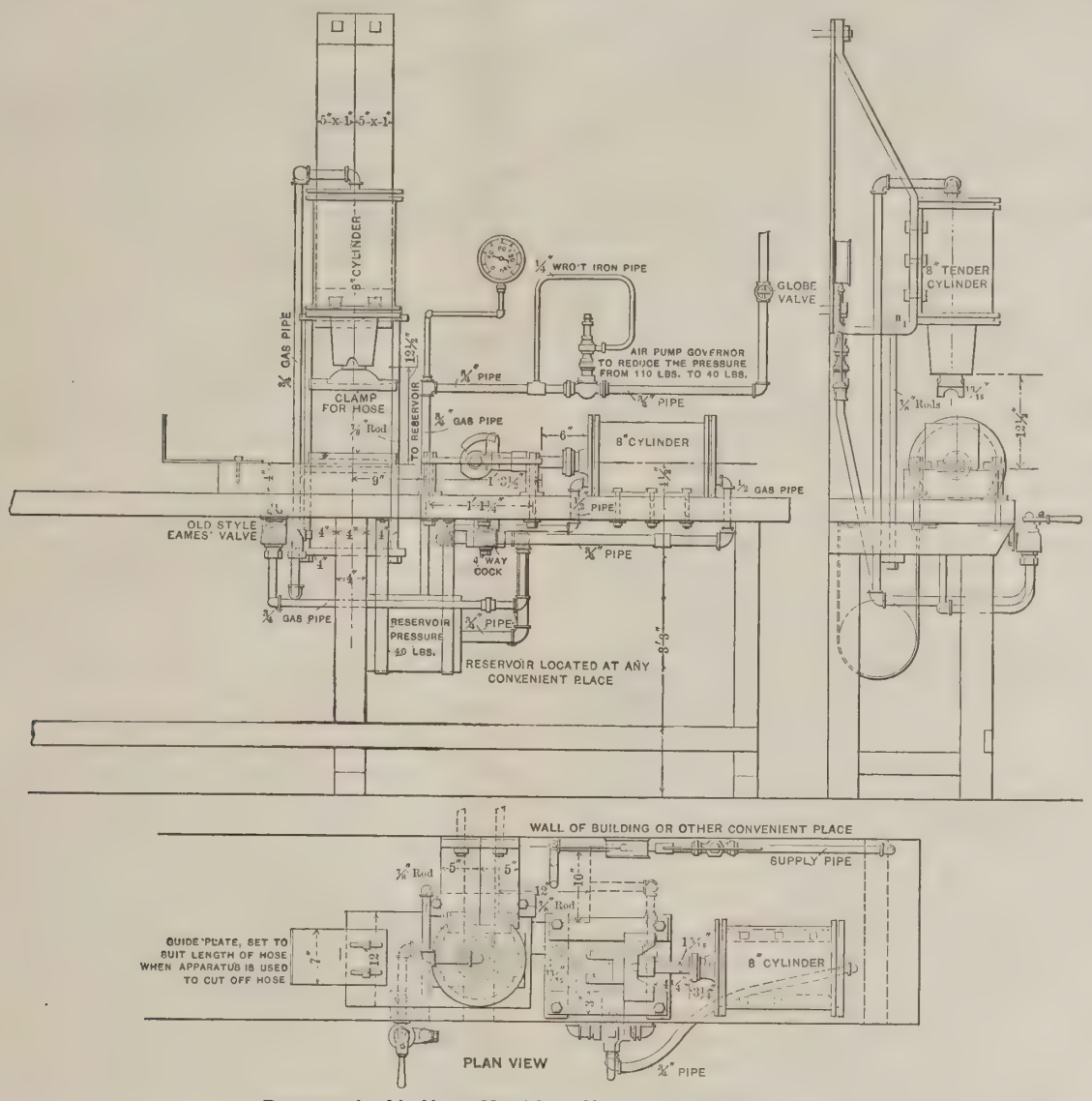
Prof. W. F. M. Goss, of Purdue University, followed Mr. Merrill with a brief address, in which he asserted that it was the desire of the technical schools to be in as close touch as possible with the practical work done outside of the schools, and for which they were seeking to train men.

The Central Ohio Electric Railway Company was incorporated Sept. 21 for the construction and operation of an electric railway between Pittsburgh and Chicago, with branches connecting with towns and cities along the route. The articles provide for freight, express and passenger traffic and the hauling of the mails. The headquarters of the company are at Mount Vernon, O. The capital is $100,000, and the incorporators are G. A. Jones, F. W. Jones, J. A. Caldwell, William M. Koons and M. Spellacy.

There is in the library of the Franklin Institute a clock which has a remarkable record for accuracy. It is an astronomical clock with Rieffler's absolutely free pendulum escapement, and Rieffler's mercurial compensating pendulum; and though one might imagine such a title would slow down any clock, it proves its accuracy by keeping correct time in spite of it. An accurate record has been kept since Nov. 1, 1893, and in the ten months intervening its variations have never reached a full second. While this may or may not be a world's record, it is surely time-keeping extraordinary and little improvement is to be hoped for.—*Journal of Railway Appliances.*

Air Hose Machine, Union Pacific Railway.

The engraving shown herewith reproduces drawings furnished us by Mr. J. H. McConnell, Superintendent of Motive Power of the Union Pacific Railway, and illustrates the construction and general arrangement of a pneumatic air hose machine used at the shops of that road at Omaha. The machine is used for cutting off air and steam hose to the desired length and to force the couplings and nipples into the hose. The principal features of the machine are the vertical and horizontal cylinders. The vertical cylinder is used in cutting hose and for holding the piece, while a coupling or nipple is forced into the same by the horizontal cylinder. To the piston rod of the horizontal cylinder is secured a crosshead which travels between guides as shown. This crosshead is pocketed to receive the hose coupling, which when dropped into the same is prevented from jumping out by the dog *R*. For holding the nipple a special casting is engaged with the crosshead. The hose to receive the fitting is placed in the block at *S*. Air is admitted to the upper end of the vertical cylinder, the piston is forced down and the hose is clamped and securely held by the concave block on the end of the piston rod. By the horizontal cylinder the fitting is then forced to place. For cutting off hose the concave blocks are removed and a suitable knife attached to the vertical piston rod. The length of the piece cut is regulated by the movable gauge *T*. The drawing shows the manner of piping, etc.



Pneumatic Air-Hose Machine, Union Pacific Railway.

Dust.

A writer in the September issue of the *Popular Science Monthly* says that dust has a very large share in nearly all the phenomena of the earth's atmosphere:

"It is what makes the clear sky appear blue; and when we look up into the sky we see the dust in the atmosphere illuminated by the sun. There is nothing else before us that can permit the light to reach the eye. Light goes invisible, straight through all gases, whatever their chemical composition. The dust catches it, reflects it in every direction, and so causes the whole atmosphere to appear clear, in the same way that makes the sunbeam visible in a darkened room. Without dust there would be no blue firmament. The sky would be as dark as or darker than we see it in the finest moonless nights. The glowing disk of the sun would stand immediately upon this dark background, and the same sharp contrast would prevail upon the illuminated surface of the earth—blinding light, where the sun's rays fall, and deep black shadows where they do not. Only the light of the moon and the stars, which would remain visible in the daytime, would be able to temper this contrast in a slight degree. The illumination of the earth's surface would be like that we see with the telescope on the lunar landscapes, for the moon has no atmospheric envelope that can hold floating dust. We then owe to dust the even moderately tempered daylight adapted now to our eyes: and it is that which contributes much to the beauty of our landscape scenery."

An Italian criminal who has served 10 years in an English prison for manslaughter, was caught trying to wreck a Lehigh Valley passenger train near Batavia, N. Y., Sept. 19, and put in jail. He ought to be sent up 10 more—10 feet in the air, and kept there until harmless.

Master Car Builders' Association Notice.

Mr. John W. Cloud, Secretary of the Master Car Builders' Association, announces that lithograph copies of the latest revised standards and recommended practice of the association, which are illustrated on a reduced scale by 15 sheets in the back of the Proceedings of 1894, may be had, on a similar number of sheets 30 by 38 inches, by applying to him. Blueprints can be taken direct from these sheets, which will be sold at 25 cents each, plus postage when sent by mail. Orders should specify how to ship if they are to go by express. Pamphlets containing the revised texts of standards and recommended practice, the same as printed in the Proceedings of 1894, together with the reduced cuts as there given, will be furnished also at 10 cents each. The lithographs and the pamphlets are now ready for delivery. Mr. Cloud's address is 974 Rookery Building, Chicago, Ill.

A "Corker."

"Two weeks ago I saw a carload of chickens in Alabama," says the correspondent of the Cincinnati *Enquirer*. "The remarkable thing about it was that the chickens were all from one day to three days old. Among the freight in a local car was a basket of eggs which had in some way been overlooked, and the car remained on the side track for a number of days. It was then picked up as an empty and taken into Selma, where, upon opening it, a number of small chickens were seen toddling about the floor, in fact, enough to be called a carload.

A carload of matches took fire from friction caused by the motion of the car recently at Burgin, Ky., and was burned.

A Paris society is said to have satisfactory proofs that Nicholas de Savin, of that city, is 126 years of age and the oldest man living.

The report of the Manhattan Railroad Company, of New York City, for the year ended on June 30 last, shows: Gross earnings from operations, $10,153,576; operating expenses, $5,532,040; net earnings, $4,621,536; other income, $311,677; gross income, $4,933,214; fixed charges, $2,600,566; net income, $2,332,647; 6 per cent. dividend on $30,000,000 capital stock, $1,800,000; surplus for the year, $532,647; cash on hand, $346,956; profit and loss (surplus), $5,623,197. The net income for the preceding year was $2,971,291.

General officers of the Illinois Central Railroad announce that after September that road will own and control the Chesapeake & Ohio Southwestern, and will run its fast passenger and freight trains from New Orleans to Chicago through Memphis over the Yazoo & Mississippi Valley and the Chesapeake & Ohio, abandoning the route for fast trains through Jackson, Miss., and Jackson, Tenn. Eight months ago the Louisville & Nashville began negotiations for the Chesapeake & Ohio Southwestern, but was finally stopped by the State of Kentucky. The price paid by the Illinois Central is said to be $5,000,000.

The Kicking End of a Boycott.

With a boycott, as with a mule, there are two terminals inclosed in the same hide. In the case of the gentleman with the long ears, if we deny him his oats and refuse him his fodder, he is likely to retaliate with the steam hammers kept in reserve at the other end of his anatomy. In this sense the boycott and the mule are similar in their habits, the kicking returns being as certain in one case as in the other. The men directly interested in the boycott of a certain industry are but a minority of those affected by it. The scorching process is for other men's skins as well as their own. There are trades and industries that run in groups and are so vitally related that a boycott of one is practically a damage to all. In the building trades we have the mason, carpenter, brickmaker, limeburner, hardware man, painter, plumber, glazer, etc. They are links in one chain—snap one and where are the rest? In the coal mining industries we have a ramification of interests that is practically beyond discernible limits, from the iron plant that has to shut down to the washerwoman who has to laundry an extra pair of cuffs to cook an egg. In the transportation business we have the whole network of traffic disarranged and broken, from the shipper who loads a car with silver to the farmer who ships a crate of chickens or a firkin of butter. This affiliation of interests is sensitive, and a pin in its flesh makes the whole body quiver. In this sense and under these conditions we cannot hurt another without hurting ourselves, and it is right here we get at the kicking end of a boycott, as the term is understood. No man can drop a dead cat in a town well to spite his neighbor without spoiling his own tea.—*The Age of Steel.*

It is said that Eli Whitney, grandson of the inventor of the cotton gin, has invented a machine for picking cotton that will do the work of 100 men.

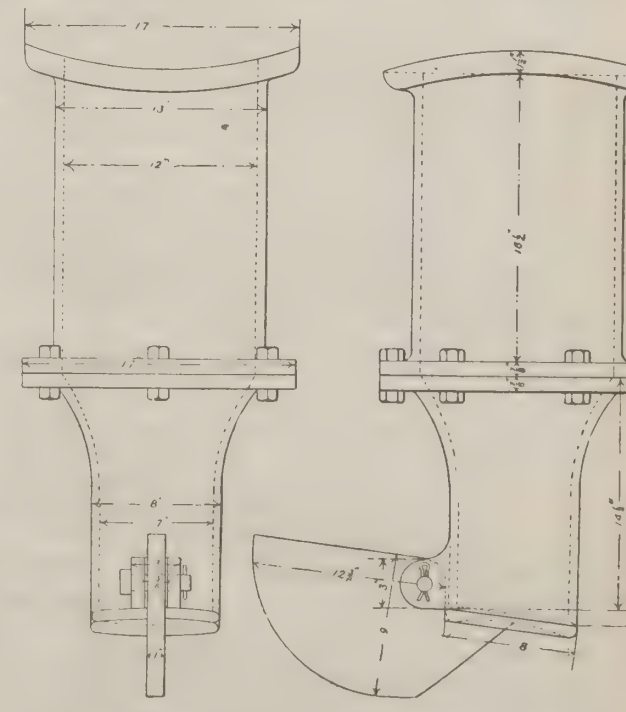
According to a statement issued by the Government of India, the number of collieries in India in the calendar year 1893 was 96, giving employment to 37,679 persons, and resulting in the production of 2,529,855 tons of coal.

A farmer in western Massachusetts recently displayed the following warning on his place: "Nottis—Know kows is alloud in these medders, eny man or women lettin thar kows run tbe rode wot gits into my medders aforesaid shall hav his tail cut of by me. Obadiah Rogers."

During a recent strike on the North British Railway, much difficulty was experienced in finding engineers to keep the necessary trains running. One of the substitutes, a young fellow, ran some distance past a station, and then, putting back, ran as much too far the other way. He was preparing to make a third attempt, when the station agent shouted, to the great amusement of the passengers: "Never mind, Tammas; stay where you are! We'll shift the station."

An Improved Cinder Trap.

One of the features of the extension smokebox that has caused locomotive builders some trouble is the arrangement of a hopper and trap for emptying the cinders and preventing access of air to the smokebox while the engine is working. Various arrangements have been tried, some of which have caused trouble either by being hard or unhandy to operate, or by persistently allowing air to leak into the smokebox and cause the active combustion of the accumulated cinders. The following engraving, which is taken from the *American Engineer and Railroad Journal*, illustrates an improved arrangement of this kind adopted on the Flint & Père Marquette, and designed by Mr. T. J. Hatswell, the master mechanic of the road. Referring to the drawing, it is seen that there are no slides, no wearing parts, and nothing to get out of order or to leak. The bottom of the drop is pivoted at the point shown just above the lower end of the chute, and consists of a slightly convex plate fitting into the bottom of the chute and held there by the counterweight extending out at the left of the pivot.



Cinder Trap, Flint & Pere Marquette Railroad.

Communications.

Sloping Crown Sheets.

Editor National Car and Locomotive Builder:

Referring to your article in the September issue relative to sloping crown sheets and different ideas as to the object of that form of construction, I would say that the first firebox constructed in this way, of which the writer has knowledge, was in the Ross-Winan anthracite burning engines, which had very long fireboxes. And not only the crown sheet sloped, but the outside shell of the firebox also. This was supposed to be so designed that better results would be obtained from anthracite fuel, the crown sheet being brought down to the fire. The center of gravity of the boiler was also lowered. This lowering of the firebox was supposed to offset the extreme height of the waist of the boiler from the rail, high boilers in those times being a novelty in locomotive construction. It was expected the plan would make a more steady riding and working engine.

Theoretically, the heat in a locomotive firebox should be equably distributed over the entire surface, and an equal quantity should pass through each flue. In practice this is not the case. When the engine is working, the flame and gas are carried in a line from about the bottom of the fire door to the top row of flues, or lower, being governed by the diaphragm arrangement in the smokebox. The heating surface, above the firedoor and back part of crown-sheet, is not so effective as the other parts of the firebox. The cold air rushing in when the door is open, further reduces the temperature of those parts. It was reasoned that if the back end of the crown sheet was lowered, and the sheet made parallel with the line of flame in the firebox, better results would be obtained. Accordingly a firebox with sloping crown sheet was put in a boiler, replacing a square box, and an improvement was at once apparent in a boiler which formerly steamed poorly. Fitting the new firebox with a firebrick arch to within two feet of the back of the firebox, and eighteen inches from the crown sheet, made a further improvement.

It is not claimed that causing the heat to be more effective at the back end of the firebox made all the improvement, as there is no doubt the increased amount of water, made possible by the drop of the crown sheet at the back end, also contributed largely to the improved steaming of the boiler, which was so satisfactory that the writer has continued the practice.

The sloping crown sheet would would have no effect in preventing the collection of sediment, as the sides of the crown bars that stand vertically to the crown sheet generally collect more sediment than the sheet. The only possible effect it could have would be the friction of the water as it swashed back and forth, which might remove some sediment.

The lower gauge cock in our boilers with sloping crown sheets is placed three inches above the highest point of crown sheet, insuring a good covering of water with one gauge. It would scarcely pay to design boilers with a view of reducing the damage occasioned by low water; the best plan would be to dispense with those fellows who would let the water get low.

James M. Boon.

Tests of Malleable Iron.

Editor National Car and Locomotive Builder:

Referring to the subject of physical tests of materials, it may not be uninteresting to users of malleable iron to know that a series of tests made at the laboratory of the Riehle Brothers Testing Machine Company indicates that the malleable nature is only prominent in castings of small section and is but little more than a skin.

A variety of test specimens from different foundries was used, varying from ⅝ inch diameter to 1¼ inches diameter, and while the smaller diameters noticeably approached wrought iron in strength and ductility, the larger specimens were not materially different from cast iron.

The same result was noticed in turning off the skin of all the specimens, when the malleable character seemed to disappear in all the sizes, and leave the cast iron element supreme. A more extended review of the matter will no doubt be given to the public soon, as there seems to have been but little investigation given the subject up to the present time.

Riehle Bros. Testing Machine Company,
C. E. Buzby, Superintendent.

The Youngstown Car Company has received an order from the Pittsburgh & Lake Erie Railroad for 50 coke cars.

The Kings, Queens & Suffolk Company, of Brook Haven, N. Y., has been incorporated to manufacture all kinds of railroad supplies and rolling stock. The capital is $600,000 in preferred stock divided into $25 shares, and $100,000,000 in common stock divided into $25 shares. The directors are Frederick W. Dunton, John N. Williamson and William L. Wood, of Jamaica; George E. Hagerman, of Rocky Point; George B. Finch and William J. Burke, of Brooklyn; Henry C. Rath, of Flushing; Isaac M. Kellogg, of Hollis; William N. Berinton and D. C. Reusch, of Jersey City; Roman Debes, F. T. Ryan and Peter D. Sturges, of New York City. George B. Finch subscribed for 63,990 shares of the capital stock of the company.

Railway Progress in New South Wales.

(*From an Australian Correspondent.*)

Railways have proved an important factor in opening up the inland districts of Australia and developing the resources of the different colonies. Their initiation, however, was attended with considerable difficulty, occasioned by the paucity of population and comparative scarcity of capital. The first railway in Australia, that from Sydney to Parramatta, on the river of the same name, was commenced by private enterprise, but subsequently the undertaking, with others, passed into the hands of the New South Wales Government, which has since retained control of the general railway system of the colony. The line from Sydney to Parramatta was opened on Sept. 26, 1855, from which time the work of railway construction, despite many interruptions, has made steady progress. Previous to October, 1888, the state railways of New South Wales were managed by a commissioner, under the Secretary for Public Works, but at that date the service was transferred to the department of the Colonial Treasurer, and the actual administration of the railways was intrusted to three commissioners—Messrs. E. M. G. Eddy (Chief Commissioner), W. M. Fehon and Charles Oliver—to whom were given very extensive powers, amounting in fact to almost independent control. The change was made with the view of securing economic management of the lines, free from political interference, and has proved advantageous in many respects. According to the Commissioners' report for the year ending June 30, 1894, there were at that date 2,501 miles of line in use in the colony, the cost of which was $154,256,617.06, of which amount debentures to the value of $6,070,018.50 have been finally paid off. Several of the branch lines are worked at a loss, owing to the sparseness of the population in the districts traversed, but with the progress of settlement better results will be obtained.

The admirable manner in which the New South Wales railways are managed is shown by the fact that, although the last two years have been marked by widely spread financial and commercial depression, which have had the effect of largely paralyzing business and industrial enterprise, and consequently diminishing the annual gross amount of railway earnings, yet the net earnings, after paying working expenses, were greater in 1894 than in 1888, a result of prudent economy and retrenchment, unattended with any diminution in the rate of wages. In 1888 the net earnings were $3,725,924.78; in 1894 they had become increased to $5,957,457.14. In 1893 the gross revenue was $14,225,492.16, in 1894 it had fallen to $13,673,-809.26, a decrease of $551,682.90; but a reduction of the working expenses by $712,835.64 left the net result in 1894 $161,152.74 better than in 1893.

While the working expenses have been reduced, the condition of the rolling stock, permanent way and the railway property generally has been improved in every possible manner, and the various lines will compare favorably with the best in the world. The sleeping, lavatory and other carriages are among the most luxurious and commodious of their kind, and the passenger carriages on the Sydney suburban lines are on the saloon principle and most comfortably fitted. The goods, refrigerating and other trucks are models of their class; and the principal railway stations, especially those constructed within the last few years, large, tasteful, well designed and furnished with long, broad platforms and every convenience. The passenger and goods rates are low compared with those of most other countries, and pleasure excursions are frequent during the season. The number of persons employed on the salaried and wages staff is 9,135. In Sydney there is a Railway Institute for the use of the employés. It is a handsome building, provided with lecture hall, classrooms, good library, etc. The employés have also a monthly periodical, the *Railway Budget*, conducted by themselves, the editor being a locomotive driver. Altogether, the New South Wales railways may fairly claim to be among the best managed of Australasian state institutions.

A negro boy tried to wreck a train on the Long Island railroad "for fun," Sept. 19. He spread the points of a split switch by placing stones between them.

Philadelphia will probably not have any elevated railroad in the near future. After a long and persistent struggle the syndicate of New York and Philadelphia capitalists, who had actually begun preliminary operations under charters granted by the State of Pennsylvania, has given up the effort to give Philadelphia an L system on account of the numerous obstacles placed in its way. A section of the road already built has been taken down and shipped away as old iron, and the whole project is definitely abandoned.

The Director of the Mint, at Washington, estimates that the total amount of gold coined in the United States during the fiscal year ending June 30 last was the greatest on record, with the exception of 1881. He places the gold coinage of the year at $99,474,912.50, made up of $55,143,640 in double eagles, $34,968,840 in eagles, $9,287,180 in half eagles, and $75,252.50 in quarter eagles. Of this amount $76,219,911.50 were coined in the Philadelphia mint, and $21,637,000 in San Francisco. The mintage at New Orleans was comparatively insignificant.

A Compliment to Locomotive Builders.

In a recently published volume of lectures by the noted writer Ruskin, the following extraordinary complimentary reference is made to the genius of those who build locomotives:

"I cannot express the amazed awe, the crushed humility, with which I sometimes watch a locomotive take its breath at a railroad station, and think what work there is in its bars and wheels, and what manner of men they must be who dig brown ironstone out of the ground and forge it into that! What assemblage of accurate and mighty faculties in them; more than fleshly power over melting crag and coiling fire, fettered and finessed at last into the precision of watchmaking; Titanian hammer-strokes, beating out of lava these glittering cylinders, and timely respondent valves, and fine-ribbed rods, which touch each other as a serpent writhes in noiseless gliding, and omnipotence of grasp; infinitely complex anatomy of active steel, compared with which the skeleton of a living creature would seem, to a careless observer, clumsy and vile—a mere morbid secretion and phosphatous prop of flesh. What would the men who thought out this, who beat it out, who touched it into its polished calm of power, who set it to its appointed task and triumphantly saw it fulfill this task to the utmost of their will, feel or think about this weak hand of mine, timidly leading a little stream of water-color which I cannot manage, into an imperfect shadow of something else—mere failure in every motion, and endless disappointment? What, I repeat, would these iron-dominant genii think of me, and what ought I to think of them?"

A Satisfactory Compromise.

It is said that the town of Pullman, Ill., was not really named after George M. Pullman himself. The story is that W. W. Beman, the architect of the town, being justly proud of his work, came to the proprietor and asked that it be named "Beman." "Um'm," said Mr Pullman "Fact is, I had thought of calling the place 'Pullman,' from the man who built it and paid for it."

"However," Mr. Pullman added, as he observed a look of disappointment on the architects's face—"however, I'm not particular. Now, what do you say to a compromise? Suppose we take the first syllable of my name, 'Pull,' and the second syllable of your name 'man.' There we have it—'Pull,' 'man'—'Pullman.' You see that that combines your idea with mine." Mr. Pullman's suggestion prevailed, and the name, it is said, is really a compromise, on this scale.

Oxygen is likely to play an important part in the submarine boat soon to be built for the navy. It has been found that a comparatively small quantity of oxygen from time to time admitted to a submarine chamber will keep the air of such a chamber for hours in the condition to sustain human life. Instead, then, of carrying large volumes of compressed air in many heavy metallic receivers, a single receiver filled with oxygen may be carried. This makes possible an important economy of weight and space.—The Philadelphia *Public Ledger*.

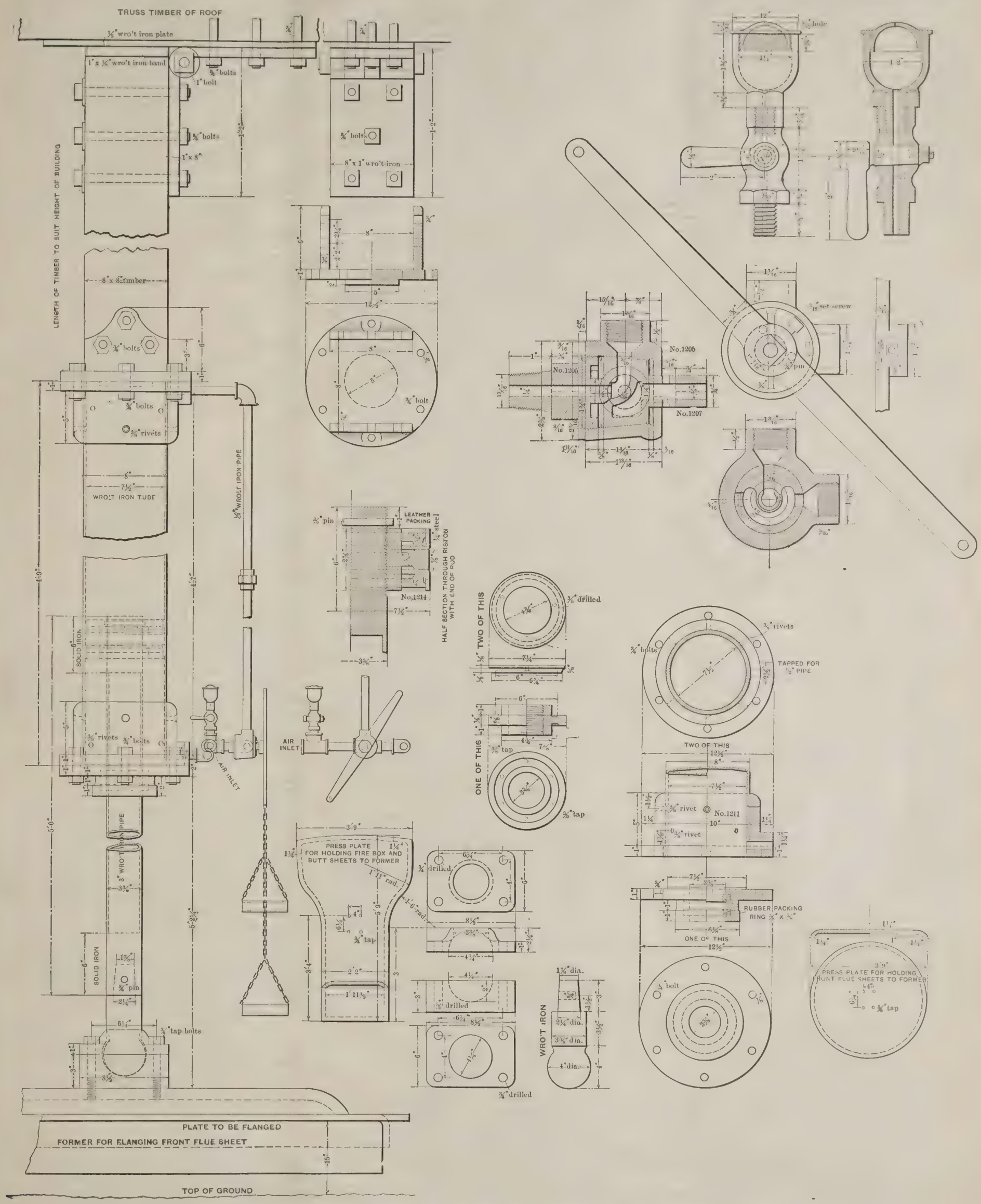
A delegate to the recent convention of the American Forestry Association declared that the United States consumes more firewood, builds more wooden houses and fences than any other nation. The consumption of wood pulp in the manufacture of paper alone involves the destruction of 500 acres of woodland daily. If we continue to use the wood supply thus lavishly, systematic tree planting on a very extensive scale is necessary if we are to save the country from the dangers of a treeless region.

A curiosity in railroad building is the road running from Ismid, a harbor about sixty miles from Constantinople, to Angora, about 300 miles. The bridges, ties, telegraph poles and rails are iron, most of which is of German manufacture. The bridges average about four to the mile, there being 1,200 of them, the longest having a stretch of 590 feet. In addition to these there are sixteen tunnels, the longest measuring 1,430 feet. This is the only railroad which penetrates the interior of Asiatic Turkey, the Smyrna lines being near the coast.

The New York & New England Railroad has ordered 15 locomotives of the Rhode Island Locomotive Works.

In a lecture recently given by Dr. H. R. Mill, in London, under the auspices of the Royal Meteorological Society, on the temperature of soil, water and air in relation to hygiene, the author showed how the atmosphere was scarcely warmed by the rays of the sun passing through it, but heated and cooled mainly by contact with the land or water on which it rested, the distribution of climate being almost a geographical rather than a meteorological problem. Land under a cloudless sky grew very hot during sunshine and cooled equally quickly at night, so that a range of 30 degrees or 40 degrees Fah. between day and night was not uncommon in the tropics. Water, on the other hand, heated slowly and cooled slowly, so that the daily range of sea surface temperature rarely exceeded 2 degrees or 3 degrees. Air resting on the land was subject to a correspondingly great range of temperature, not only between day and night, but between summer and winter, while air resting on the sea was little affected by variations of warmth.

Forty large locomotives recently turned out by the Paris, Lyons & Mediterranean Railway have a curious funnel-shaped attachment in front, designed to cut through the air as the bow of a boat cuts through the water. The friction of the air thus avoided, it is claimed, adds materially to the speed of the trains and saves coal, though the new engines are somewhat unsightly in appearance.



PNEUMATIC PRESS FOR BOILER SHOP, UNION PACIFIC RAILWAY.

Pneumatic Boiler Shop Press, Union Pacific Railway.

The above engraving reproduces the working drawings of a pneumatic press used in the boiler shop of the Union Pacific Railway at Omaha, to secure a tube butt or other boiler sheet to the flange block while being flanged. It consists of a vertical cylinder supported from the roof as shown by the drawing. The lower end of the piston rod is connected by a ball bearing to a press plate. The sheet that is to be flanged, after being heated, is placed on the flange block; air is admitted to the upper end of the cylinder, and the piston and press plate are forced down upon the sheet, which is held immovable until flanged. Air is then admitted to the lower end of the cylinder, while that in the upper end is permitted to escape. By this means the piston and plate are again raised and the sheet is removed.

It will thus be seen that the operation of the press is very simple. It has proved a great economizer of time and work in the shop at Omaha, and gives good general satisfaction.

The engraving has been made large so as to plainly show the construction of this device, and to accurately give the dimensions of the different details, in order that those of our readers who may wish to make a somewhat similar arrangement can do so in the light of the suggestions this device presents. Some of our previous illustrations of these pneumatic devices have been used in this way, and the number of such devices in use in railroad shops has been increased in this manner to the good advantage of all concerned.

The Buffalo, Attica & Arcade Railroad, better known as the Tonawanda Valley Railroad, enjoys the distinction of having had more names than most railroads. It was built in 1853 and called the Attica & Arcade Railroad; then its name was changed to the Attica & Alleghany Railroad, and later on, in 1872, it became the Tonawanda Valley Railroad. Afterward it was known as the Attica & Freedom Railroad and now its present name. At first it was built as a standard gage road, and in 1870 it was made narrow gage. At present it is being altered to the standard gage and is being generally rehabilitated.

Southern and Southwestern Railway Club.

Compressed Air Flue Cleaning Device.

At the August meeting of this club, held at Atlanta, Ga., Mr. C. T. Thomas, Chairman of the Committee on "Rapid Cleaning of Flues of Locomotives," rendered a report on this subject, which was accompanied by the following illustrations of a device for cleaning flues by compressed air. Modesty deters the chairman from saying in his report who invented the device, but it is probable that it is his own invention.

The report on the subject shows that the old flue auger is still generally used throughout the country for opening stopped-up flues, and in some cases the job is finished by a jet of compressed air. The apparatus illustrated herewith cleans out the flues and forces the dust and dirt to

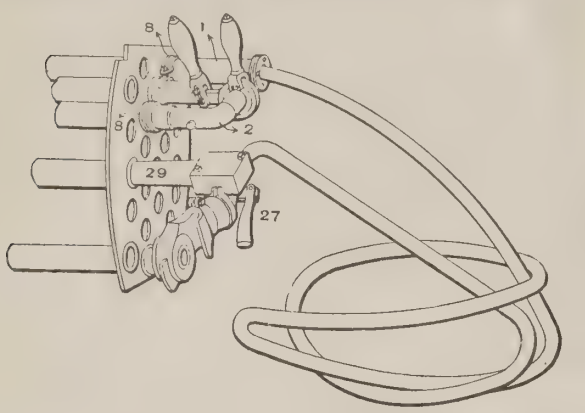


Fig. 1.—Pneumatic Device for Cleaning Flues.

the opposite end of the boiler from where the machine is operated. Its operation and method of application are thus described in the report:

Its simplicity of manipulation, together with its small bulk, allows it to be operated in front of brick arches where they are used in locomotive boilers, and thus avoid knocking out the arches to clean the flues, which otherwise could not be done. Its work is done with more rapidity than the flue auger, and leaves the flue entirely clean; at the same

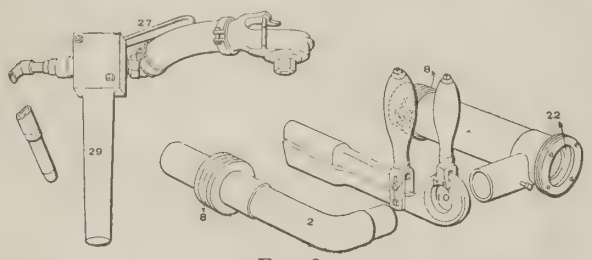


Fig. 2.

time the double wedges of the holder clamping the holder fast in the flue, and allowing cam motion to throw the double cylinders against the flue head, make an air-tight joint at Fig. 8. The rubber diaphragm 22 prevents any air or dirt escaping around the flexible tubing, and forces it through the adjacent flue to the other end of the boiler. The stop-cock 27 is placed at a convenient position by the plug holder 29 being pressed in another tube. The arrangement also has the property of extending the cylinders 1 and 2, so that they will reach to the deck plate in cleaning about No. 2, and take in the flues. It also has the advantage of allowing the flues to be cleaned at any point on the line of the road where two engines stop at one time, so that the air of one engine can be used to clean the flues of the other without disturbing the arch.

Draft Appliances.

A report was made to the club on this subject by Mr. E. M. Roberts, Superintendent of Motive Power of the South Carolina & Georgia Railway. The report said that the differences in fuel and in the design and proportion of exhaust pipes, and the relation of the latter to the shapes and dimensions of stacks, partly account for the wide diversity of detail which now exists in the arrangement of our locomotive smokeboxes. The report describes the action of the exhaust in producing a draft through the fire with the arrangement of short smokebox, diamond stack, low exhaust nozzles and the petticoat pipe, and with the later arrangement of extension smokebox, straight stack, and with diaphragm and netting in the smokebox. The report considers that a straight stack is preferable to a taper or choke stack, for the reason that less refinement is necessary in the adjustment between the exhaust and stack—for with the taper or choke stack the escaping steam must expand at or below the choke to produce proper vacuum, while with a straight stack, variation of the height and diameter of the exhaust will not affect results, thus producing a considerable economy in repairs and maintenance. Referring to the report of the Master Mechanics' Association Committee on Exhaust Nozzles and Steam Passages, the report says :

"The committee's report of this year shows by shop test that a short front gives more vacuum than a long, but we think there are conditions that must be considered before accepting this result. The test was made without netting, and we are aware that the vacuum would vary in service with the thickness of the fire and openings, or leakage into the firebox. The size of the receptacle for sparks is dependent on the character of fuel, the mesh of netting, and the service and length of run required without sparking."

The opinion is expressed in the report that it is impossible to obtain a uniform draft through all the flues with a solid diaphragm plate in front of them. With round and rectangular perforations in this plate when small, (not exceeding three-eighths of an inch round) and not too numerous, results slightly better than with a blank sheet are obtained, but with larger and numerous holes the functions of the sheet as a draft regulator are interfered with, and the draft is concentrated in the tubes nearest the line of draft.

As a remedy for this the report proposes the use of a perforated diaphragm with projecting lips over the perforations, as illustrated in the drawing below, which is reproduced from the report. The arrangement is thus described:

These hoods project downwardly and rearwardly, offering a resistance to the air and gases, causing them to take a circuitous passage through the diaphragm, and at the same time preventing the escape of sparks otherwise than by passage at bottom of plate, allowing a freer escape of gases to the stack, while the circuitous course of the current produces a nicely balanced effect upon the tubes and all parts of the fire, and admits of using a much lighter and milder exhaust to force the fire, and the gases are allowed to flow through the tubes more slowly, and in consequence the sparks and carbon are more completely consumed in the furnace and tubes. By the difference in location the deflecting lips are made to bear varying relations to the direction of the draft from different tubes; that is to say, from the lower and more distant tubes the direction of the draft is such that it passes upward beneath the lips, and thus suffers less opposition than the draft from the nearer tubes.

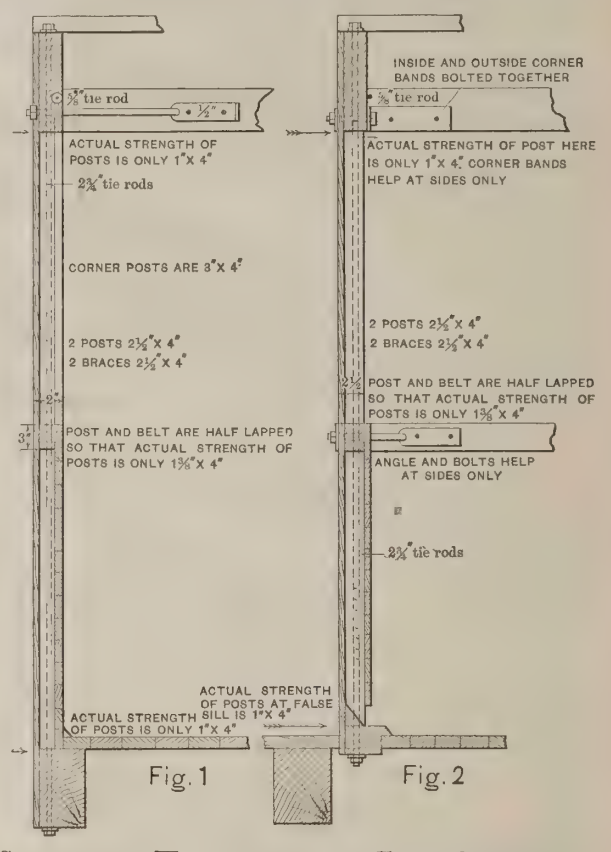
We are enabled to use 4¼ to 4⅜ inch single nozzles with 16 by 24 inches, and 4¾ to 4⅞ inches for 18-inch engines, with an economy in fuel, based on same mileage and number of cars handled under similar conditions, of $300 per annum for each engine.

Careening of Passenger Truck Bolsters.

Mr. W. H. H. Price, a member of the committee on this subject, said that after giving the matter some thought and investigation, the committee reached the conclusion that the defect complained of showed itself only when cars were settling. In such case good practice required the car to be tightened up to proper camber, and evenly adjusted on each side. If such care cannot be readily given to the car, the center plates can be packed with wedge-shaped pieces, to bring it to the normal position required.

Construction of Box Car Ends.

Continuing the subject of the improved end construction of box cars, taken up at the April meeting, the secretary, Mr. S. D. Charpiot, presented drawing showing a construction proposed by Messrs. Sanderson and Soule. The sketches shown in Figs. 1 and 2 were sent in by Mr, Sanderson, showing the weak points of the usual constructions. Fig. 3 shows the proposed improved construction, the main features of which are the reinforcing of the center and intermediate posts with $\frac{5}{16}$-inch angle irons 3 inches by 1¼ inches; the top of angle bars on the center posts being shaped into a three-quarter bolt, running through the top of the end plate. The top of the angle bars on the

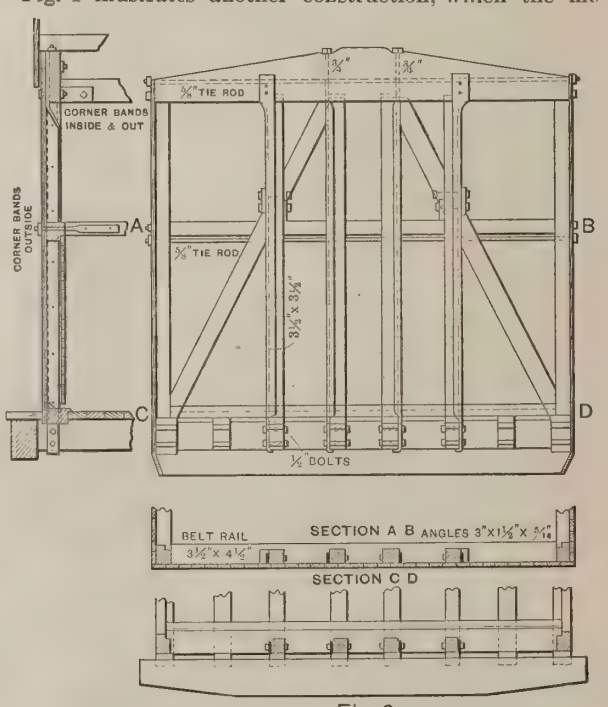


Showing the Weaknesses of the Usual Construction of Box-Car Ends.

intermediate posts are twisted to present its broader surface to the plate, to which it is fastened by two bolts.

The 3-inch or broad wing of the angle bar is extended below the center and intermediate sills, and terminates into a lip firmly anchoring the posts to the sills, on which they are placed, and fastening them with two through bolts. The design calls for inside and outside corner bands at the middle and top, and tie rods at the same location as shown on the sketch; the framing of the end of the car is separate from the end sills.

Fig. 4 illustrates another construction, which the me-

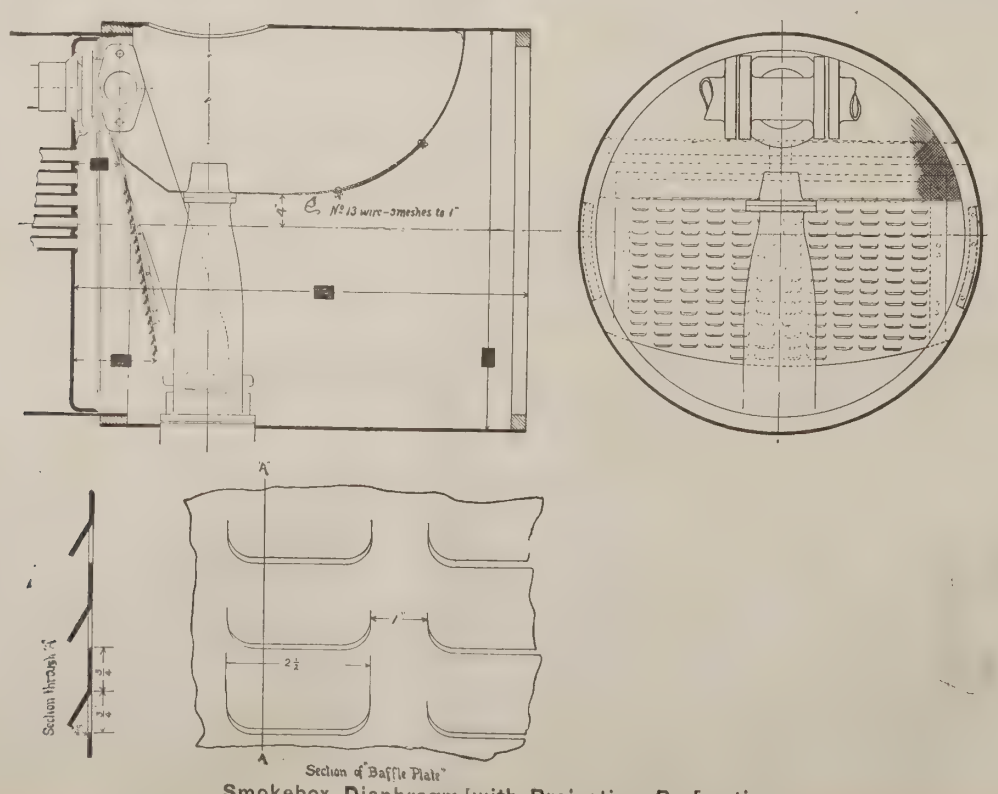


Proposed Improved End Construction.

Feet of posts gained into sills ⅞ inch. False sill cut out 2¾ inches for posts. Posts cut out ¾ inch for false sills, so that any sill can be dropped without disturbing end framing.

chanical staff of the Norfolk & Western Railroad intends to adopt and is described in the following letter from Mr. Sanderson :

We have made up our minds that the best framing we can get up for the ends of box cars will be by using 4 inch eye beams for the posts and braces ; these eye beams to be held in castings, top and bottom, which castings will be secured to the end plates and end sills, or longitudinal sills, as the case may require, in the usual way. The plate to be tied to the end sill or longitudinal sills by vertical through bolts, which will lay in the grooves of the eye beams, cross rails to be put in between the eye beams, one about the usual height of the belt rail, and one about half way between this and the floor. These to be 4 inch by 4 inch solid pine sticks, under each of which a long through bolt would run, made tight to the side of the car, keeping these rails to their places, tying the whole car firmly together crossways. The corner posts will be of wood as usual, but made of a heavier section than we have used heretofore. Angle plates used inside and out at the level of the belt rail and top and bottom corners, the end plates to be secured to each



Smokebox Diaphragm with Projecting Perforations.

of the longitudinal purlins by the means of long strap bolts. The inside sheathing and the ends can be virtually the same as the outside. In this way we believe we can make a box car end which will stand almost anything.

The drawing shown in Fig. 4 was made by Mr. Charpiot, and in reference to it he says:

"I placed the I beams forming the upright posts on the end sill, but they could readily be placed on the center and intermediate sills, the same as shown in Fig. 3. Of course the designs of the pockets at top and bottom of I beams can be varied in a multiplicity of shapes and sizes, which have not been elaborated, as this is only a suggestion of construction. In case I beams should be objectionable, no doubt a construction similar to that shown in Fig. 4 might serve a good purpose and give satisfactory service, composed of wood posts and iron rods. By making the posts, beams and rails not less than 4 inches by 4 inches or 4 inches by 5 inches, or even of greater section if need be, with vertical and horizontal cross rods, angle and corner posts, and anchor bolts when needed, we would then get a section of timber strong enough to resist the battering shocks of shifting cargoes. The introduction of post pockets for the posts would give them the full strength of their section. Such a construction might be more readily repaired in case of wrecks, when the members made of metal generally give considerable trouble to straighten and put back in shape."

The next meeting of the club, which is the annual meeting with election of officers, will take place at the Kim-

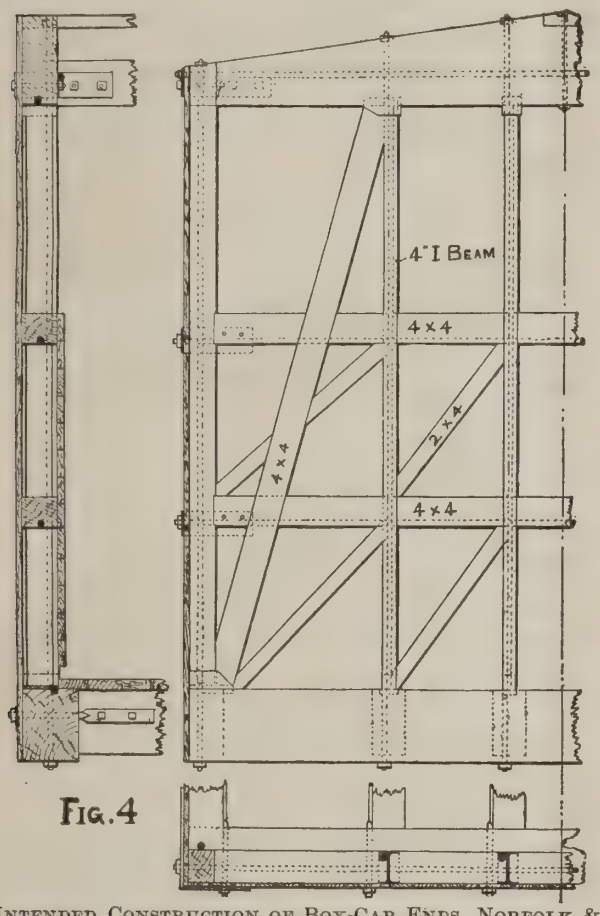


FIG. 4

INTENDED CONSTRUCTION OF BOX-CAR ENDS, NORFOLK & WESTERN RAILROAD.

ball House, Atlanta, Ga., on Thursday, Nov. 15, at 10 o'clock A. M. The subjects for discussion will be:

1. What is the cause of uneven wear of driving wheel tires, running in the Southwestern territory? Wm. Rutherford, P. H. Schrieber and W. H. Hudson, Committee.

2. What is the most economical method of obtaining compressed air for general use in railroad shops and its application? Messrs. E. M. Roberts, T. W. Gentry, John S. Cook, Committee.

3. Handholds and safety appliances for protection of trainmen as adopted by the Master Car Builders' Association. Are we living up to them? If not, why not? Messrs. J. M. Holt, W. H. H. Price, A. B. Corinth, Committee.

4. What are the best agents and the best appliances in use for removing and preventing scales in locomotive boilers? Messrs. F. H. McGee, Geo. D. Harris, T. B. Irwin, Committee.

The Committee on Counterbalancing of Driving Wheels, Messrs. Sanderson, Pomeroy, Gentry and Gibbs, is expected to report; also the Committee on Draft Sheets, best form for economy of fuel, Messrs. Gifford, Owens and Michaal.

Early Stage Travel in the West.

Time was, not many years ago, when the huge Concord stage, with its six galloping horses, urged by the long, stinging lash of the big-hatted, tobacco-spitting driver, was the only means of transportation on the Pacific coast for passengers, express and mail, save the few steamers where navigable waters afforded them a chance to compete. There were great trunk lines from which a perfect network of small lines ramified every settlement and mining camp. The network still remains, but the great trunk lines are for the most part superseded by the iron horse. Such great lines as that from Sacramento, Cal., to Portland, Ore., and from Walla Walla, Wash., to Helena, Mont., have long since given way to the railroads, following the example set nearly a quarter of a century ago by the great overland stage line, established by Ben Holliday, from Independence, Mo., to Sacramento. That was the greatest stage enterprise in the world, and for 10 years it defied Indians and highwaymen, and carried thousands of passengers and millions of treasure. Now the lines are shorter and the huge coach, with its scores of passengers, its great load of trunks, express boxes and mail sacks, is seen on but few of them, and yet the traveler can get from them all the staging experience he wants, including an impromptu interview with the "lone highwayman."

The forerunner of the stage in the mines was the mounted express, messengers being pushed into the mountains in all directions as early as 1850, to reach every little mining camp. These messengers carried treasure and small packages, but their chief business was in handling mail. They took lists of names to such postoffices as Marysville, Sacramento Stockton and San Francisco, and searched for letters and papers. At first they charged $4 a letter, but competition soon reduced this to $1. It also caused them to pick up their heels. Rivalry reached fever heat, and it was a daily struggle to make the fastest time. Often long-distance races were run by prearrangement. Such a race was run from Sacramento to Yreka, about 300 miles, with the President's message, in March, 1853. Horses were stationed along the route at ten-mile intervals, and kept saddled for two days, waiting for the messenger to dash into view. This race cost Adams & Co., the winners, $1,500, and Wells, Fargo & Co. fully as much. Soon stage lines succeeded these mounted messengers and held the field until the iron horse appeared, and are now the means of communication between the railroad and all interior points. The wonderful pony express from Sacramento to Independence, Mo., was the last of the mounted express lines.

The skill of the old-time driver is wonderful. With his long whip-lash he can touch up any horse in his team with a stinging admonition to behave or to increase his speed, making the lash alight on any portion of the animal's anatomy he may chose. Giving the whip a preliminary twirl about his head, his hand firmly grasping the short stock, he throws it forward with a swinging motion and then gives it a backward twist, and the long lash uncoils itself with a snap like the crack of a pistol. I have seen a bird sitting on a fence by the roadside killed in this way, the stage bowling along at the rate of 10 miles an hour. But this dexterity with the whip is largely ornamental. It is the handling of the reins and the heavy foot brake where skill is the most important. It is here that accidents are averted and lives saved. On the down grade the brake is almost the sole reliance. There is no other means of holding the stage in check. A few years ago on the steep grade between Lake Tahoe and Truckee, the brake rod broke while a heavily loaded stage was descending, killing or wounding a majority of the passengers and frightened animals. Coming down a steep grade on Siskiyou Mountain one bright moonlight evening, I had an exciting experience somewhat similar. I was the only passenger, and sat on the left of the driver, securely strapped in by the apron. In some way the six horses became frightened and plunged down the steep grade at a gallop. The brake was of no service whatever. The driver was cool and had them under sufficient control to keep them on the grade, but he was afraid that when we came to the turn in the road at the foot of the hill the stage would upset. He advised me to unbuckle the apron so as to free my limbs, and, if the stage upset, to endeavor to jump into a bush. "It will scratch you up some," he consolingly remarked, "but won't break any arms or legs." Mentally I selected bushes successively as we approached them at great speed, meanwhile clinging to my seat with desperate clutch. When we reached the bottom of the grade, which was at this point wider than common, the driver, with consummate skill, swung the stage as far as possible out and made a sweeping turn, and started on the up grade again in safety. Such coolness, bravery and skill as this have made the old-time drivers famous.

The most celebrated driver, though by no means the most skillful, or possessing the highest personal qualities, was Hank Monk, who was on the route between Carson City and Placerville for many years. Who does not remember Artemus Ward's humorous account of how Hank drove Horace Greeley over the mountains and got him into Placerville in time to deliver his lecture? Going up the steep grade was slow work, and Greeley, who was accompanied by Sam Bowles, of the Springfield *Republican*, and Governor Bross, of Illinois, constantly complained about loss of time. Hank gave him no satisfaction, except to say, "I has my orders." After the summit was passed Hank lashed his horses into a gallop, and the stage plunged down the grades with a speed that was terrifying to the tenderfeet within, and not entirely free from danger even with so skillful a driver handling the ribbons. The passengers bounced about the interior like rubber balls, every moment expecting the vehicle to plunge off the grade into the canyon below. In vain they protested. Hank's invariable answer was: "I has my orders; git him there at seving; keep your seat, Horace. Ge 'lang," and away the stage went faster than ever. Horace was there at seven, but not in either a physical or mental condition to deliver an edifying discourse.—HARRY L. WELLS, in the *Express Gazette*.

"'Our hero sat in the corner of the railway compartment devouring his newspapers,'" read Miss Myrtle Dolan, from the latest acquisition to her paper-cover library. "He wor devouring what?" asked her father, with sudden interest. "His newspaper, the book says," replied Myrtle. "Go an wid yez. Oi t'ought 'twor a mon ye wor readin' about, an' now, be the powers, he turns out to be a goat."

Passengers on the railways tip guards and porters, but seldom give a thought to the engine drivers, one of whom tells this story: A gentleman gave half a crown to the guard, with the request that he would do his best to make up for lost time, as he wanted to catch a particular train at a junction. When the junction was reached the train in question was steaming out of the station, whereupon the passenger, annoyed, went to the driver and said: "I think, driver, you might have enabled me to get my train." "Ah, sir," replied the driver, "you greased the wheels at the wrong end of the train."—*London Strand Magazine.*

Electric Traveling Cranes.

Messrs. Manning, Maxwell & Moore, dealers in railway and machinists' tools and supplies, of 111 and 113 Liberty street, New York, have received the following orders for the Shaw three-motor electric traveling cranes, built by the Shaw Electric Crane Company, of Muskegon, Mich.:

Pittsburgh Tin Plate Works, one 12-ton crane; Henry R. Worthington, the celebrated steam pump establishment, one 30-ton crane; the Midvale Steel Company, Nicetown, Philadelphia, Pa., one 40-ton double trolley crane. The order from the Midvale Steel Company is especially satisfactory, in view of the fact that it now has in its works one 80-ton, two 40-ton and two 20-ton Shaw electric cranes.

Steam Hose.

The difficulties of producing a satisfactory steam hose for car heating purposes appear to have been largely overcome. The rubber companies have been endeavoring to manufacture something that would last a year or longer in car heating service, and in all cases be reliable. The great difficulties to be overcome have been the tendency of the hose to swell inwardly, thereby decreasing the inside diameter, and to chip off and carry portions of the rubber lining through into the valves of the heating apparatus, thereby clogging them up.

The belief was for a long time entertained by the various manufacturers that the rubber would have to be heavily compounded with minerals in order to withstand the action of steam. After much experimenting in this line it was decided that this was a mistake. It was then attempted to retain the inside diameter of the hose and to overcome the swelling by inserting wire on the inside. This was not satisfactory as the hose continued to swell between the coils of the wire, and frequently the wire, by being heated and through the mechanical action, chafed and destroyed the hose much quicker than where the wire was not employed.

While foreign rubber manufacturers, as a rule, are not equal to American manufacturers of mechanical rubber goods, Mr. C. H. Dale, General Manager of the Peerless Rubber Mfg. Company, of New York, while in England discovered a compound there of which their steam hose is made, the basis being fine Para rubber, which has given excellent results. While it is not assumed that there are any secrets to any extent in the compounding of mechanical rubber goods, this is a compound that is not generally known: The minerals compounded with a fine grade of Para rubber are of a very light material and in no way interfere with the elasticity and flexibility of the gum itself. In this it differs from all of the minerals heretofore employed in compounding steam hose. All of the hose manufactured by the Peerless Rubber Manufacturing Company during the season of 1893-4 on this principle gave very satisfactory results, wearing the entire season; and it is believed that most of it is still in good condition and fit for service for the season of 1894-5.

The company announces that it is prepared to supply hose for car heating with the guarantee of one season, and it claims that in between coaches there is no question but what 90 per cent. of it will wear two seasons or longer, providing it is properly cared for during the summer or non-heating months; that is, if it is taken off and put away until required in the fall.

Messrs. B. M. Jones & Co., of 11 and 13 Oliver street, Boston, announce that the lowering of the rates of duty in the steel schedule of the Tariff Act of Aug. 27, 1894, enables them to sell the "Mushet's Steel" at the following reduced prices: "Special," 46 cts. per pound; "Titanic," 19 cts. per pound.

The Drexel Railway Supply Co., of the Rookery Building, Chicago, announces that it is now prepared to make steel castings of any description, particularly car and locomotive castings of all kinds, including couplers, knuckles, followers, etc., and brakeshoes, wedges, also machine castings, gearing, sprockets and clutches.

The Composite Brake Shoe Company, of 620 Atlantic Avenue, Boston, Mass., announce that they have made arrangements with the Pennsylvania Iron Works Company, of Philadelphia and the Kinzer & Jones Mfg. Company, of Pittsburg, Pa., for the manufacture of their composite brakeshoe. It is stated that this brakeshoe is becoming a standard with many street railways, especially for the electric service, and has superior braking and wearing features.

Quit hardening steel at the forging heat.

Do not lay hot steel in a draft, or where it will cool unevenly.

Where high steel has been put improperly into shapes liable to crack, try a bath of warm, muddy water, if oil is not at hand.

A drill hardened on an ascending, refining heat will cut twice as much as one that is slightly overheated.

There is nothing better to quench in than water.

Do not forget that if a tool is overheated for hardening it is vastly better to let it go cold and then reheat, than to let it cool down and then plunge on a descending heat.—*Sparks from the Crescent Anvil.*

At the annual meeting of stockholders of Westinghouse Air Brake Company held at Wilmerding, Pa., Sept. 4, the following officers and directors were elected: President and director, George Westinghouse, Jr.; Vice-President and director, Robert Pitcairn; directors, H. H. Westinghouse, A. M. Byers, T. W. Welsh, John Caldwell and W. W. Card. The report showed total assets, $8,674,928.41; liabilities, capital stock, $5,000,000, and the surplus of $3,126,231.73, leaving net earnings for the year $548,695.68. The president stated that there had been practically no increase in the number of engine and car equipments during the year, the business of the company having been mostly from the sale of supplies for repairs and maintenance.

L. Schutte & Co., engineers and machinists, of Philadelphia, have issued an illustrated pamphlet which describes their latest appliance for the noiseless heating of water by direct steam. The apparatus consists of an outward and upward discharging steam nozzle, covered by a shield, which has numerous openings for the admission of water, so that the jet takes the form of an inverted cone, discharging upward. Air, admitted through a small pipe, is drawn in by the jet, and by mixing with the steam prevents the sudden collapse of bubbles and the consequent noise which is such a great objection to heating by direct steam in the old way. A valve or cock on this air pipe regulates the quantity of air as may appear most desirable. The apparatus will work noiselessly at any pressure of steam from 5 pounds to 100 pounds or more.

Car Lighting in England.

The lighting of railway cars by electricity in England does not seem to be making much progress, as the Midland Railway has recently decided to abandon the electric lighting system which has been in use on some of its trains for several years, and adopt Pintsch gas. The managers of the road gave as their reason for making this change that the electric system, although furnishing an aggreeable light, was very unreliable and exceedingly expensive to operate and maintain.

The Acme Machinery Company, of Cleveland, O., manufacturer of bolt cutters, nut tappers and bolt heading machines, has issued a new catalogue of these machines, which, as is well known, are of a high standard of excellence. The works of the company were erected in 1884, and have since been greatly enlarged. They are equipped with the best modern tools the market affords.

Marble Molding and Countersinking Machine.

We present to our readers in this issue an illustration of some elaborate moldings made by machinery on the Riehle marble molding and countersinking machine. (See Fig. 1.) The machine on which these moldings were made is herewith illustrated, Fig. 2. These moldings can be cut in many forms, and upon the hardest and most brittle marble, by machinery. Formerly it was impossible to decorate the interior of handsome dwellings and public buildings with so much marble and stone work as is now done, on account of the great cost of cutting by hand, but by the use of machinery interior work in stone has become a very prominent feature of the architecture of the present day.

An examination of the interior work of all the large buildings in New York City erected in the last ten years is a confirmation of the above assertion. All of this work has been done upon the Riehle marble molding and countersinking machines. What is true of New York City is also true of many of the leading cities. The special tool for making these elaborate moldings is a patented one. The patent is owned and controlled by Riehle Bros. Testing Machine Company, of Philadelphia, who are the exclusive manufacturers of it.

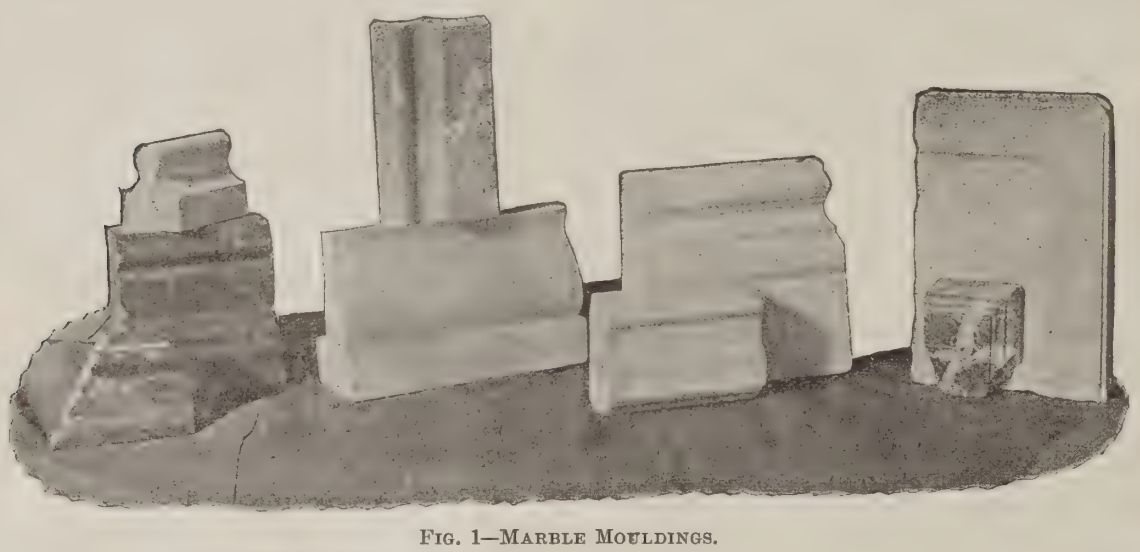


Fig. 1—Marble Mouldings.

An Improved Air-Hose Hanger.

About the most damaging condition that airbrakes are subjected to is the sucking of dust and dirt into the delicate mechanism of the triple valves. It is known that this is sucked into the train pipes through the air-hose, the foreign substances finding lodgment therein when uncoupled and either dangling or hung on the dummy coupling. The following engraving illustrates an improved hanger and dust guard for air-hose, invented by Mr. J. A. Jisson, Air-brake Inspector of the Louisville & Nashville Railroad at Nashville, Tenn.

Air Hose Hanger.

The device is made of malleable iron and is very light. It is made in one piece and is not liable to be bent or twisted. The device is operated by entering the teat into the hose opening and turning it so that the jaws will clamp the lugs in the same manner as when coupling two air hose. The teat presses against the rubber packing ring in the hose coupling, and makes a dustproof and airtight joint.

The Q. & C. Company, of Chicago, has issued a pamphlet entitled "The Cattle-Guard Problem," by Benj. Reece, C. E., together with the "Law of Cattle-Guards and Railroad Fences, Containing Statutes and Decisions of the States of the Union." Railway officers who desire copies may obtain them free of charge on application.

The National Malleable Casting Company recently started a portion of their plant at Indianapolis, Ind., and has now put more furnaces at work, giving employment to a considerable number of men who have been idle for some time.

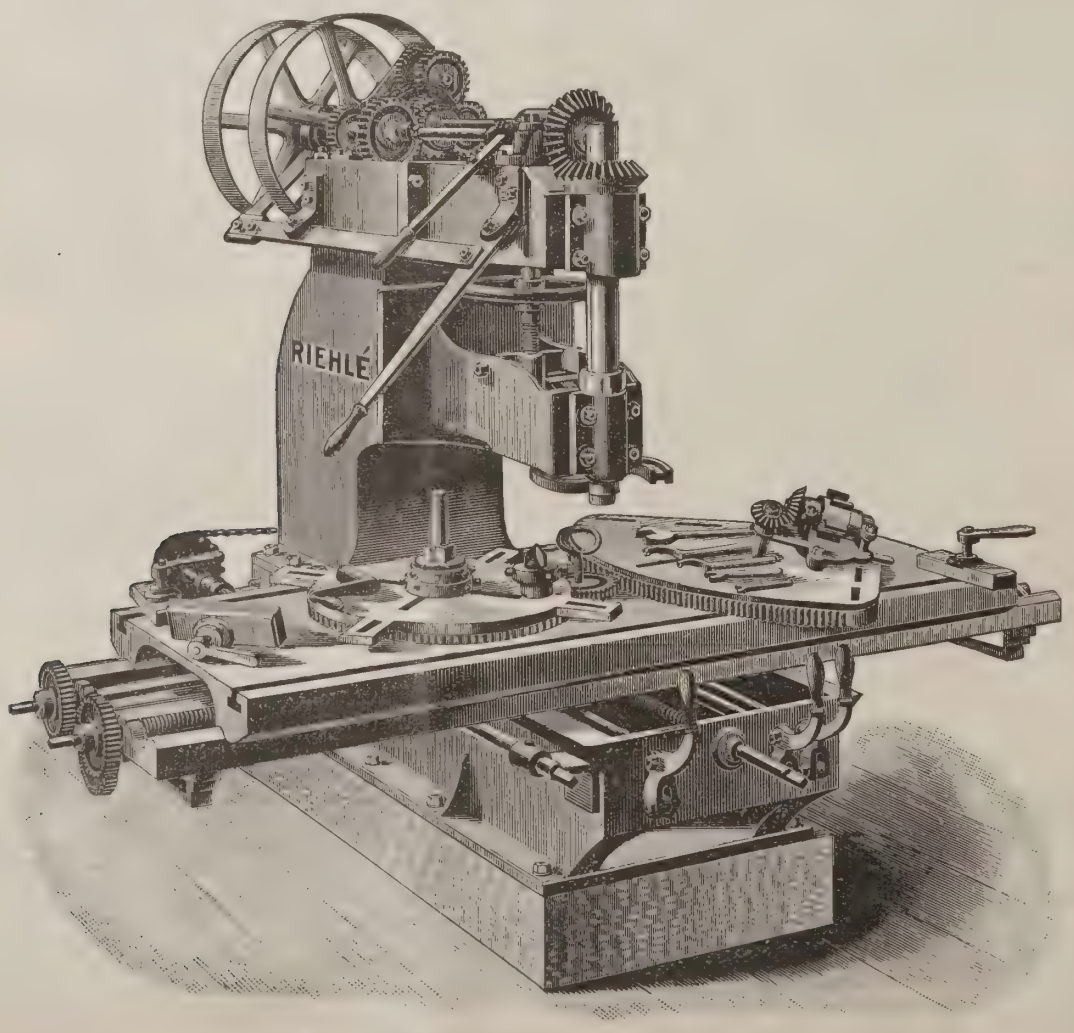


Fig. 2—Riehle Marble Moulding Machine.

A Good Educational Work.

An excellent educational work is being done by the Young Men's Institute of New York City, under the auspices of the Young Men's Christian Association. Instruction is given in the following subjects: Steam engineering, practical electricity, sanitary plumbing, carriage drafting, mechanical drawing, architectural drawing, freehand drawing, arithmetic, bookkeeping, penmanship, shorthand, typewriting, English grammar and composition, vocal music and glee club, and first aid to the injured.

The classes are open to all young men between the ages of 17 and 35 years. A distinctive feature of this educational work is that the theory is taught to those who are getting the practical part of the subject in their daily work. Firemen are taught all the theory necessary for becoming engineers; engineers are prepared to take charge of higher grade engines; machinists are taught the mechanical drawing which they need in their work; young men in offices are taught commercial subjects. In this way the efficiency and commercial value of each student are increased for his employer. The enrolment for the season 1893-94 was 425 young men.

There will be special exercises at the Institute, 222 Bowery, New York City, Tuesday, Oct. 2, to formally open the Educational Department of the work.

The Phosphor-Bronze Smelting Company, of 2200 Washington Avenue, Philadelphia, has issued a new price-list of the well-known phosphor-bronze alloys.

The Union Railroad of Providence, operating 120 miles of road and about 200 cars, has awarded the contract for the electric heating of all its cars to the Consolidated Car-Heating Company, of Albany, N. Y. This is the largest electrci heating order ever given.

Our Directory

OF OFFICIAL CHANGES IN SEPTEMBER.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Addyston & Ohio River.—S. Gano, Jr., has been appointed General Manager, with headquarters at Cincinnati, O.

Annapolis, Washington & Baltimore.—Jas. H. Brown, General Manager, died Sept. 14.

Atchison, Topeka & Santa Fe.—W. E. Symons, Master Mechanic at Raton, N. M., has resigned.

Buffalo, Rochester & Pittsburgh.—F. G. Lauer is made Master Mechanic at Rochester, N. Y.

Butte, Anaconda & Pacific.—C. A. Swineford is appointed Superintendent, vice J. J. McLaughlin, resigned.

Chicago & Eastern Illinois.—Albert Griggs is appointed Assistant Superintendent Motive Power and Machinery; headquarters, Danville, Ill.

Chicago Great Western.—S. C. Stickney, Acting General Manager, is made General Manager.

Cincinnati, Georgetown & Portsmouth.—J. M. Myers is appointed Superintendent, vice Frank McQuiston, resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—Jas. A. Keegan is appointed Master Mechanic at Delaware, O., vice J. H. Bary, resigned.

Erie & Wyoming Valley.—S. D. King is appointed Superintendent Motive Power. D. E. Barton is made Master Car Builder.

Flint & Pere Marquette.—S. T. Crapo is given full title of General Manager. H. D. Morris has been appointed Purchasing Agent, with headquarters at Saginaw, Mich., vice E. F. Weld, resigned.

Kansas City Northwestern.—C. M. Rathburn, General Superintendent, resigned, and duties of office assigned to S. H. G. Clark, General Superintendent Missouri Pacific, by which road it is operated.

Ketner, St. Mary's & Shawmut.—J. H. Beardsley is appointed General Manager.

Lake Shore & Michigan Southern.—D. W. Caldwell is elected General Manager. A. A. Bradeen has been appointed Master Mechanic, with headquarters at Cleveland, O., vice J. S. Graham.

Mexican National.—L. H. Sherman, Master Mechanic at Santiago, Mex., has resigned. E. W. Knapp is made Master Mechanic at Acambarro, and Robert Dewar is made Master Mechanic at Santiago.

Mexican Central.—General Manager E. W. Jackson has resigned.

Macon & Northern.—E. P. Horn is appointed General Manager.

New York & New England.—F. E. Dewey is appointed General Superintendent.

New York, Lake Erie & Western.—S. Bradley has been made Acting Master Mechanic of the Mahoning Division.

New York, New Haven & Hartford.—J. N. Lauder, Superintendent of Motive Power, Old Colony Division, is dead.

Savannah Line.—Hugh M. Comar and R. Somers have been appointed Receivers.

South Carolina & Georgia.—E. M. Roberts, Superintendent of Motive Power, has resigned.

Southern Iron Car Line.—H. M. Laird is appointed Master Mechanic.

Southern Railway.—R. D. Wade is appointed Superintendent of Motive Power. W. H. Thomas is appointed Assistant Superintendent of Motive Power.

South Atlantic & Ohio.—D. H. Conklin, General Manager, has resigned.

Toledo & Ohio Central Extension.—T. D. Dale, previously Treasurer and General Manager, has been appointed Receiver.

Utah Central.—J. H. Burgoon is appointed General Superintendent and Freight and Passenger Agent, vice T. J. Mackintosh, resigned.

Western Railway of Alabama.—Geo. C. Smith is elected President and General Manager. Office at Atlanta, Ga.

Wanted.

NATIONAL CAR AND LOCOMOTIVE BUILDER

NOVEMBER, 1894.

CONTENTS.

The Mexican Central intends ordering 250 freight cars.

The Boston & Albany expects to soon ask bids for new cars.

The Merchants' Dispatch Transportation Company intends ordering 300 freight cars.

The Delaware & Hudson has ordered 200 box cars of the Jackson & Woodin Company.

The Ussuri section of the Siberian Railway was opened for traffic, Oct. 13, as far as Ussuri.

The Safety Car Wheel Company, of Detroit, has been incorporated in Michigan with a capital stock of $500,000.

A 600-foot bridge across the Iowa River at Iowa Falls, Ia., on the Illinois Central was destroyed by fire Sept. 28.

It is reported that the construction of the railroad from Antofagasta to Aguas Blancas, Chile, will be commenced at once.

The roundhouse and eight locomotives of the Intercolonial Railroad were burned at Riviere du Loupe, Que., on Oct. 20.

Three men were killed and four injured by the explosion of a steam pipe in the Illinois Steel Works at South Chicago, Oct. 8.

During the past year 41,399 applications were made for patents and 24,204 were granted. Of these 1,460 related to railway cars.

The Michigan-Peninsular Car Company, which started up its Detroit shops in July, has again closed its plant for an indefinite period.

Work on the Trans-Siberian Railway is being pushed on at such a rate that it is expected to be finished in 1901, instead of 1904, as originally intended.

The Southern Railway has ordered 11 six-wheel switch engines; three of the Rhode Island Locomotive Works and eight of the Richmond Locomotive & Machine Works.

Richard Nagel has received a twenty-years sentence at St. Louis for wrecking a train on the Mobile & Ohio, June 4 last. The fireman was killed and the engineer injured.

Work which had been suspended on 18 Class R engines at the Juniata shops of the Pennsylvania company has been resumed. The engines are intended for use on the Western lines.

The earnings of the Chicago, Milwaukee & St. Paul Railroad for the third week of October were $669,061; for the corresponding week of last October, $916,656; decrease, $247,595.

The Schenectady Locomotive Works have recently received an order from the Boston & Albany for six 6-wheel switch engines, four passenger and four consolidation locomotives.

The Southern Railway is in the market for new freight cars; also the Florida Central & Peninsular, the Central of Georgia, the Cincinnati, New Orleans & Texas Pacific, and the Plant system.

It is stated that H. B. Plant, of the Plant system, has bought the Florida Southern Railroad, which runs through 250 miles of the richest agricultural and phosphate lands in the State, for $2,000,000.

During the last week of October the Pennsylvania shops at Columbus, O., turned out nine engines. The full force of this shop is 1,200, and at present over 1,100 men are at work on nine hours' time.

Two men who tried to wreck a Union Pacific passenger train in Utah during the Debs strike were recently sentenced at Ogden, Utah, to 12 years' imprisonment each, and a third one for 4 years.

The Texas & Pacific Coal Company has given an order to the Missouri Car & Foundry Company for 200 coal cars. They will have the Schaeffer bolster, the New York air-brake and the Gould coupler.

The "Knickerbocker special" is the name of a new fast train of the Big Four route, which leaves St. Louis at noon, and deposits its passengers in New York City at 6:30 next evening, and in Boston at 9:05 p. m.

It is reported that the contract for the construction of the Guatemala Northern Railroad has been let. The road is to connect the City of Guatemala with Port Barrios on the Pacific Coast, a distance of 160 miles.

It is announced that the Southern Railway will soon begin the erection of extensive new machine shops in Atlanta, Ga., on the grounds now occupied by the shops of the old East Tennessee, Virginia & Georgia road.

Taking deep inspirations is an easy method of warming one's self when cold. They stimulate the circulation and oxygenate the blood, thus producing more heat. It is like applying forced draft to the furnace of a boiler.

The man who invented the whaleback type of boats now in use on the lakes says that the idea first came to him in a dream. It is a matter of long standing report that the invention of the shot-tower originated in the same way.

Observations have been made to learn what protection is given ground covered by snow. In one observation the temperature of the air above the snow was six degrees below zero; under the snow the thermometer stood at 33 degrees.

Mr. Orlando Stewart, the newly appointed Superintendent of Motive Power of the Bangor & Aroostook Railroad, expects to erect new shops for that road at Oldtown, Me., in the coming spring. The road is building a 60-mile extension.

A cloudburst caused a depot on the Philadelphia & Reading Railroad, at a small town near Reading, Pa., to be washed on the track in front of an approaching express train, Oct. 3. The depot was demolished, as was also the woodwork of the express engine.

A freight train on the Chesapeake, Ohio & Southwestern was wrecked two miles west of Newbern, Tenn., Oct. 16. The engineer, fireman and a brakeman were dangerously injured. Unknown persons had placed a tie on a trestle, which resulted in the wreck.

The aggregate length of telegraph lines in existence throughout the world is computed at 1,069,123 miles. This total is made up as follows: Europe, 382,937 miles; America, 548,812 miles; Asia, 67,875 miles; Africa, 21,687 miles; and Australasia, 47,812 miles.

A 12-year-old boy was arrested at Bells, Tenn., Oct. 10, charged with wrecking the fast mail on the Louisville & Nashville on the 8th, in which several persons were injured, some probably fatally. The boy said he opened the switch to see what would happen to the train.

The Grand Trunk Railroad is building at its Montreal shops two locomotives, one of which is to be a single expansion and the other a compound. They are being built for the puopose of making a test of the efficiency of the two types under various conditions of service.

A woman's leg is worth $23,000, according to a Brooklyn jury. This amount was awarded Mrs. Anna Ericson, who was run over by a trolley car of the Brooklyn City Railroad, and lost her right leg in consequence. Her husband is also suing on account of the loss of his wife's services.

William Haring, who was one of the victims at the accident on the Manhattan Beach Railroad at the Parkville tunnel on June 3, 1893, received a check for $28,000 from the Long Island Railroad Company, Oct. 26, as compensation for his injuries, which consisted of the loss of both legs.

The Michigan Central's well known policy of contributing to the comfort of its passengers in every possible way has suggested the extensive use of New River smokeless soft coal on its locomotives entering Chicago. As the result of tests a contract has been closed for an unlimited supply of the smokeless coal.

John Jacob Astor, who has a strong taste for mechanics, took charge of a passenger engine on the Illinois Central Railroad recently, and, it is said, run it the hundred miles between Fort Dodge and Sioux City, Ia., at a rate that often dazed the regular engineer. It was a star—sort of asterisk—performance.

A passenger train consisting of six cars was wrecked on the Philadelphia & Reading road Oct. 18. As the third car was passing over a split switch the wheel flanges threw it open, and the three last cars of the train, consisting of two day coaches and a Pullman car, were run off on a siding and thrown from the track. One passenger was severely injured.

Tin plate works to be the largest of their kind in the United States, and to cost $300,000, are to be erected shortly by Goldsmith, Lowenberg & Co., of New York, at New Kensington, Pa.; their capacity will be 60 tons of tin plate daily, it is estimated. The Pittsburg Tinplate Manufacturing Company will, it is said, also at once erect a tin plate mill at New Kensington, having a capacity of 30 tons daily.

It is reported that the Southern Railway has perfected plans for the purchase of the Paducah, Tennessee & Alabama, the Birmingham, Sheffield & Tennessee and the Mobile & Birmingham railroads, and their completion and connection with each other. This would give the Southern Railway a direct line between the Gulf at Mobile and St. Louis, and make it an active competitor with the Louisville & Nashville.

It is said that aluminium forms a definite chemical compound with copper. If a crucible containing molten aluminium, and another containing molten copper at little more than a red heat, have their contents mixed, the reaction is so intense that the metals are brought to a state of ebullition, and the crucible becomes white-hot. A billet of aluminium bronze shows no variation in composition from one end of it to the other.

The Pennsylvania railroad lines east of Pittsburgh and Erie for September, 1894, as compared with the same month in 1893, show an increase in gross earnings of $103,573.07; a decrease in expenses of $41,053.20; an increase in the net earnings of $144,626.27. The lines west of Pittsburgh and Erie for September, 1894, as compared with the same month in 1893, show a decrease in gross earnings of $220,380.43; a decrease in expenses of $50,161.57; a decrease in net earnings of $170,218.86; a general decrease in net earnings of $35,592.59.

The Panama Canal is fast developing into the most colossal and expensive ruin in the world. The wharves are falling into the water and acres of machinery are rusting to dissolution. On the isthmus are nearly 1,000 miles of steel track with locomotives and thousands of dump carts, now half-hidded in the tropical growth. Seventy-six great steam shovels stand side by side in the excavation buried in luxuriant vegetation. While 200 locomotives have been housed, it is estimated that nine-tenths of the millions squandered on this prodigous enterprise are going to waste.

Engineering reports a queer accident on the Chatham & Dover line. As a train was running through a station on this road last month a piece of coal fell off the bunker of the tank engine and injured four or five people standing on the platform, one sustaining a fractured jaw and concussion of the brain. General Hutchinson, in reporting on this, recommends that all bunkers of tank engines and all tenders be fitted with railings, and that strict orders be issued that coal must not on any account ever be stacked above this railing. Many companies, including the Chatham & Dover, are already doing this.

Messrs. Miguel Morrell and M. Ferrer, of Santa Barbara Cal., have designed and patented a robber-proof express car, by the construction of which attacking robbers will be exposed to the fire of the express messenger from bullet-proof projections on the sides of the car. In the interior are barred compartments for the storage of treasure, the approaches to which are all exposed to the messenger's fire in case of attempted robbery, while the messenger himself can retreat to a bullet-proof compartment that commands the interior of the car and the sides of the train. It is said that the construction is designed to be simple and substantial, and yet not very expensive.

A passenger train on the Southern Railway left the track about three miles south of Bristol, Tenn., Oct. 7. The engine fell across the track, and the express and mail cars leaped over it, and, falling on their sides, were soon a prey to the flames communicated from the firebox, and which consumed all of the train—eight coaches—with the exception of the last car, a Pullman sleeper, which was cut loose and backed away. None of the passengers was seriously injured, but all the baggage was burned. The accident happened in a deep cut, and was the result of a bolt having been designedly placed on the rail by some unknown person.

The annual report of the Northern Pacific Railroad Company shows that the gross earnings were $17,902,076, against $29,551,302 in 1893; operating expenses $13,316,555, against $18,793,339 in 1893; and net earnings, $4,585,521, against $10,757,963 in 1893; other income, $826,513; making the total income for the year $5,412,034. Against this there was charged from charges for rentals, etc., $1,680,373, and with this amount there were interest charges of $10,234,-666, making a total of $11,915,039 to be charged against the total income of $5,412,034, which left a deficit of $6,503,004. Last year the deficit was $889,255. Of the deficit for 1894 $2,262,794 was interest on the consolidated mortgage bonds which was not paid.

Standard Stable Stock Car, C., M. & St. P. Ry.

The engravings on this and the opposite page illustrate the general construction and the design of numerous details of the standard stable stock car of the Chicago, Milwaukee & St. Paul Railway. This road is one of the largest carriers of live stock in the world, and therefore special attention has been given to the construction of its stock car equipment with the view of having these cars strong in construction, durable in service, and also provide for the greatest practicable comfort of the animals to be carried.

The drawings reproduced in our engravings show all the improvements made in the design of these cars up to date.

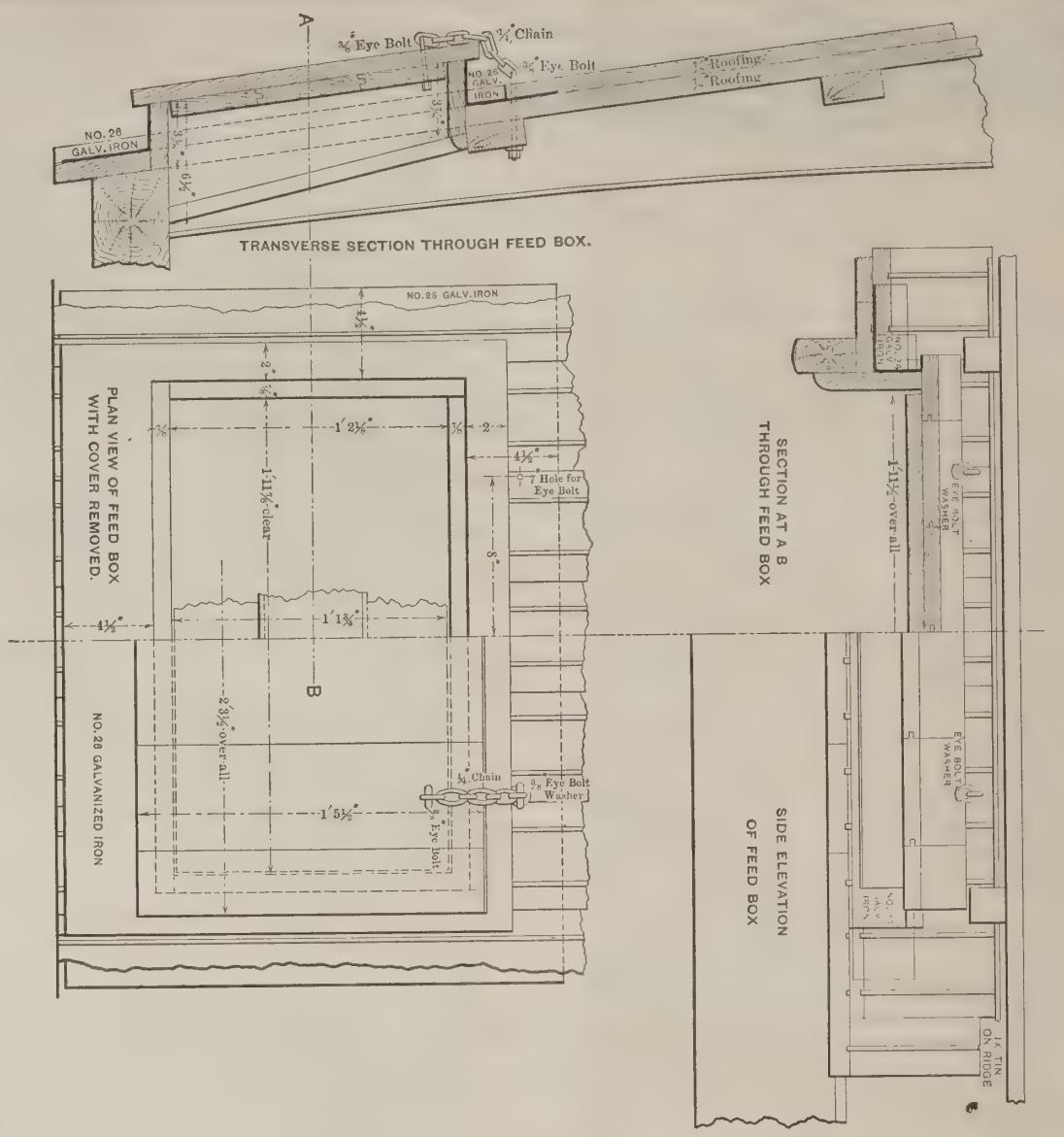
The car is 36 feet 11¾ inches long outside of pillars, and is 9 feet 4¾ inches wide. It is 36 feet 2½ inches long and 8 feet 7½ inches wide inside of the lining. The roof is 9 feet 8¾ inches wide. The top of the brake staff stands 13 feet 7¾ inches above the rails. The top of the running board is 12 feet 4½ inches, and the center of the drawbar is 34¾ inches above the rails. The bottom of car line stands 7 feet 5½ inches above the floor. The car weighs 18,200 pounds, and its capacity is 60,000 pounds.

The side, intermediate and center sills, are made of Norway pine and are 35 feet 6 inches long, by 4½ by 8 inches. The side plates are also made of Norway pine, hnd are 36 feet 11¾ inches long, by 4½ by 8 inches. Nearly all the other members of the framing are made of white oak of the dimensions shown in the following table:

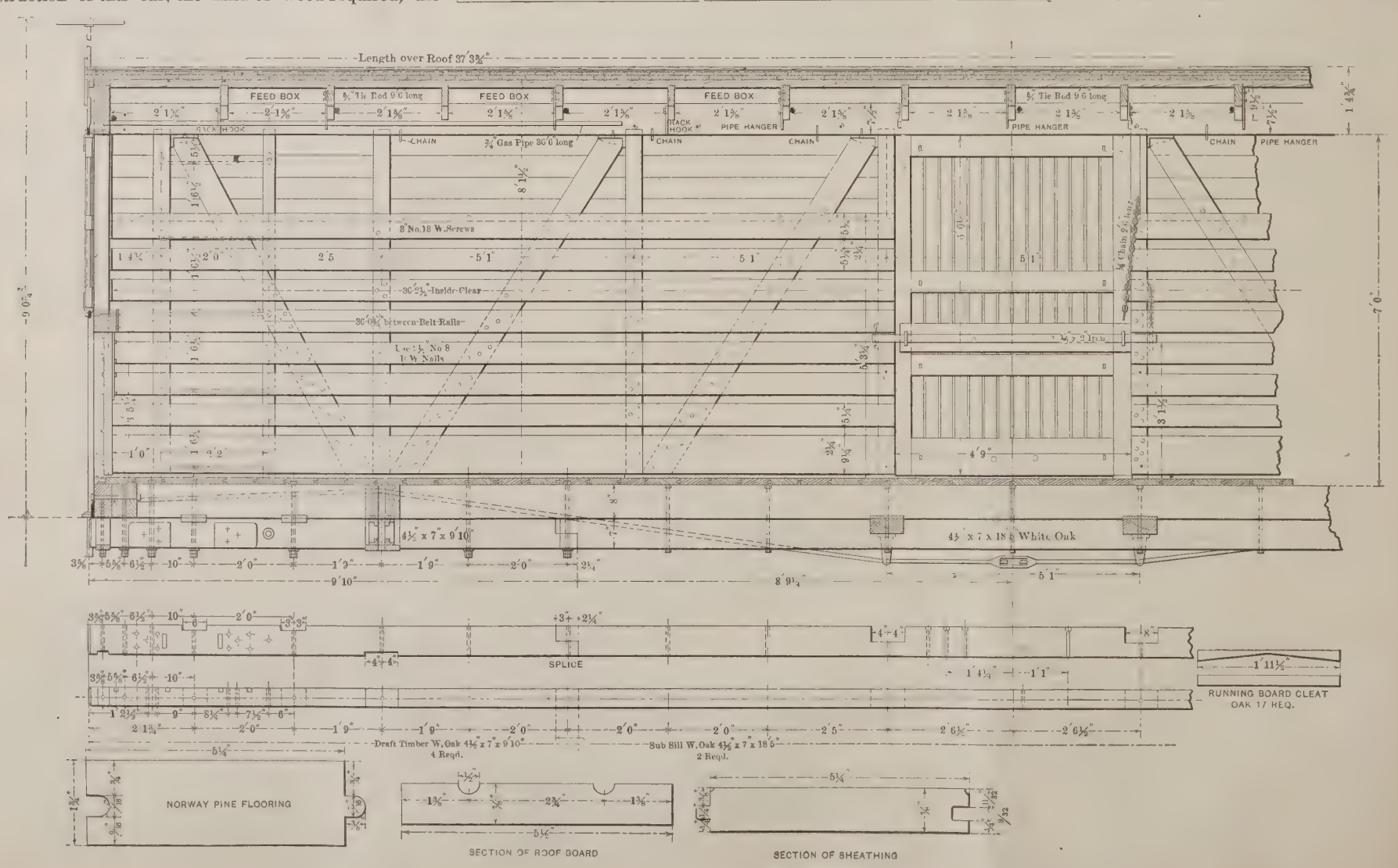
No. of Pieces.	Name.	Kind of Wood.	Finished Size. In.	In.	Ft.	In.
	Framing.					
2	End sills	White	oak	5 x	7⅞ x	9 2
2	Sub sills	"	"	4½ x	7 x	18 5
4	Draft timbers (see draw gear).	"	"	11½ x	7 x	9 10
2	End plates	"	"	3¾ x	13¼ x	9 1
2	Cross ties	"	"	4 x	8 x	8 11
2	Dead wood (see draw gear)	"	"	4½ x	8 x	1 9
4	Corner posts, ends	"	"	3¾ x	4 x	7 3
4	" " side	"	"	3¾ x	4 x	7 7
4	Side door posts	"	"	3¾ x	4 x	7 7
4	End door posts	"	"	3¾ x	4 x	7 7
4	Transom posts	"	"	3¾ x	4 x	7 7
4	Intermediate posts	"	"	3¾ x	4 x	7 7
2	Ladder posts	"	"	2¾ x	3¾ x	7 7
8	Side braces	"	"	2 x	6 x	8 5
4	" "	"	"	2 x	6 x	8 05⅛
4	End "	"	"	2 x	6 x	7 4
10	Carlines	"	"	1¾ x	9¼ x	9 3¼
1	Ridge piece	"	"	2 x	4 x	26 11¾
4	Intermediate ribs, spliced	"	"	1½ x	3 x	23 05⅛
4	" " "	"	"	1½ x	3 x	13 11⅛
4	Side belt rails	"	"	1¾ x	6 x	15 10½
2	End " "	"	"	1¾ x	5¼ x	8 7½
2	Upper end door thresholds	"	"	3¾ x	5¼ x	2 2½
2	Side door thresholds	"	"	3 x	5½ x	4 8¼
6	Shims for side door thresholds.	"	"	¾ x	3 x	0 5½
2	" " ladder posts	"	"	⅝ x	2¾ x	0 5½
2	Side door slides	"	"	1½ x	1½ x	9 0
2	Center pin blocks for car frame	"	"	4½ x	7¼ x	0 9¾
17	Running board cleats	"	"	1¾ x	1¾ x	1 11½
8	Strips for hay rack	"	"	1½ x	2½ x	14 11
4	Finish strips on end plate	White	pine	⅞ x	2¼ x	4 10

Drawings of these are reproduced in our engravings with such other data marked on them as will enable those interested to study their design or to reproduce them. The following table names the other wooden parts used in the construction of this car, the kind of wood required, the number of members of each kind required, and their dimensions:

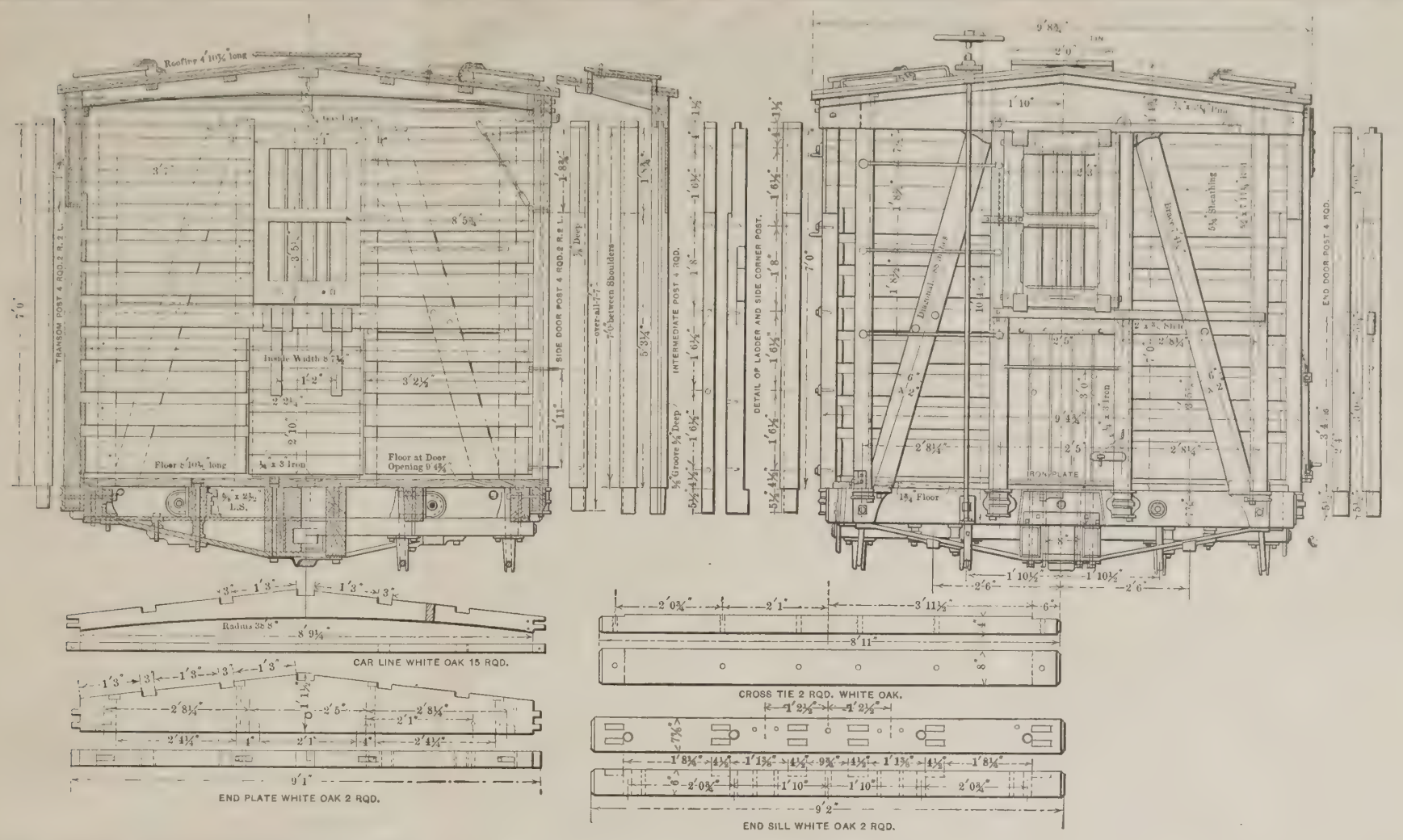
No. of Pieces.	Name.	Kind of Wood.	Finished Size. In.	In.	Ft.	In.
	Flooring.					
12	Tongued and grooved	Norw.	pine	1¾ x	5¼ x	9 4¾
72	" " "	"	"	1¾ x	5¼ x	8 10½
	Siding.					
24	Side boards	White	oak	⅞ x	5¼ x	15 10½
4	" " at bottom	"	"	⅞ x	9¼ x	15 10½
8	End boards	"	"	⅞ x	5¼ x	3 3¼
4	" "	"	"	⅞ x	6 x	3 2⅜
12	" "	"	"	⅞ x	5¼ x	3 2½
4	" " at bottom	"	"	⅞ x	9¼ x	3 2½
4	" cleats	"	"	⅞ x	2⅞ x	1 8¾
8	Furring strips for letter board.	"	"	1¾ x	2⅞ x	4 9
2	" " " "	"	"	1¾ x	2⅞ x	4 1
2	Furring strips for letter board.	"	"	1¾ x	2¾ x	2 1⅝
2	" " " "	"	"	1¾ x	2⅞ x	1 85⅜
4	" " " "	"	"	1¾ x	2⅜ x	0 10¾
16	Sheathing for letter boards (side)	White	pine	⅞ x	5¼ x	15 8½
16	" " " " (end)	"	"	⅞ x	5¼ x	3 7
	Roofing (Lower Course).					
116	Jointed edges coved as per drawing	White	pine	⅞ x	5½ x	4 10⅞
48	" " " "	"	"	⅞ x	5½ x	3 2¼
48	" " " "	"	"	⅞ x	5½ x	0 5
	Roofing (Upper Course).					
116	Jointed edges coved as per drawing	White	pine	⅞ x	5½ x	4 10⅞
48	" " " "	"	"	⅞ x	5½ x	3 0⅛
3	Running boards	"	"	⅞ x	8 x	13 8¼
4	" "	"	"	⅞ x	8 x	11 9¾
1	" "	"	"	⅞ x	8 x	14 1⅛
1	" "	"	"	⅞ x	8 x	9 6⅜



Details of Feed Box, Stable Stock Car.



Longitudinal Section, and Details, Chicago, Milwaukee & St. Paul Ry. Standard Stable Stock Car.



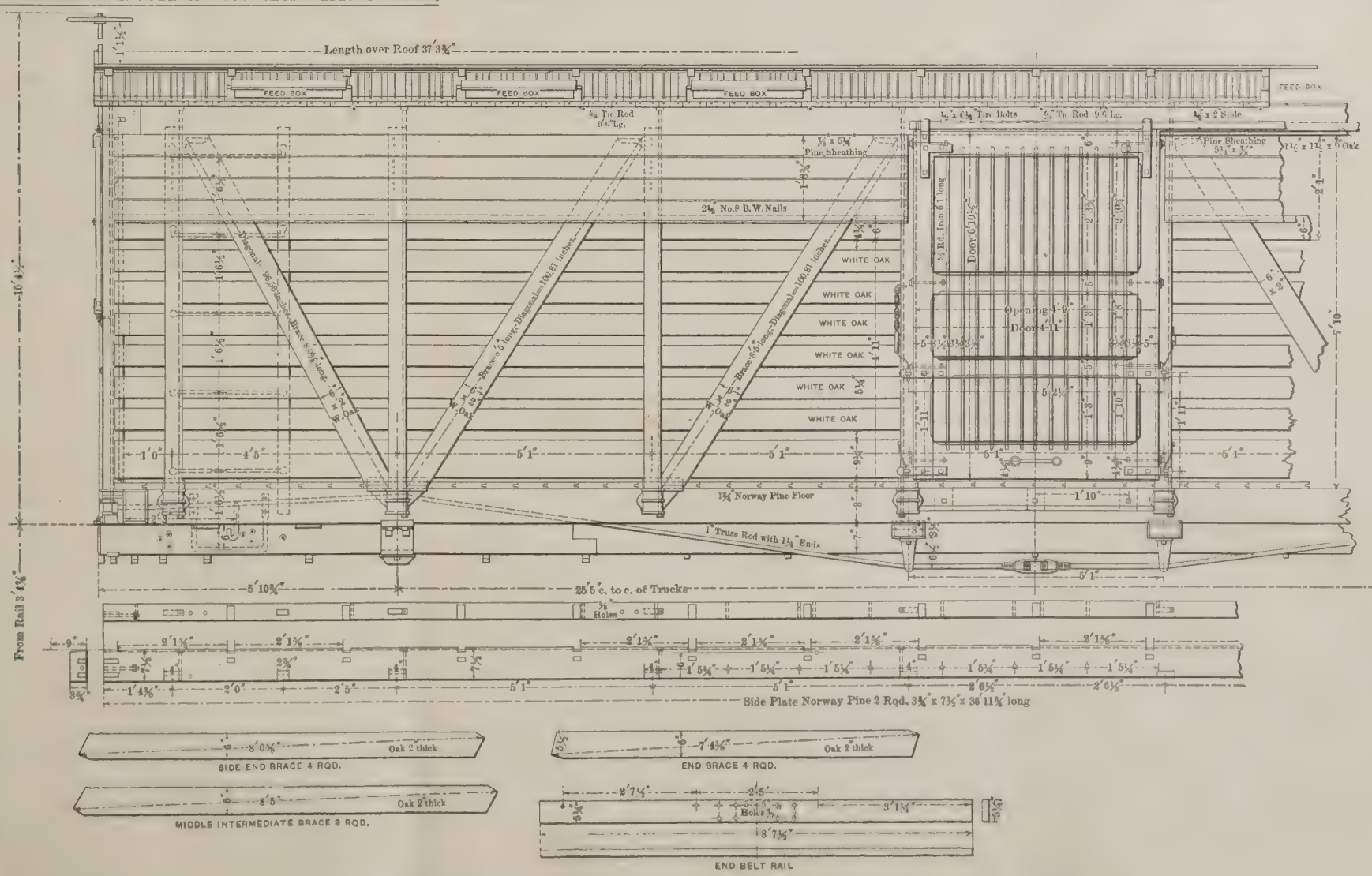
Sectional and End Views, Stable Stock Car.

No.	Name.	Kind of Wood.	Finished Size.
	Hay Boxes and Covers.		
24	Side Pieces	White pine	⅞x 6¼x 1 3¾
12	End "	" "	⅞x 3⅞x 1 1⅞
12	" "	" "	⅞x 3⅜x 2 1⅝
12	Sheathing, grooved	" "	⅞x 4¼x 1 1⅛
12	" tongued	" "	⅞x 4¼x 1 1⅛
12	" " and groov'd	" "	⅞x 5¼x 1 1⅛
48	" " " "	" "	⅞x 5¼x 1 5⅛
12	" "	" "	⅞x 3¼x 1 5⅛
12	" grooved	" "	⅞x 3¼x 1 5⅛
12	Strips of ¼ rd. molding (26 lin. ft.)	" "	¾x ¾x 2 1⅝
	Side Doors.		
4	Stiles	White oak	1¾x 5 x 6 11
2	Bottom rails	" "	1¾x 9 x 4 4½
2	Top rails	" "	1¾x 6 x 4 4½
4	Intermediate rails	" "	1¾x 5 x 4 4½
2	Safety bars	" "	1¾x 7 x 4 7¾
	End Doors (Upper).		
4	Stiles	White oak	1¾x 4½x 3 5⅛
2	Bottom rails	" "	1¾x 5 x 1 9½
2	Top rails	" "	1¾x 5 x 1 9½
2	Middle rails	" "	1¾x 3 x 1 9½
2	Stop blocks	" "	2¼x 3¾x 0 7
	End Doors (Lower)		
6	Sheathing, tong'd and groov'd	White pine	⅞x 5¼x 2 10
2	" "	" "	⅞x 4¼x 2 10
2	" grooved	" "	⅞x 4¼x 2 10
10	" tong'd and groov'd	" "	⅞x 5¼x 2 2¼
2	" "	" "	⅞x 3¾x 2 2¼
2	" grooved	" "	⅞x 4 x 2 2¼

It will be noticed that the feedboxes are important features of these cars, and complete drawings of these and their details are given herewith. There are a dozen of these feed boxes on each car. Four hayracks are placed within each car at a convenient height from the floor between the side doors and the ends of the car. Drawings of these will be given in our next issue, as will also be given the drawings of numerous other details of construction of these cars.

It has been well said that in this country the long-distance shipment of livestock has been improved to almost perfection. For humane as well as economical reasons it is required that livestock in transit shall be provided with food at regular intervals, not long exceeding in time those of ordinary circumstances. Arrangements for accomplishing this means for the shipper more pounds of valuable meat at the end of the trip, and lack of such arrangements means proportionate loss. The type of car illustrated herewith is excellently adapted to meet these requirements in every particular. The heavy livestock traffic of the Chicago, Milwaukee & St. Paul Railway has been handled very successfully by these cars for about two years now, and we are informed by Mr. J. N. Barr, the Superintendent of Motive Power of the road, and to whom we are indebted for our illustrative and descriptive matter, that they give entire satisfaction to shippers, and that no criticisms have been made that would suggest improvement. To those contemplating the building of new stock cars the design here illustrated will prove of interest and benefit, and while a car of this large capacity may be deemed unsuited to the needs of railroads in foreign countries, with which livestock traffic is growing in importance, its design will at all events show the best practice in stock car construction that experience has led to in North America.

The Southern Pacific Company has started a new limited regular weekly train service between New Orleans and San Francisco, which is known as the "Sunset Limited." The train is composed of the finest Pullman sleeping and dining cars, fully equipped with all the latest conveniences. No extra charge is made for passage on this train.



Side Elevation and Details, Chicago, Milwaukee & St. Paul Standard Stable Stock Car

Car Shop Economy.—III.

BY JAMES F. HOBART.

(*Continued from page* 150, NATIONAL CAR AND LOCOMOTIVE BUILDER *for October*).

Nut Tapping and Bolt Cutting.—Methods of doing this work need an overhauling in a good many railroad shops. Antiquated machines, making very few revolutions per minute, don't pay in such times as the present. Every shop ought to run machinery as fast as the crack locomotive on that road, viz., "as fast as it can go." There is no sense in tapping a three-eighths bolt at a speed of 20 revolutions per minute, the same speed as is used for a one-and-a-half inch bolt.

If one of these "by-the-day" machines exists in your shop, and has taken root so deeply that it cannot be replaced by a modern tool, then just drive that machine through a pair of cone (step) pulleys and see what a difference it makes in the daily output. Probably if the old "by-the-day" man is on duty, who has seen that machine for the past 20 years, you will be obliged to give him a little vacation, while you learn a smart boy to run the machine. Again, trouble may be met with in getting the belt to run on the fastest speed of the step pulley. If any trouble is met with in that direction, a little *piecework oil* will lubricate the machine so the belt will run all right just where you want it.

Bolt cutting machines are subject to the same trouble. They are operated at speeds much too slow. Many of these machines now running in car shops could have their speeds doubled without deterioriating the quality of the work turned out, or injuring the dies by overheating. The same may be said of the lathes, drill presses and other machine tools; they run slower than is necessary. Even upon soft iron of moderately small diameters, lathes are sometimes run at speeds which make necessary a second look at the machine to make sure which way it is running! In working brass the speed is increased, but only up to where iron could just as well be worked, and *is* worked in progressive shops where "Get there" is impressed upon every machine operator in the shop. Steel may be worked at higher speeds than car-shop machinists ever use. Go into the shop of any concern using a good deal of steel, and see how fast metal-cutting machines run in that shop. Take, for example, the shop of T. R. Almond, the chuck manufacturer, York and Washington streets, Brooklyn, N.Y. Every day in the year his lathes are running from 300 to 400 revolutions per minute upon steel 1¾ inches in diameter, giving a speed of from 137 to 180 lineal feet per minute. Even at these speeds, in a finishing cut, the tool stands up to its work without regrinding, over 70 to 80 inches in length of steel of the diameter mentioned, giving an area of 385 to 440 square inches for each grinding of the tool.

Hand Lathe Work.—There is a deal of this kind of work done in railroad shops, which is unnecessary. By "hand lathe work," I do not mean tooling of work in a speed lathe with hand tools, but I do mean the making in ordinary lathes, by hand manipulation, such things as studs, set screws, finished hexagonal nuts and the multitude of small metal parts that go to make up the modern passenger car and locomotive. For the purpose of example take a steel nut (hexagonal of course), the sides left as delivered from the hot press, the top to be finished. To put these nuts one by one through the nut-tapper, then screw them upon a short screw arbor mounted in a lathe chuck, take much time, especially as all the turning off has to be done after the work is thus mounted. Then the nut must be finished up a little with a hand tool, smoothed with emery cloth, and perhaps polished.

All this, as the Chinaman said, "takes too much long enough." The way to do such work is to use a turret lathe with a hollow spindle. Put on a chuck which will just take the nut, and which will allow it to be squeezed therein tight enough to hold it there during the milling operations. A rod inside the hollow spindle will drive the nut out of the chuck after it has been milled. The first tool in the turret is a square-end concern used for pressing the nut firmly into the chuck after it has been loosely placed therein by the fingers, while the lathe is running, if necessary, but usually it is not, as the lathe must be stopped and reversed to back out the tap, and then, when it is stopped again, the nut can be removed and another slipped into the chuck.

The nut tool is a drill which cuts out the hole to the size necessary for tapping. In nice work a reamer follows the drill, but in car work this is unnecessary. A mill comes next which faces off the whole top side of the nut and makes it so smooth that further polishing is unnecessary. Then comes the tap; that tool must be mounted in a peculiar kind of chuck, which in turn is put into the turret. The device consists of a stud which is fastened into the turret as described, and a sleeve which slides upon the stud. The sleeve carries the tap, and by means of a clutch arrangement the sleeve and stud are locked while the lathe man is pressing upon the turret feed lever. It is also locked while the lever is being pushed in the opposite direction to pull the tap out of the work (the lathe, of course, being reversed), but when in position midway between the two described the sleeve and stud are free, and the former can revolve, carrying the drill with it.

In practice the chuck works as follows: In pulling on the turret lever to force the tap to take hold, the clutch is locked and the sleeve becomes fixed to the stud, carrying the tap into the work. When the tap gets in nearly deep enough the turret carriage arrives at the stop and can go no farther. But the thread keeps on drawing the tap into the work until it gets far enough in to pull the members of the chuck clutch apart. Then the tap will revolve with the work and go no farther into it. The turret lever is not touched again until the lathe has been reversed. Then the lever is forced back to pull the tap *out* of the work. This action causes the other clutch to act, again locking the stud and sleeve and screwing the tap out of the work. Nothing further is necessary, except to smooth up the corners of the nut a little with a bit of emery cloth. Then the lathe is stopped, the finished nut driven out by the plunger rod in the hollow lathe spindle, another nut put into chuck, the lathe reversed to "go-ahead motion" again, and the same things repeated. Time, 30 to 35 seconds per finished nut. Compare this with the old way, and note the difference.

Drop Press and Punching.—This is a time saver—a pair of time savers in fact. Much of the small work can be made in the drop press, by one man, which now requires several blacksmsiths and their helpers to turn out Take for instance, a plain eyebolt. Lots of them are used in car work, and to make one requires several operations, not the least of which is welding. By the drop-press method eyes are died right out of a solid bar, with very little waste of material (only the "fin" where the dies come together), and, if to be short, the shank can be quickly drawn down to the proper size, leaving a "solid" eyebolt.

For long eyebolts, two welds are necessary, one in the eye, the other to join the short eyebolt to the long rod. In the drop-press method, one and sometimes both welds are dispensed with and the perfect eyebolt can be formed and finished nearly as quickly as the turret lathe finished up and tapped the hexagonal nut. The amount of work that could be done to advantage in a drop press is very large. All the grab irons and ladder rungs (when iron ones are used, as they always should be) can be forged in the drop press to advantage.

The Power Press.—It is from the use of this machine that the greatest economy of blacksmithing is secured. Procure one of these machines, and, with a double punch, all the old flat sheet-iron which comes to the scrap-heap can be punched into as nice cut washers as can be desired. Lots of such metal goes to the junk dealer from every railroad, but there are hundreds of good washers in a wornout tender tank, a dozen or two in a discarded switch target plate, and any quantity of thick washers for bridge work in worn-out boiler plate, and shearings from the boiler-shop.

One of the new-fashioned dies will punch the hole and the washer at the same stroke, and the machine turns out complete washers as fast as a man can shift the plate under the punch, which is almost as fast as an ordinary clock can tick. But washers are not the only things that can be made with the power press. Brake levers, even of the heavy Westinghouse pattern, can be pressed out complete, holes and all, at a single stroke of the machine. All of the brake levers used on the Lehigh Valley road are punched out in this manner by a machine built for that purpose.

The inventor of the double-punch washer die, and of such a machine as just described, is the foreman of the Lehigh Valley machine shops, at Packerton, Pa., Mr. James Long, who has placed a number of these machines in the shops of various lines, where they are doing good work and effecting considerable economy.

Buffer Plates and Bolster Irons.—These pieces can be punched and sheared easily at a single operation on one of Long's machines. The buffer plates have four holes punched through them. These holes are subsequently countersunk by placing the plates in an iron form or jig, consisting of two heavy pieces of metal hinged together. This device is opened like a book, the plate laid in and the holes countersunk by driving a punch (by hand) of the right shape into the holes, one after the other. This way could be improved upon by setting up the punch to do the countersinking all at once, but, as it has to be done hot, the jig method works fairly well, two men being able to countersink the plates as fast as another man can heat them in a very large forge fire, where the plates are piled up solid in two piles, the bottom plate being removed alternately from each pile as fast as heated to a dull red.

Treating Second-Hand Material.—A good deal of the ironwork that comes back to the shop from wrecks, repairs, changes and the breaking up of old cars, seems to be in as good condition as when new, but, owing to the doubt that there may be concealed cracks, flaws or fractures, the master mechanic hesitates before ordering the second-hand material used again. But some have found a way of detecting flaws in most kinds of ironwork, from a bolt to a car axle. The way is to heat the object, then, while hot, to examine carefully for cracks, which nearly all become visible during the conduction of heat, one side of the crack appearing redder than the other side, making the crack appear sharply defined, like a joint between two differently heated pieces of metals. A very insignificant crack will show itself in this way, and a big crack will show up in such a striking manner that one is apt to wonder how the bar holds together with such a break in it.

Bolts may be heated and straightened and their soundness noted at the same time, for, in nine cases out of ten, if there is a crack in a bolt it will be just under the head. In the one case out of ten above alluded to, the crack elsewhere was caused by heavy bending where the crack appears. Car axles that have made a large mileage are taken into the shop and heated one end at a time. Existing cracks are usually found, and they are generally located pretty near to the junction of the axle and the inner wheel surface.

Iron truck frames, examined in the same manner, especially when a little out of shape by jambing, or squeezing, yield up their defects, and have the strains of molecular crystallization redistributed and released at the same time. In case of car axles especially, it would be well to heat them entirely at a single operation, in a large furnace, and after examining for cracks, to allow them to cool slowly in the open air, but piled rather closely together, so as not to cool too rapidly. There is one thing in favor of rapid heating: the cracks, if they do exist, beceme visible much better when the heat is suddenly applied to a portion of the object, say to one end of an axle. As the heat spreads or travels to the other parts, any crack will show up smartly as a dividing line between the hotter and cooler portions of the metal.

Stencil Lettering and Shading.—Some roads show very fine lettering on their cars at an expense less than one-half that incurred by other roads in putting up no better looking work. This variation in cost is caused by the different methods of lettering. The expensive system is to lay-out each letter in regular sign-painting style, then outline each letter with a striking pencil (brush), a final filling in of the outlines, and then an evening up or blending of the whole letter. The economical way is to use a stencil cut for the whole word, name or sentence. Such a stencil is made by laying out the lettering on stout (not too thick) manilla paper. After completely outlining each letter with a pencil, cut out the letters with a sharp penknife, taking care to leave a sufficient number of tie strips to prevent the falling out of the centers of some letters and figures such as O, B, D, etc. In fact, the paper stencils must be cut the same as any other stencil.

Color is applied directly to the surface of the stensil and dabbed through the openings with the end of a rather short-bristled brush; that is the secret of stencil lettering. The brush must be square and even on the end, for if any of the bristles bend and slide under the paper stencil there will be no smooth, even line at the edges of the letters, but rough, jagged edges that cannot well be patched up. If a proper brush be used, and the man who uses it has the "know-how," there will be no difficulty in getting a fine edge to each letter. Then blending is all that is necessary to finish up a good job of lettering.

To prepare a shading stencil, the original stencil is printed upon another sheet of manilla paper; then, when dry, the proper shading is laid out and cut in the same manner that the original was made. Double shading is done in the same way. Both the finished stencils are printed on a third sheet of paper, and the second shading is located and cut out

Gold-leaf work is sometimes handled in a similar manner. The stencil is cut to the exact shape required for the gold leaf, and the size put on with the stencil. If care be taken in putting on the size no trouble will occur when the extra gold leaf is rubbed off.

Shop Fuel for Steam-Making.—Considerable difference of opinion exists among railroad managers as to the practicability of burning refuse wood as steam-making fuel. Some roads make a practice of so doing; the D., L. & W., at their Scranton, Pa., shops, run one or two boilers continually on wood, the others, in the same battery, being fired with coal. Old cars, broken up, or repaired, furnish most of the fuel. Shop waste makes another considerable item, and whatever more is needed is made up from the road in the shape of old ties. Some roads do not consider old ties worth collecting and fitting for shop firewood, therefore they burn them on the road in bunches of 100 or 200. Other roads sell them on the spot to local residents. Still others collect and sell their ties by the carload to manufacturers along the line of the road.

To Visit the World's Railways.

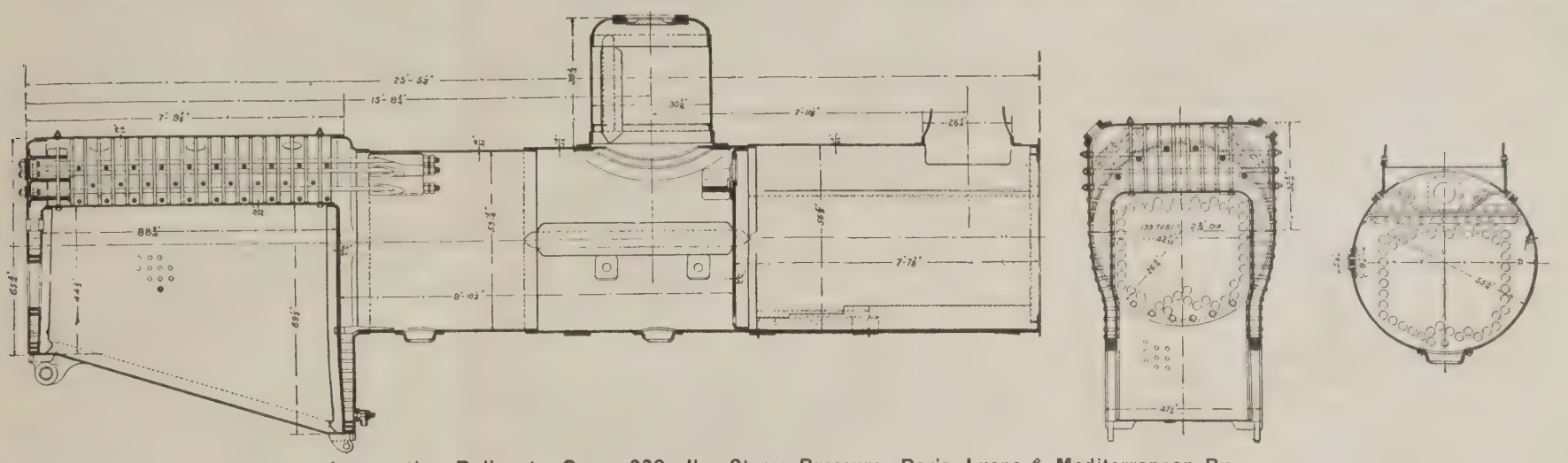
A commission representing the Field Columbian Museum sailed from New York early in October to visit every country in the world having railroads, in the interests of the museum. The party is made up as follows: Maj. J. G. Pangborn, President; Lieutenant Read, U. S. A., Secretary; Edward H. Winchell, New York, artist; W. H. Jackson, Denver, Col., photographer; Clement F. Street, mechanical editor of the *Railway Review*, Engineer; a stenographer and a servant.

The route the party will pursue is stated to be as follows: The members spent the month of October in Great Britain and will proceed from there direct to the Orient, leaving the continent of Europe until the next year. On the first of November they leave London and go via Gibraltar to Morocco, Algiers, Egypt, Palestine, Turkey, to the terminus of the Russian Trans-Caspian Railway, Persia, Ceylon, Bombay, Calcutta, Delhi, Burmah, Straits Settlement, Siam, China, Japan, Sandwich Islands, Friendly Islands, Australia, New Zealand, New South Wales, Queensland, Madagascar, Transvaal and Cape Colony, and up the west coast of Africa to Lisbon. From Lisbon begins the European continental tour. After its completion the commission will sail from Lisbon to Rio de Janeiro and make an extended tour of South America, Mexico and the West Indies before its final return to the United States.

A High Pressure French Locomotive Boiler.

In a paper read before the Western Railway Club at Chicago, Mr. E. M. Herr gave an interesting account of his observations of European locomotives during his recent trip. He exhibited a drawing of one of the latest boilers designed to carry 220 pounds steam pressure. It is in use on an 8-wheel coupled freight engine on the Paris, Lyons & Mediterranean Railway. We reproduce the drawings herewith. Speaking of French locomotive practice Mr. Herr said :

Very high steam pressures are now common on French compound locomotives, the newer type nearly all carrying 220 pounds per square inch. The boilers for these high pressures are mostly Belpaire and are very carefully constructed and made of steel bought on very elaborate specifications as to quality and strength: 59,750 pounds per square inch and an elongation of 26 per cent. in 7⅞ inches are specified by the Paris, Lyons & Mediterranean Railway. They also require the entire flanging and fitting to be done at red heat, that every sheet shall be annealed after flanging and that all punched holes shall be above .08 inch small and reamed out. All staybolts, including the roof stays and cross braces above the firebox, are drilled with about $\frac{3}{16}$-inch holes through their entire length. In the most recent boilers Serve tubes are used. By using these ribbed tubes a much shorter length is necessary to provide proper heating surface. Serve tube boilers with tubes less than 10 ft. long are common. The firebox is of course of copper, as are all the short staybolts in the side, back and tube sheets. The crownbolts are steel.



Locomotive Boiler to Carry 220 lbs. Steam Pressure Paris, Lyons & Mediterranean Ry.

Annual Report of the Pullman Company.

The annual meeting of Pullman's Palace Car Company was held in Chicago, Oct. 18. The usual quarterly dividend of $2 per share was declared. The old directors were re-elected. The fiscal report states that 5,282,324 passengers were carried in Pullman cars during the year ending July 31. The surplus for the year is $2,320,416.90. Last year's surplus was $4,000,000. In his report Mr. Pullman said, in referring to the strike, that the impression given out that the trouble was caused by excessive rents at Pullman was not true. None of the old tenants was evicted. Many have left as they found work elsewhere, but 279 remain. The shops now employ 2,640 men. Car building contracts are being executed at prices that give no profit. Such contracts are taken because the shops are being kept in operation for the repairing of the company's own cars, and to give as much employment as possible in the present condition of business.

Speaking of the car-building business, Mr. Pullman said:

The depression in the car-building business, which began in 1893, manifested itself not only in a falling off in the prices for cars, averaging in all classes 24 per cent., but in such stagnation that the force in the Pullman shops on November 1, 1893, was less than 1,100, while the average number employed in the fiscal year ending July 31, 1893, was 4,497. In the months of August and September, 1893, we had an opportunity of making only six bids for work, of which but three were accepted.

In order to procure car-building contracts, a reduction of the wages of April, 1893, of the car-shop employees, averaging 19 per cent., was made, to make them correspond with those paid by other car manufacturers ; and by making bids at shop cost and less we secured work aggregating about $1,500,000. On the accepted bids out, net loss was over $50,000.

In referring to the strike, Mr. Pullman said among other things that if the men had continued at work instead of remaining idle for nearly three months, wages amounting to more than $350,000 would have been paid them, a sum to be contrasted with the total value of contributions made for them, which did not exceed $50,000.

I may observe also that there have been indications of a feeling in some quarters that this company ought to have maintained the scale of wages existing in the car manufacturing department in April, 1893, without regard to the current selling prices for cars, paying the consequent increased losses in the car building business out of the company's earnings in the independent business of operating sleeping cars, and thus sharing the sleeping-car earnings with the car building employees who, to use the language of one questioner, "had been working for a long time." At the time of the strike 227 of the shop employees had been in the employment of the company for less than a year, and more than half the entire force had been with the company less than five years. Had all of them earned a guaranty of uninterrupted, undiminished wages?

By increased attention to their work the mechanics have under the same scale of piecework prices increased their average daily earnings from $2.03 in last April to $2.16 in the last half of September, the latest report received.

The Central Railway Club.

Cleaning Passenger Cars, Driving-Boxes, Hanging Freight Car Doors, Pistons and Packings.

At the September meeting of this club Mr. F. H. Soule read a report on

Cleaning Passenger Cars.

The report stated that passenger cars should be washed off on the outside after about every 200 miles run with clear cold water, using an arrangement consisting of a hollow handle attached to a perforated brush head through which a stream of water is applied simultaneously with the rubbing of the brush, where hose connections are available. Where bucket and brush are used care should be taken to renew the water before it becomes gritty. The hand rails and door knobs should be wiped clean, the other parts of car body being not wiped, but merely washed thoroughly as above. The trucks should also be wiped on the outside, and other parts that can be reached without going under the trucks. In freezing weather the cars should be clean on the outside by dry wiping exclusively. No injury to varnish will occur under this process, and a better appearance will be attained than by the use of warm water.

The use of the compound known as "Perfection Car Cleaner" was recommended for occasional use, diluted with water. It was said to be non-injurious to varnish. The usual attention to lamps should be maintained, and water coolers should be emptied, rinsed and wiped out inside. Closets, urinals and drip pans should be thoroughly washed out and rinsed, followed by another rinsing with solution composed of chloro-naptholeum and water, in proportions of one gallon naphtholeum to one barrel of water. Urinal thus treated will remain odorless during continuous trips between terminals, and icings of the urinals will not be necessary.

Next cushions should be taken out, doors and windows opened, and interior of car dusted throughout. The wood work and glass should then be wiped, and if necessary cleaned off with a damp sponge. The floor should be mopped with cold water in summer and warm water in winter, and sponged under the seats, corner of car, and under the steam pipes with soft-soap or kindred compounds, and rinsed with cold water. The cushions should be thoroughly dusted, and put back in place, and windows, doors and ventilators closed to prevent dust blowing in from the outside. Curtains or blinds should also be drawn to preserve color of upholstery. Upholstery should be beaten or cleaned by the use of compressed air once a week during the summer months, and twice a month at least during the winter.

During the discussion of the report it developed that the hollow iron handles of the fountain brushes mentioned made these so heavy and cumberson that their use had been abandoned on some roads. Mr. Potts said that on the Michigan Central they used a bamboo handle with gas pipe connection for these brushes, the water flowing through the handle, and the results were entirely satisfactory.

Mr. Mackenzie said the experience of the Nickel Plate with the fountain brush was unsatisfactory. Compressed air had been found injurious to the finish of the interior of the cars, especially around the window sashes. A compound of castile soap and oxalic acid is used for cleaning the exterior surface of cars on this road.

Mr. Potts favored the use of the fountain brush in washing cars, as the application of the brush simultaneously with a flowing stream quickly cleaned the interstices in which dust and dirt accumulated. The labor of one man was also saved.

Driving Boxes.

Mr. West presented a report from the committee on "Best Construction and Practice on Locomotive Driving Boxes."

The report did not approve of the use of solid bronze boxes because of high first cost, large expansion when hot, and because when worn the sides are apt to close and pinch the journal and cause a hot-box. A solid bronze bearing cost less than one with soft filling. If the journal gets hot there is no soft metal to melt and plug up oil holes. A box with gib brass is more liable to break on account of cracks starting from the corners of slots cut for the brass. The report indorsed cast-iron boxes. This subject caused considerable discussion.

At the October meeting Mr. McIlwain read a committee report on methods of hanging freight-car doors. It was substantially as follows :

Hanging Freight-Car Doors.

There are some of us here to-day who remember the crude methods of how doors were hung 30 years ago, with a track at the bottom and a guard at the top, generally of wood, fastened with a common eyebolt and hasp. In those days every station master was supplied with a bar to open car doors. Doors and bars were almost as great an expense as drawbars. Later a great improvement was made when the door track was moved to the top, with hook-shaped hangers attached to the top of the door with button-head bolts, the nuts outward as a rule. The door was held in place when closed with two hasps on the bottom near each corner. The hasps were fastened similar to the hangers.

This class of door could very often be found along the side of the track between stations or around the section men's quarters utilized as "lean-to's" for the cows and pigs. As we grew older, and it is to be hoped, wiser, the car door attachments were improved ; brackets were applied to the side of the car at the bottom of the doors. This improvement prevented the door from swinging outward over a safe distance, when opened or unfastened. This plan, with a guard or shield over the top, is common practice to-day. From the plain top door slide and hanger to the hanger with rollers or sheaves, progress has been very rapid. We believe that the coming freight-car door to be perfect in every particular, and satisfactory to both the transportation and mechanical departments, will require to embody these essential points : First, safety; second, protection to the property in transportation from theft, fire and water ; third, ease of operation ; and last, but not least, economy in production and maintenance.

Pistons and Packings.

A report on this subject was made by Messrs. Miller, Ames and Taber. It favored the use of T-ring pistons instead of solid heads. The comparative first cost of these pistons is about 50 per cent. in favor of the solid head. However, the frequent renewals and reboring of cylinders will soon place the balance in favor of the T-ring piston. The committee reported in favor of a nut on the end of the piston-rod to retain spider, this being preferable to key or other method of fastenings.

Mr. Ames reported using United States metallic packing on piston and valve rods, and he believes it to be as economical as any packing in use to-day. The average cost per year for piston and valve-rod packing is about $2.95 per engine. Mr. Taber reported his experience with metallic packing as being satisfactory and preferable to hemp.

Hemp is being used at present on all Dunkirk, Allegheny Valley & Pittsburgh engines; cost about 26 cents per thousand miles on freight and 17 cents per thousand miles on passenger. With this packing the wear on steel piston and valve rods was found to be as follows with four engines, two in freight and two in passenger service :

Miles run.	Wear on valve stems. Inch.	Wear on piston rods. Inch.
83,604	$\frac{1}{32}$	$\frac{1}{64}$
77,808	$\frac{3}{32}$	$\frac{3}{64}$
57,725	$\frac{1}{16}$	$\frac{1}{16}$
53,152	$\frac{1}{16}$	$\frac{3}{64}$

Hemp, United States and Sullivan metallic packing are used on the New York, Chicago & St. Louis. In addition to these a home-made metallic packing is used for valve stems. One of the officers of the road in speaking of the matter said :

"We have had considerable trouble with the Sullivan packing in valve stems, allowing steam to escape. The home-made and United States have been very satisfactory. The cost of Sullivan and United States is the same, 50 cents each for valve stem and piston rod, or $2 per engine. From present experience we believe that this packing will average about 50,000 miles without renewing. The wear on valve stems is very slight. Engine No. 159 on passenger run has made 264 miles every day except one since Oct. 1, 1893—metallic packing in valve stems, home-made—96,096 miles. The stems are worn on left side $\frac{1}{64}$ inch, on right side $\frac{1}{32}$ inch. The home-made consists of three metallic rings divided in three pieces each, with a piece of 2¼-inch rubber hose around same. This is placed in stuffing box, front end pressing against steam ring. A rubber gasket is placed between back end of packing and gland. The first cost of this packing is about 30 cents for one valve stem, and costs about 10 cents per thousand miles to maintain."

The committee recommends any good metallic packing as the most economical and preferable for use in all cases. Messrs. Bissell and Rood made a report upon the advisability of having a dinner in connection with the annual meeting in January, and it was decided not to abandon the banquet. The president appointed Messrs. Bissell, Rood, Robson, Hewitt and Griffith a committee with full power to make all necessary arrangements.

A stick of dynamite placed on the rail was exploded by a Baltimore & Ohio passenger train Oct. 18. The track and engine truck were badly damaged and the passengers were badly jarred and scared, but no one was seriously hurt.

Railway Companies and Their Employes.

In discussing some phases of the labor problem in our last issue we mentioned the fact that Mr. Ossian D. Ashley, President of the Wabash Railroad Company, had proposed a plan for promoting content among wage workers and for enlisting their best efforts in the interests they serve. Mr. Ashley being himself an old railroad man and a large employer of labor, is specially well qualified to treat the subject as pertaining to railroad service, and he has chosen this field for the elaboration of his theory partly because of the magnitude of this service and the great number of its employes, and partly, perhaps, because it is on the efficiency of such service that the interests he represents depend for prosperity. The articles written by Mr. Ashley on the subject have appeared in the *Railway Age and Northwestern Railroader*. We present in the following a *résumé* of these that will indicate to the reader the nature and scope of Mr. Ashley's plan: The proposition is begun with the broad statement that intelligent humanity regards "the unequal distribution of wealth, which gives to half the human race ease and comfort, while yet the other half lives only by incessant toil or suffers in poverty, as an evil which should be corrected by any just process." Unhappily this feeling has brought to the surface narrow-minded, hot-headed men whose counsels in labor circles have retarded instead of advanced the object in view. Peaceful agencies and lawful methods must prevail. The principles of self-government insure the equal rights of all and protection to life and property. Goodwill toward men is the sentiment that promotes philanthropic schemes, and such must depend on voluntary action. Therefore, advancement along these lines is a work of education that requires time to show material progress.

Generally speaking the efforts at profit-sharing have not proved satisfactory, partly because of unskillful methods, because responsibility cannot be enforced, and because under adverse circumstances employés are both unwilling and unable to bear their share of losses. This does not imply that the principle of co-operation is wrong, but simply that mental and physical labor must be combined in conducting business undertakings, "and that where the one strives to act independently of the other it must fail from sheer inability to compete with the combined forces of both." To promote the welfare of employés there must be mutual assent of employer and employés to regard and advance each other's interests. Antagonism is fatal.

Railway service offers a good field for the prosecution of the plan proposed, and as its success would lead to economy in operating expenses, three parties would be gainers —the people, the operatives, and the railway companies. The first step is to proclaim a policy of promotion according to ability and meritorious service, this to extend to official positions. The next step is the establishment of a well-constructed system of life insurance and pensions, to be conducted on different principles than those governing ordinary life insurance, as it should embrace accidents and pensions within its provisions. The fund to establish this system should be entirely provided from the earnings of the railway, as it should be permanently under the complete control of the company. The employés would simply be beneficiaries of the plan by virtue of faithful service and in proportion to the length of such service. This arrangement is well calculated to promote loyalty and efficient service, and this is bound to result in economical operating.

Referring to the coal and railroad strikes of the past summer, which, through sympathetic influences spread over vast territories, Mr. Ashley says the results were a loss of traffic to the railroads extending through May, June and a part of July, a loss to many industrial works which were obliged to close for want of fuel; a loss to the railways and the people in the advanced price of coal, and a loss to the strikers of their usual wages. These losses aggregated millions of dollars, and were largely suffered by people who had no relation to the disputants. The only persons who could have profited by the coal strike were the dealers, who could sell coal at high prices when the supply was checked, showing almost incredible simplicity on the part of the strikers.

These strikes were the most causeless in the history of organized labor, and they were the most complete failures. The lesson was severe but salutary, teaching that mob law cannot prevail here, "and that all claims made upon employers by the employed, or *vice versa*, must be founded upon justice to have any chance of success." The unprecedented interference with train movements during both these strikes, and the general lawlessness of the strikers, amounting to an insurrection in the railroad strike, caused foreigners to doubt the stability of our government, but they do not know the intense patriotism of our people and their love of law and order which, though often seemingly dormant in exciting times, never fails to assert itself at the contact of real danger. Patriotism, here, is "so overpoweringly in control in numbers, intelligence, respectability, wealth and influence, that opposition could muster but a mere handful at any serious emergency." Subordinate to patriotism and the love of justice, law and order is the popular desire for improving the conditions of the industrious and deserving. This sanctions "whatever can be done to lighten the burdens of labor by providing educational advantages, opening the paths of competition equally to all, adding to compensation when meritorious and faithful work deserves it, and placing within the reach of the earnest, active and energetic, however humble in station, fame, honor and competence."

Continuing, Mr. Ashley says:

"Projects for the improvement of the social condition of the human race, founded upon force, can never be successful here or elsewhere, because the proposition is equivalent to one which contemplates the practical slavery of one class to benefit another. Every lover of liberty will always be ready to risk his life if necessary to preserve and perpetuate to his descendants the precious boon acquired by our fathers at the cost of so much suffering and bloodshed. All plans not in harmony with our republican institutions and our sacred rights are visionary and contain within themselves the seeds of their own destruction. Thoroughly convinced of this, and yet feeling that so far as the faithful carrying out of mutual obligations in life can aid in giving equality of condition or in the acquisition of such equality, it is incumbent upon all men to aid in facilitating movements which may lead to the desired end by peaceful and just processes. But the fundamental idea which must govern such movements, in order to stand any chance of success, must be the recognition of reciprocal duties, reciprocal responsibilities and mutuality of interests."

This is the true solution of the social problem under consideration. There exists no valid objection to employers extending to employees a fair share of the profits of an enterprise in which they are mutually engaged, but it is indispensable that employees should, in return, share the risks and losses, or by faithful and efficient service fairly earn the advantages conceded them. As sharing the losses is generally impracticable their responsibility should be limited to meritorious service.

Mr. Ashley's proposition contemplates the gradual emancipation of wage workers from conditions of inequality, and the removal of barriers from the path "of progressive intelligence and praiseworthy effort." It hold out expectation of reward only to those who may win it by superior and continuous work.

To railway companies the plan suggested calls for no sacrifice, as the better service it would secure would lead to more economical operation, the savings effected by which would more than reimburse the necessary expenditure.

The present poverty-stricken condition of the railroads makes it impracticable to put the proposition in effect at present, but the probable future prosperity of the railroads makes it advisable to give the subject consideration. Mr. Ashley's faith in this coming prosperty is thus expressed:

"I do not believe in the poverty of railways as a permanent condition. Several powerful agencies are at work, even now, to change this condition. One of these is to be seen in the limited construction of further superfluous competing lines, which will permit the transportation demand to grow up to the capacity of existing lines; another in the increasing disposition of railway managers to reject unprofitable freight forced upon them by the stress of competition; and the third is in the change in popular sentiment as to railway legislation."

The scope of the plan includes all classes of employes, those in the office as well as those on the road and in the shop. The prevailing plans of local insurance on some of the large roads are reviewed, that of the Pennsylvania system being indorsed as probably as perfect as any which can be devised under contributions from employes. All of these plans are voluntary, and good physical condition of the applicant is necessary for membership. Employes who leave the service sacrifice the benefits of membership, and it has been demonstrated that this regulation exerts a powerful restraining influence on employes from quitting. It will be remembered that the Debs strike gained slight support from P. R. R. employes. It is believed that the insurance plan of this road was framed in accord with such plans prevailing on English railways, where it is a significant fact that while in other departments of labor in England there have been serious strikes and disturbances, railway operations have been singularly exempt.

The Eyes of a Portrait.

The following lucid explanation of the frequently noticed phenomenon of the way the eyes of some portraits seem to follow a spectator is published in the *Cincinnati Commercial Gazette*:

Suppose a portrait have its face and eyes directed straight in front, so as to look at the spectator. Let a straight line be drawn through the tip of the nose and half way between the eyes. On each side of this middle line there will be the same breadth of head, of cheek, of chin, and of neck, and each iris will be in the middle of the whole of the eye. If one now go to one side, the apparent horizontal breadth of every part of the head and face will be diminished, but the parts on each side of the middle line will be diminished equally; and at every position, however oblique, there will be the same breadth of face on each side of the middle line, and the iris will remain in the center of the eyeball, so that the portrait will preserve all the character of a figure looking at the spectator, and must necessarily do so wherever he stands. In portraits the apparent motion of the head is generally rendered indistinct by the canvas being imperfectly stretched, as the slightest concavity or convexity entirely deforms the face.

The Pittsburgh, Akron & Western Railroad, constructed three years ago between Akron and Delphos, Ohio, was sold Oct. 17 for $844,000.

Mouth Breathing.

An article appears in the *Northwestern Sanitarian* on the evil effects of breathing through the mouth instead of the nasal passages, written by Dr. C. Gurnee Fellows. As cold weather is now approaching, the season when mouth breathing is most dangerous, the admonitions of the article are pertinent. It seems that the air we breath should be preliminarily warmed before entering the lungs, and that the nasal passages are arranged to perform this service.

The mouth is the entrance to the digestive rather than to the respiratory organs. Mouth breathing is neither natural nor healthful, but nature has so provided, that when, through diseased conditions, the nasal passages are closed, we may obtain air through the mouth. The nose, however, is the entrance to the respiratory tract. Within the cavity of the nose are scroll-like bones, covered with mucous membrane, which greatly increase the surface of exposure in order to furnish the three special functions of heating, moistening and filtering the inspired air. The fact that mouth breathing is injurious is not sufficiently known. The air rushes into the lungs in such volume that its temperature is not regulated, its force is not controlled, it is in no way purified, and can thus easily give rise to diseased conditions of many kinds.

The winter season is the most prolific in the production of these resulting maladies, because of the difference in temperature of the external air and the body; and among the diseases liable to arise are pneumonia, bronchitis, laryngitis, croup, etc.; whereas the same air taken normally through the nose, being prepared for its reception into the delicate lungs, simply fulfills the natural law, and no harm results.

Western Union Annual Report.

The annual report of the Western Union Telegraph Company for the year ending June 30, 1894, shows that as compared with 1893 there was a decrease in the revenues of $3,125,787. There was a reduction in the expenses of $1,422,235, leaving the net profits lower by $1,703,733 than in the previous year. The company constructed during the year over 1,300 miles of new pole line and nearly 22,000 miles of new wire, but lines taken down reduced the net increase of pole line to 367 miles; while the net increase of wire was reduced to 21,591 miles. More than half of this is copper; the cost for these additions to the property amounting to $557,021.64.

The average toll per message was 30.5 cents, and the average cost per message 23.3 cents. The higher cost per message is due to the general depression of business and the impracticability of reducing expenses at the many smaller offices beyond a standard that would provide for the proper handling of the messages. The largest amount expended during the year was for wages. It was found possible to so arrange the hours of duty of the employés of the company at the larger offices as to give each one a fair share of the reduced work at command, without materially reducing the number employed. Since the expiration of the fiscal year the system of the American Rapid Telegraph Company, which comprised 2,684 miles of poles and 20,370 miles of wire, extending east to Boston, south to Washington and west to Chicago, has been purchased for $550,000 in Western Union stock at par. The company has also purchased since the close of the fiscal year 10,000 miles of copper wire, which will be erected before January 1 on important trunk routes. A five per cent. dividend was declared.

The Last Great Buffalo Herd.

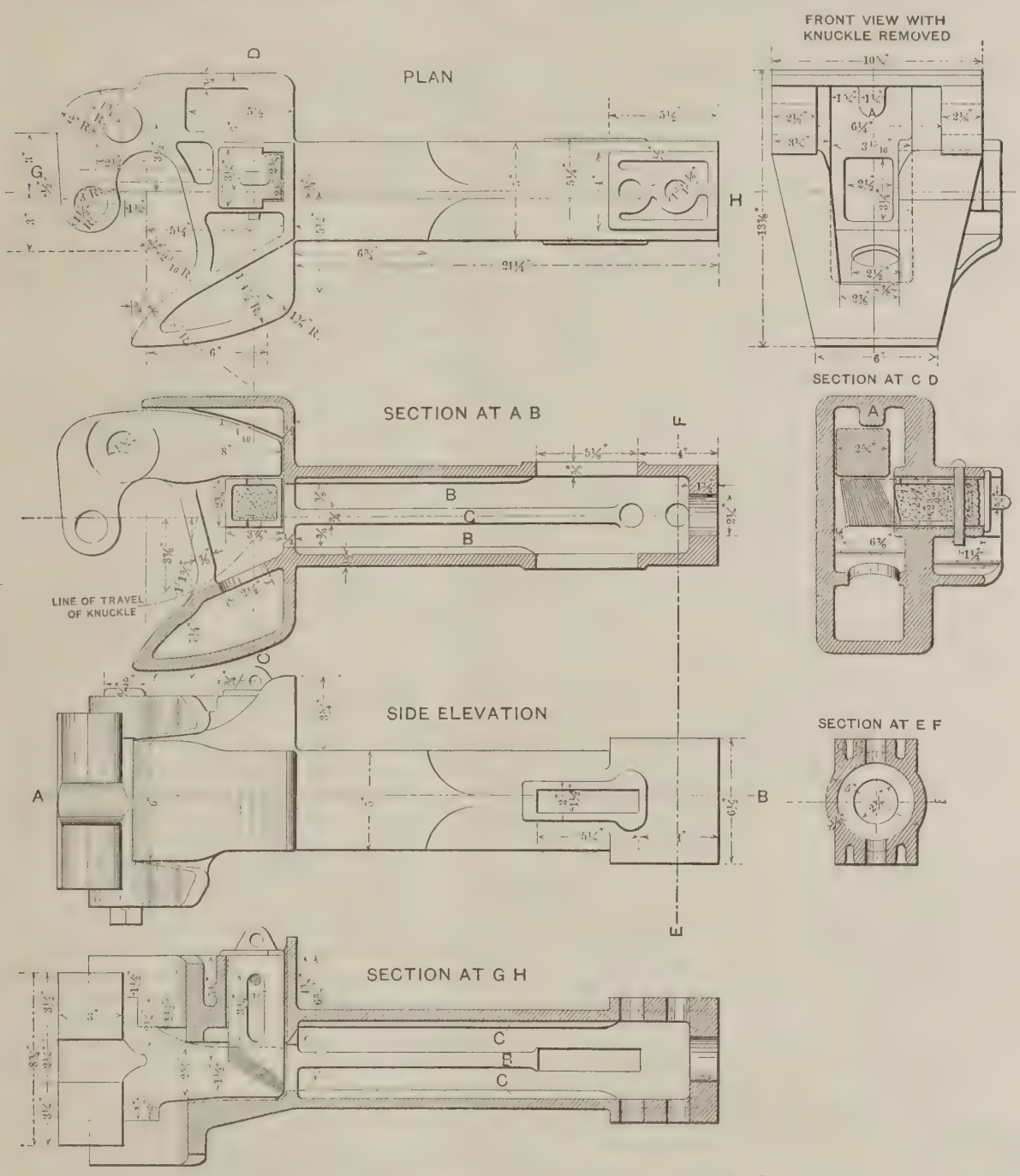
Hunters know that buffaloes will never, unless forced, cross the iron of a railroad track, and this fact figured largely in the unfortunate work of extermination which these animals have suffered since the Western plains have been spanned by railroads.

The greatest blow dealt the bison herds of the North west was the completion of the Northern Pacific track west from Bismarck to the Rocky Mountains. The road practically divided the herds, and those to the south were soon swallowed up in the general slaughter waged by Indians, pot, hide and tongue hunters, foreign sportsmen and others who were out to kill anything they saw on sight. This was during the winter of 1882-83. The buffaloes to the north were in many scattered bands, but there was one great herd of not less than 75,000 head, which had found a temporary refuge in the triangle formed by the Musselshell, Missouri and Yellowstone rivers in Montana, and as yet they had not been "smelled out" by either red or white hunters. But they were as surely doomed as though already killed, for the railroad iron cut them off from the southern range, and the Indians of the Canadian northwest, as well as those of our own country, barred their retreat into the far north, and so they were hemmed in between the two, with no possibility of escape in either direction. This last great herd was completely wiped out of existence in less than four months, and before the close of the year there were but a few singles and pairs left as fugitives in that vast country where but a year or two before they could have been counted almost by the hundreds of thousands. At the end of that season 800,000 buffalo hides were shipped east from Glendive, on the Yellowstone River.

Standard Car Coupler, Missouri Pacific Railway.

The engravings below illustrate the construction of the car coupler that is to be used on the lines of the Missouri Pacific system. We are indebted to the courtesy of Mr. Frank Reardon, Superintendent of Locomotive and Car Department of the road, for the drawings from which our engravings are made.

As will be seen, the coupler is of the approved vertical-plane type, possessing for a lock, a vertically moving block or pin, the lower extremity of which is beveled that it may be displaced by being forced vertically upward by the end of the knuckle striking it at this point as it swings to place in coupling. This block or pin has a ⅝-inch steel rod run through it at the top and riveted at both ends to the shank of the coupler, thus rendering it impossible to detach the same from the coupler without rupturing the cross-pin. The area of the cross section of the lock at the point where the knuckle strikes has been carefully computed, ample allowance being made to prevent the possibility of bending or shearing. Unlike the Janney, the knuckle is not beveled at the extremity of the inner-arm, but quite the contrary is square in cross-section through-



Standard Automatic Car Coupler, Missouri Pacific Ry.

out. This undoubtedly makes as strong a hook as is possible in the M. C. B. coupler. Other than this there are no features of novelty in the coupler.

The shank at the end of the barrel, as will be seen, is arranged to receive either the old-fashioned tail bolt, the American continuous arrangement, or the over strap clutch, rendering the coupler at once adaptable to the draft rigging of any car. The shank at its head is made very strong, and where it joins on the barrel is shaped perfectly square in order to protect the draft timbers by setting back on the ends of same squarely, in case of violent impact in switching.

The contour lines to be used in the freight service coincide throughout with the lines adopted by the Master Car Builders' Association, and those used in the passenger service are similar to the lines as set forth in Janney's patent of 1874, which has been found to work and interchange perfectly with the standard contour lines. The coupler complete weighs about 220 pounds, the knuckle of same weighing 50 pounds, and is to be made entirely of the best cast steel.

The Tudor Iron Works at East St. Louis were partly destroyed by fire Oct. 9. The loss on machinery is about $50,000, and on buildings $10,000. Nearly 300 men are thrown out of employment.

Siberian Railway Notes.

The section of the Siberian railway between St. Petersburg and Omsk has quite recently been opened, and it is now possible to go from St. Petersburg to Omsk and back, with a day's stay in the latter town, a distance of some 4,400 miles, in ten days. The natural conditions were on the whole unfavorable, and in many places it was impossible both to ride and drive. *Engineering* says that the men often had to carry their food with them, and they were not unfrequently compelled to allow themselves to be lowered down in baskets in order to prepare the track. On the section between Ufr and the Sima River there was, between Urakowo and Bulaschawa, a bog of about 60 miles extent, which had been formed through the rain water accumulating in the course of thousands of years in this natural pit of granite. The draining was not particularly difficult, but it entailed great hardships on the men. Both the engineers and the men were for a long time compelled to live in huts, built of earth on crossed piles, which they could only approach in boats. The mosquitoes were another trial, and 4,000 masks had to be procured, in addition to which smoking with juniper was resorted to. On the borders of Europe and Asia has been erected a large obelisk of granite, the one side of which bears the inscription "Europe," and the other that of "Asia."

Annual Report of the Rio Grande Western.

These are some of the figures in the annual report of the Rio Grande Western Railway Company: Gross earnings, $2,101,318, a decrease of $395,142; operating expenses, $1,377,013, a decrease of $296,715; net earnings, $724,306, a decrease of $95,554; surplus, $9,350, an increase of $95,856, as there was a deficit last year of $86,506. President Palmer made the following interesting statements in regard to the condition of the road:

That the company in such a very unhappy year should have earned and paid all interest and other obligations, and come out without any floating debt, should be a matter of congratulation to the owners of the property. The reduction in operating expenses of $220,133, accompanying reduced earnings of $395,000, has been effected by the practice of economies without lowering the standard of the roadbed or track, both of which are in excellent condition. With the restoration of business prosperity, it is expected that the only important increase in expenses will be in maintenance of rolling stock.

The plant of the Cleveland Foundry Company was burned Oct. 10, entailing a loss of $100,000.

Fuel Oil at the Midwinter Fair.

The steam plant at the recent Midwinter Fair, held at San Francisco, used oil fuel exclusively. This plant constituted the entire steam power, consisting of eight sectional boilers of 357 horse-power each, arranged in two groups of four. Each boiler had one large furnace 9 feet 1 inch wide, 16 feet long and 5 feet high, with four doors and draft openings. Crude petroleum was used as a fuel, and to adapt the boilers to this the bridge walls and grate bars were removed and the entire bottoms of the furnaces covered with firebricks. Pieces of firebrick also were thrown in to make a mass that would retain heat for a considerable period. The bottom of the furnace was much lower than would be the case with coal as a fuel, the large capacity being necessary as the combustion was entirely in the form of flame. The door openings were closed with a screen of loosely laid red bricks, except an inspection hole about 3 inches square, and the screen effectually prevented loss by radiation. Each boiler was fitted with eight burners. The oil was carried through a tube placed axially in the apparatus and discharging by a hole ¼-inch diameter. Steam entered at the side about the middle of the length of the casing and passed out through an annular opening around the oil jet. The jet of steam was made to take a rapid spiral motion by means of rifle grooves in the casing. The discharge openings for both oil and steam were adjustable by screwing the parts into one another. When no steam was on, the oil was discharged with sufficient force to throw a stream four or five feet into the furnace. The oil entered the apparatus through a pipe ¼-inch diameter, under a pressure of 12 pounds per square inch. Steam entered through a pipe ⅛-inch diameter, full boiler pressure being used. The oil became completely evaporized, and no combustible matter was left in the furnace or tubes.

Outside the boiler-room a large pit was dug and lined with wood, and in this were placed two iron tanks, each capable of holding 7,500 gallons. Tank cars were run to the pit and the oil piped into the receiving tanks. About 4,000 gallons were used every day.

During the hours of heaviest loads in the evening, only two men were required, one to look after the oil supply and the furnace, and the other for the water; while during the rest of the 24 hours, from midnight until 6 p. m., one man easily took charge of the whole. No dirt being present, the boilers were painted white and remained so. If coal were used, six to eight men would have been needed. From midnight to about 6 a. m. the average load was about 200 horse power; during the day from 800 to 1,000 horse power; and during the heavy-load period in the evening 2,500 horse power. The oil-discharge pipe from the pressure tank was 3 inches in diameter until it reached the line of the boiler fronts, where it divided into two pipes each 2 inches diameter and feeding 4 boilers.

Street Cars of New Design.

The Wason Manufacturing Company, of Springfield, Mass., has recently finished a number of new cars for a Springfield street railway company. Formerly Jones and Stephenson had almost a monopoly on the street car building of the country, but the electric lines have made such changes necessary in this class of vehicles that the Wason company is in a position to become a formidable competitor to them. The company's experience in making railway coaches is now useful, and they have produced a car for the local street railway that will attract wide attention. The car is the box pattern, and a peculiarity is that there is only one entrance to the platform at either end. The closed side of the platform is curved, forming a sort of pocket. On the other side of the platform is the entrance to the car right by the steps. Then the door is much wider than usual, allowing free access.

The cars are built from carefully chosen and thoroughly seasoned lumber. The bed frame is connected and held together with steel rods, and the roof is made exceptionally strong by means of steel tie-rods. This additional strength is made necessary as so much strain is put on the old style of roof by the trolley poles that the roofs would soon become weak and loosened. The interior finish is of mahogany, with decorated oak ceilings. The ends of the car give the impression of double doors. The doors are hung on graphite bushings, which are tested by being given 8,000 revolutions an hour for 24 hours without apparent wear. The glass in the side windows is polished plate 30 by 33 inches, and the end windows are of beveled plate. The windows have the Burrows curtain fixtures. The car is lighted by electroliers, providing six lamps in each ceiling. The cushions and backs are covered with the best quality of mohair plush. The cars are equipped with the electric heater made by the Consolidated Car Heating Company, and are fitted with the improved style of gate, and with radial drawbars and enlarged buffers. The trucks have a seven-foot wheel base and wheels 33 inches in diameter. The motor is the Westinghouse improved electric.

The largest log of wood that has ever been shipped by sea was landed recently at Liverpool, England. It was brought from the West Coast of Africa, and weighed 15 tons.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

NO PLACE LIKE HOME.

We receive frequent letters from railroad men connected with all the different branches of railroad work, asking our opinion on the advisability of their going to foreign countries to seek employment in their respective capacities. The general trend of these inquiries shows a common inclination to go to South America or Africa. The caption of this article indicates the nature of the advice given in answer to these solicitations, and we wish here to say for the benefit of those who are entertaining ideas that the services of American railroad men are in great demand in foreign countries, that they are quite mistaken. In every country of our acquaintance where there are railroads, there are also men in plenty to work in the shops and run the engines and the trains. This is especially true of South American countries, where for the past four years there has been a dearth of railroad employment even for those on the ground. Wages average much lower in these countries than here; and the cost of living, as we live here, is greater. The treatment of employés is not as good as here, by great odds. Generally speaking, the equipments of South American railroads are not as good, and are not kept in as good state of repair, as the equipments of North American railroads are. Every old railroad man knows how greatly this adds to the labor and hardships of railroad work of every kind.

Another reason why North American railroad men should remain home at present, as far as these southern countries are concerned, lies in the fact that south of the Equator summer is now coming on. There the months of December, January and February are the hottest of the year, and the most unhealthful, as during their term diseases to which northerners are most susceptible are rife. Those who live in the Northern Temperate Zone, and who contemplate taking up residence in the southern Tropical or Temperate zones, should make the change during the northern spring or early summer months, so as to reach the new country during the cool weather and thus have some months in which to become acclimated and accustomed to the change of food and methods of living. Nature provides in devious ways for the safety and comfort of her creatures. Birds and animals of northern climes are given new coats of feathers and fur, respectively, to keep them warm in winter. Human beings are also prepared for winter weather by a thickening of the blood and a general toning up of the system to withstand cold. To go to a hot climate for the first time with one's system prepared by nature for cold weather is dangerous to life, as many who have tried the experiment have found.

These are some of the reasons why North American railroad men had better not go to southern countries in search of work just now—particularly when they can't talk Spanish. As regards the future they will do well to wait until they are assured of permanent employment at higher wages than they can earn here before going to those countries. For citizens of the United States it is perhaps more true than for those of almost any other country, that "there is no place like home."

MASTER CAR BUILDERS' STANDARDS.

At the last convention of the Master Car Builders' Association it was suggested that, inasmuch as the rules of the association as regards the standards of details of car construction were simply recommendatory in character, and carried no actual obligation of conformity by members, to obtain more uniform conformity to standards it would be well to enlist, if possible, the influence of the approval of the American Railway Association.

The suggestion was acted on, and the fall meeting of the last-named association showed its appreciation of the value of the standards by giving them its indorsement and approval. It is expected that the effect of this will be to have sufficient pressure brought on members who do not conform to standards to cause them to do so. This was the idea of the suggestion, and it was doubtless the dominating idea of the members of the American Railway Association when they gave these standards indorsement.

The M. C. B. Association is justified in thus seeking to strengthen its position in regard to standardizing the construction of the details of cars that affect their safe handling and easy repairing in interchange. The fact that freight cars have to run on other roads than those they are built for is quite sufficient to require that they should be built with this end in view. Except in the case of some special types, these cars spend a large part of their lives on foreign roads; but too often they are built for some particular road instead of being built for service on any road they may be required to run on. Locomotives generally remain in service on the roads that own them and that they were built for, therefore the Master Mechanics' Association has but few standards, and these are simply to promote the best practice in locomotive building taught by investigation and experience. Their principal aim is to secure excellence in construction that will insure economy in operation and maintenance. No one questions the privilege of master mechanics to deviate from these standards as much as they please. It is considered that such may be a departure from good practice, but as the particular road operating the locomotives is the only sufferer, other people are not exercised very much about it. It is a condition that will regulate itself. With cars the case is entirely different, and the Master Car Builders' Association has adopted what are called recommended practices to obtain excellence in construction and economy in repairs, and it has adopted what are called standards to obtain such uniformity of construction of such parts of the cars as affect their safety on the railroad lines of the country and the safety of the cars they come in contact with in general interchange service. Some of the standards aim to promote the safety of trainmen, and others aim to make provision for possible necessary repairs without burdening the railroads with the necessity of keeping in stock at the storehouses scattered along their lines a needlessly large and diversified stock of materials. It must be acknowledged that these are all sensible and laudable objects, and that they deserve the support of all officers in charge of the design of cars. Adherence to the recommended practices may be disregarded by master car builders with about the same results that master mechanics can disregard the standards of their association, but adherence to the standards of car construction is a duty that these officers owe to the interests that employ them, the commercial interests of the country, and to the safety and prosperity of American railroad service. Therefore, in its efforts to have its adopted standards lived up to, the Master Car Builders' Association is deserving of all possible support.

HEMP VERSUS METALLIC PACKING.

Some figures were presented at the October meeting of the Central Railway Club on the comparative merits of hemp and metallic packing for piston and valve-stem stuffing boxes that ought to interest every railway master mechanic who yet entertains any doubt as to which is the best. A committee recommended good metallic packing as the most economical and generally preferable for use in all cases. It was shown that hemp packing costs about 26 cents per thousand miles for freight engines and about 17 cents for passenger engines. It was stated that a good form of metallic packing made by specialists costs about $2.95 per engine per year. At the rate named for hemp packing, the annual cost would be, for freight engines making 3,000 miles a month, $9.36; for passenger engines making 3,500 miles a month the cost would be $7.14 per year, an average of $8.20 per year for both kinds of service, or an excess of $5.15 per year per engine with hemp packing. This would amount to over $500 per year per hundred engines. On a road with 400 engines it means a matter of over $2,000, according to these figures. We believe they are emphatically within the mark. A prominent superintendent of motive power of a road operating over 400 locomotives recently assured us that the economy resulting from the substitution of metallic for hemp packing was several times greater than this. It was further shown at the meeting referred to that on two freight and two passenger engines averaging 68,000 miles the wear of valve-stems, with hemp packing, was over $\frac{5}{32}$ inch, and that on a passenger engine with metallic packing the valve-stem wear for over 96,000 miles service was less than $\frac{1}{32}$ inch. From these figures it appears that with hemp packing the wear is about five times as great, and the cost fully three times as great, as with metallic packing.

From the above it is evident that hemp packing is an expensive luxury where used in locomotive service. If it was, in fact, a luxury or a convenience, there would be some excuse for its continued use, but it is neither. It is an annoying relic of old practice that entails a good deal of unnecessary labor and hardship on engineers. Although it costs more to purchase and increases the cost of repairs and the labor of running an engine, these are not the only evils to be charged against it, for it is the indirect cause of unnecessary fuel consumption. It is only when a locomotive is in very good condition that hemp packing can prevent for any length of time the waste of steam by blowing from stuffing boxes. When the crosshead and guides become worn the aperture in the piston stuffing box gland is enlarged, and the packing soon leaks or is blown out. The steam that escapes blows the lubricant off the guides and aggravates the trouble.

Bushings become worn in the valve-stem glands, and leakage of steam quickly results. Being quite familiar with the hardships of running locomotives and the causes of wasteful fuel consumption, we can say that there is hardly anything on the list more aggravating and wasteful than a blowing piston or valve-stem stuffing box. With hemp packing there is nothing so hard to guard against; with metallic packing there is nothing so easy to prevent.

Some years ago the writer ran a locomotive on a railroad that was in the hands of receivers. The engine was in bad condition, and as a consequence the stuffing boxes of both pistons and valve stems and the pump had to be packed every hundred miles run. It was a cold winter. The work of packing devolved on the engineer, and the engine was always out of doors when the job could be done. The hardship, the annoyance of blowing steam and the observed waste of fuel combined to make a lasting impression of the folly and inexcusable expense of using hemp packing for locomotives.

Quite aside from the questions of first cost, of wear and of convenience, is that of safety, and this is enhanced in no inconsiderable way by the use of metallic packing. We have seen the time when hemp packing was in general use that it was a treat to the eyes to see, in cold weather, the distinct outlines of the smokestack, cylinders, etc., of a working locomotive. It was an unusual sight, and at once declared the fact that the engine was new, in good condition, and "light on packing." Generally in cold weather, the leakage of steam from blowing stuffing boxes enveloped more or less completely the front ends of locomotives seen working, unless they were running against or with and faster than the wind. This constituted a source of danger, as with a slowly running engine or with an accompanying wind the view of the engineer was often seriously obstructed by the rising cloud of steam in front.

It was not unusual to have to shut off steam when approaching hazardous places and entering yards, in order to clearly see ahead, and although we cannot recall any particular instance where this led to actual damage, yet doubtless it did many times, and it certainly was frequently a menace of disaster. With the advent of metallic packing matters changed for the better in this as well as in other ways. Engineers were relieved of the necessity of forever wrestling with packing tools and hemp, and of work that under some circumstances was real hardship. Their view while moving about, as above described, was less obstructed, the confined steam performed its intended work and saved the fireman labor and the company fuel. It has long been known that metallic packing was cheaper to supply. If to these virtues is to be added that of reducing wear and the necessary cost of repairs, then it seems that every desirable object is promoted by its adoption.

AN INSTANCE OF BAD BRAKE PRACTICE.

Later particulars of the passenger train collision on the Northern of France Railway, Sept. 9, announced in our last issue, state that 6 persons were killed and 25 injured by it. The train was an express bound from Paris to Brussels, and came into collision near the station of Appilly with a switch engine that was pulling out of a siding on a crossover road on to the line going in the direction of Paris. The front "van" and the first four cars were completely smashed and piled up in a heap between the tender and the remainder of the train, while the switch engine "was knocked clear out of the road and turned right around."

The train was fitted with the simple vacuum brake, and, in accordance with the practice of the railroad, the cock for working the ejector was situated on the fireman's side of the locomotive and the releasing valve on the engineer's side. Owing to a sharp curve and trees that obscured the view the engineer did not notice the obstruction until within about 150 yards of it. He then called to the fireman to apply the brake, but, although some six seconds elapsed before the collision, the order was not executed in time to get the brake in operation on any part of the train except the engine and tender. The shock broke the train-pipe and rendered the brake useless. The train ran about 100 yards beyond the point of collision, the engine and half the train running on the ground.

The surprising feature of the wreck is not its severity or mortality, but that such wretched brake equipment and practice should be permitted on a railroad in such an enlightened country as France. The practice of placing the

means of applying the brake out of the reach of the engineer, to be applied by the fireman on order in emergency, is simply criminal in its stupidity, and in this case may be charged with a large share of responsibility for the damage and loss of life. To Americans it seems hardly less criminally stupid to intrust the safety of a passenger train to a brake equipment that, when damaged by rupture, as the brake in this case was, will thereby be rendered useless. With the advantages of the Westinghouse automatic emergency brake in view, it seems probable that if it had been in use on this occasion there would have been no collision, and it is certain that, even if there had been a collision, its severity would have been greatly mitigated.

Referring to the form of record of renewals of parts of locomotives, used in the office of the Superintendent of Machinery of the Chicago & Alton Railroad, and illustrated in our last issue, it should be added that the arrangement consists of a board about 11 feet long and 3 feet high, filling a vacant space in the wall on one side of the room, on which at the beginning of each year a sheet of paper, ruled and lettered as shown in our illustration, is stretched. When the year's work is complete this sheet is cut down and can be filed away for future reference.

One of the early stories of railroad travel in this country related that on the occasion of a passenger train passing an obstruction that barely cleared its side, the brakeman called "look out!" to passengers who had their heads poked through the windows. Whereupon one fellow who was not looking out the window misunderstood the warning and "looked out" so quickly and effectively that his head collided with the obstruction with disastrous results to himself. The story was always told as a joke, but here is verification of its probability and proof that history repeats itself; On Oct. 22 a crowded excursion train going to Granite City, Ill., ran past a long row of cattle chutes. The brakeman called out "Danger!" at the car door. Nearly every passenger misunderstood the signal and all who could stuck their heads out of the windows. John Miller had an arm broken, and Carl Wendt had his skull crushed and died an hour later. Six others were bruised.

The *resume* published on another page, of the proposition of Mr. O. D. Ashley, President of the Wabash Railroad, to better the condition of railroad employes and to establish more harmonious relations between them and the employing companies, outlines a policy that should be carefully studied by railroad officers generally. Mr. Ashley has the courage of his convictions, and if railroad affairs were in better shape he would, doubtless, put his plan to a practical test. There is small room for doubt of its probable success. Its underlying idea is by considerate treatment of employes to secure the best service. Any observer of human nature knows that this is the proper course to pursue, and any railroad man knows that the attainment of the object sought would result in a saving of operating expenses on such a large road as the Wabash amounting to many thousands of dollars annually. As we understand the plan, it involves a necessary outlay of about $50,000 that with future accruments of interest and contributions would form a fund to provide insurance and pensions for deserving employes. We believe that by concerted action it would be a very easy matter for the employes of the Wabash to reduce its operating expenses $50,000 a year. One class of employes could do it—the engine men. With the co-operation of all classes there would be no possibility of failure. Of course, to secure general co-operation more would be required than the mere establishment of the fund and the declaration of its purpose. Much of its possible success would depend on the proper carrying out of details. But the plan is good and contains within it the means of accomplishing the objects sought.

As we go to press, on Oct. 31, California papers of Oct. 22 reach us announcing the sad news of another bereavement that has befallen Mr. Henry J. Small, Superintendent of Motive Power of the Southern Pacific Company. Those who met Mrs. Small at Saratoga last June, as well as those who have enjoyed her acquaintance much longer, will learn with surprise and sorrow that the estimable lady died at her home in Sacramento, Oct. 20. It is only a few months since Mr. Small lost his brother, the well-known W. T. Small. All of Mr. Small's friends in the railroad fraternity will, we are sure, join us in extending to him heartfelt sympathy for the losses that in time come to us all.

New York Railroad Club.

At the October meeting of this club its constitution was amended to provide that the Secretary shall be appointed, by a majority of the Executive Committee, to hold the office at the pleasure of that committee, and to receive a salary fixed by the committee. The amendment was adopted on the suggestion of Mr. M. N. Forney, its object being to avoid a general election of secretary, and, incidentally, unpleasant forms of electioneering sometimes practiced in elections of the secretaries of societies. Mr Forney said that the executive committee of a society was better qualified to select a secretary than the general membership, and that the committee was the best judge of a person's fitness for the office.

Mr. George H. Baker read a paper on locomotive injectors. This is published in full on another page. It excited a good deal of discussion, a synopsis of which will be given in our next issue.

Mr. G. N. Joughins showed the club how in an emergency he had provided a needed brass shoe for a crosshead. A piece of a discarded brass jacket-band had been utilized, the ends being turned up and bolted to the crosshead. It had stood considerable service, and Mr. Joughins exhibited it and related the experience as possibly offering a suggestion to others in a like emergency.

Literature.

One of the most interesting publications that reached this office is the *Blacksmith and Wheelwright*. It is a monthly paper, and is carefully edited, each issue being replete with articles of special interest to those engaged in the fields to which the paper is devoted. It is edited by Mr. Vaughan Linder, and is published by the M. T. Richardson Co., 84 Reade street, New York.

The *Street Railway Journal* issued a souvenir number, Oct. 17, in honor of its tenth anniversary and of the Atlanta meeting of the American Street Railway Association. It contains a 16-page article on Atlanta, a 10-page article on the Association, a 30-page article on the street railway systems of the Southern cities, and a 20-page article on the history of the street railway industry. All of these are handsomely illustrated, the number containing over 400 illustrations, among which are more than 125 portraits of street railway men. The number contains 122 pages, and altogether is very creditable to the enterprise of the publishers.

The Engineering Magazine has for several years published an index to current technical literature in which it was aimed to give the title of articles of special interest that appeared in domestic and foreign papers published in the English language. As this feature was found to be appreciated, it has been improved from time to time. Now it has been extended so as to give concise and expert reviews of the most important articles that appear each month in the various fields of applied science. The *Magazine* will also supply a full text of each article reviewed or named in the index for a nominal sum. A further and very convenient refinement of detail in this deparment is the adoption of a form of coupon that will enable those desiring to order copies of articles mentioned to do so very easily and without the trouble of sending small remittances. Undoubtedly this department, as now perfected, will be very interesting, and a valuable help to those who wish to keep abreast with the current technical literature of the industrial arts.

Report of Proceedings of the Master Car Builders' Association. 1894. Edited by John W. Cloud, Rookery Building, Chicago

This report was issued in September. As usual, it gives a complete report of the proceedings of the annual convention of the association, which in this case was held at Saratoga last June. Much of the matter contained in the report appeared in the NATIONAL CAR AND LOCOMOTIVE BUILDER in the July and August issues succeeding the convention, but of course the matter then given was much curtailed, some of the reports and much of the discussion relative thereto being given simply in abstract. The report now issued is entirely complete, and gives not only a verbatim account of the proceedings of the convention, but also gives, as usual, the Code of Rules governing the interchange of cars, as amended by the convention, and the standards and recommended practices of the association. The quality of the paper used in the report, and especially that of the cover, is not as good as that used in the report of the Master Mechanics' Association. This means earlier disintegration. Typographically we see nothing to criticise in the report, although, comparing it with that of the Master Mechanics', the reader is impressed with the fact that while the latter presents the reports of committees in large type, and uses small type for the discussions relative thereto, the Master Car Builders' report pursues the opposite course, and prints the committee reports in small type and the discussions of them in large type. The question is thus raised: Which of these plans is the best? There is much to be said in favor of either plan; but the question is simply one of convenience to the reader. Evidently the editor of one of these reports considers that the substance of the committee report is of most interest to readers, while the discussions are of minor importance. The opposite view is held by his contemporary. Partly to economize in space and partly because discussion is generally considered of much importance as presenting the views of many men, committee reports are generally printed in smaller type than the discussion they excite. This practice is followed in the pages of this paper, and in adopting it for the Master Car Builders' report the secretary simply follows current practice. The opposite practice, however, has much to commend it. A studied report upon any subject that has been a matter of special investigation by a committee is generally a more valuable contribution to its literature than any mere discussion of such a report, the remarks constituting which are frequently given off-hand and with slight consideration.

American Society of Railroad Superintendents.

The twenty-fourth meeting of the American Society of Railroad Superintendents was held in New York, Oct. 15. President George W. Beach, of the Naugatuck Division of the New York, New Haven & Hartford, presided. Mr. Willard A. Smith delivered an address on "Railroad Education," in which he made a general survey of all the kinds of education needed for the prosperity of railroads and their employees. He condemned the various attempts to reform society by wholesale. The only way to reform large bodies of persons is to reform the individuals. In the railroad service itself, education is needed in all departments, high and low. Speaking of the influence of education in the mechanical department, he said that while invention opens out a wide field of possibilities, we have much to do to bring present mediocre men and machines up to the highest standard. Educate the men to make better use of the knowledge already available. Much good is to be expected from the co-operation of railroads and technical schools. Railroad officers should give much more time and attention to the education of employees.

Reports of standing committees were presented as follows: On roadway, D. B. McCoy, chairman; on machinery, J. F. Divine, chairman; on transportation, F. K. Huger, chairman; on signaling, W. G. Wattson, chairman. Considerable discussion followed on signals, derailing switches, government of employes, train rules and economy in freight service.

The American Railway Association.

Over 100 representative members attended the regular fall meeting of this association that was held in New York, Oct. 17. Col. H. S. Haines, the president of the association, who has presided at every meeting since 1887, was detained at home by sickness, and the chair was occupied by Mr. E. B. Thomas, first vice-president of the association. An invitation to the association to become a member of the International Railway Congress was received and accepted, and a resolution was adopted requesting Colone Haines to become the representative of the association at the meeting of the Congress to be held in London in June, 1895.

A communication was presented from the Master Car Builders' Association asking approval of the M. C. B. Association's adopted standards of details of car construction. The executive committee presented a resolution indorsing these standards, and it was adopted. The M. C. B. Association also sent a communication concerning a standard wheel and track gage. The executive committee was ordered to appoint a committee of three to take up this subject and to confer with the Master Car Builders' and the Roadmasters Associations; if these conferences result in a satisfactory conclusion the executive committee is to take a letter ballot, with power to declare the result thereof the standard of the Association, if it shall see fit to do so.

Mr. Willard A. Smith, representing the Master Mechanics Association Committee appointed to request assistance in the matter of locomotive tests at Purdue University, was present, and stated the case. The Executive Committee, however, did not recommend action on this request at present. The sentiment of the meeting seemed to be that in the present stage of the matter it ought to be managed wholly by the Master Mechanics' Association. Several general managers, who were not in favor of taking action at this meeting, manifested the intention to favor the tests through their mechanical departments.

The next meeting of the Association will be held in St. Louis on April 7, 1895.

Place for Holding the Next M. C. B. and M. M. Conventions.

The Secretary of the American Railway Master Mechanics' Association has issued the following circular:

The Joint Committee of the Master Car Builders' Association and the Master Mechanics' Association have decided on Thousand Islands, Alexandria Bay, N. Y., as the place for the next convention in June, 1895. The committee have made the following arrangements with Mr. J. B. Wistar, proprietor of the "Thousand Island House," Thousand Islands. Alexandria Bay, N. Y., and Mr. Charles W. Crossmon, proprietor of "The Crossmon House," Thousand Islands, Alexandria Bay, N. Y., as to terms, as follows:

Single rooms with board, $3.00 per day each person.

Single rooms with board and bath, $4.00 per day each person.

Double rooms with two persons, $3.00 per day each person.

These rates are to members of the Association and their friends. Applications for rooms should be made to Mr. J. B. Wistar, proprietor "Thousand Island House," Thousand Islands, Alexandria Bay, N. Y., and Mr. Charles W. Crossmon, proprietor "The Crossmon House," Thousand Islands, Alexandria Bay, N. Y.

The committee request that members will apply at once for rooms, as those who first apply will be best served.

S. A. CRONE, R. C. BLACKALL, C. E. FULLER, Jr., Committee.

M. C. B. Gages and Lithographs of Drawings.

The secretary of the Master Car Builders' Association has issued the following circular letter:

CHICAGO, Oct. 15, 1894.

To the Members of the Master Car Builders' Association:

Replies to circular dated Sept. 4, in regard to gages recently adopted by the association, do not indicate that orders for 50 sets can be assured at the prices quoted by gage manufacturers. Many of the replies indicate that the prices quoted are considered too high, and that gages have been or will be made by the companies at their own shops. The executive committee has considered the question, and decided that it cannot effect satisfactory arrangements with gage manufacturers for these gages. It recommends that railroad companies making these gages should have the large lithograph drawings of same from this office, so that the gages may be properly made in so far as the essential or gaging dimensions are concerned.

The new sheets of 1894, Nos. 12 and C, are as follows:

Sheet 12:
- Standard terms and gaging points for wheels and track:
- Standard guard rail and frog wind gage.
- Standard check gage for mounting wheels.
- Standard wheel tread.
- Standard flange thickness gages of new wheels.

Sheet C. Recommended practice for
- Journal bearing and wedge gages.
- Safety chains for freight cars.
- Minimum thickness for steel tires.
- Dummy coupling hook.

These lithographs are made on thin semi-transparent paper, so that blueprints may be taken therefrom the same as from tracings. They are sold at 25 cents per copy or $3.75 for a set of 15 sheets.

Personal.

Mr. Charles Potts has been appointed Division Master Mechanic of the Pennsylvania Railroad, at Erie, Pa.

Mr. Robert Redding has been appointed Division Master Mechanic of the Pennsylvania Railroad at Sunbury, Pa.

Mr. E. C. Spalding, General Manager of the Southern Iron Car Company, has been appointed Receiver of the Atalanta & Florida R. R.

Mr. L. R. Brooks has been appointed Superintendent of Motive Power of the New Orleans & Southern, with headquarters at New Orleans, La.

Mr. J. J. Bossinger has been appointed Master Car Builder of the Florida Central & Peninsular Railroad, with headquarters at Fernandina, Fla.

Mr. S. J. Morris has resigned as General Foreman of the Louisville & Nashville shops at New Orleans to accept a position on the Western of Alabama.

Mr. Hans Zopke, Royal Engineer of the Russian railway system, is now in this country examining the various American railway systems.

Mr. Daniel O'Leary has been appointed Master Mechanic of the Seattle, Lake Shore & Eastern, succeeding Mr. George Gabriel, assigned to other duties.

Mr. F. D. Thompson has been appointed General Superintendent of the Chesapeake, Ohio & Southwestern Railroad, with headquarters at Louisville Ky.

Mr. James Maglenn has been appointed to the new office of Superintendent of Motive Power of the Seaboard Air Line. His office is now located at Raleigh, N. C.

Mr. E. W. Jackson, who recently resigned as General Manager of the Mexican Central, has been appointed General Manager of the Interoceanic Railway of Mexico.

Mr. Joseph Herrin has been appointed Superintendent of the Atlanta & West Point Railroad, and will have general supervision over the car and locomotive departments.

Mr. Thomas Crow has resigned as Master Mechanic of the New Orleans & Southern at New Orleans, La., to accept the position of Chief Engineer of the Belle View plantation

Mr. H. E. Burt has been appointed General Superintendent of the Minnesota & Wisconsin, in place of Mr. James Menogue, who was acting superintendent. Headquarters, Spring Valley, Wis.

Mr. George L. Bradbury, General Manager of the Lake Erie & Western, was on Oct. 10 chosen Vice-President of the Cincinnati, Jackson & Mackinaw, in charge of the operation of the road.

Mr. J. P. Bay has been appointed Master Mechanic of the Denver & Gulf divisions of the Union Pacific, with headquarters at Denver, Col. His jurisdiction extends over the South Park road.

Mr. James F. Blackwood, who has been General Foreman of the South Carolina & Georgia shops at Charleston, S. C., has been appointed Acting Superintendent of Motive Power, *vice* E. M. Roberts, resigned.

Mr. J. D. Begg, who has for a number of years been a machinist in the shops of the Columbus, Hocking Valley & Toledo at Columbus, O., has been appointed Division Master Mechanic of the Southern Pacific at Houston, Tex.

Mr. F. F. Hemenway, who has been for the last fourteen years connected with *American Machinist* as associate editor, and editor, has severed his connection with that paper. Mr. Hemenway's future plans have not yet been announced.

Mr. Edmund S. Bowen, formerly assistant to the President of the New York & New England, was on Oct. 9 appointed General Manager of the South Carolina & Georgia, in charge of transportation and maintenance, with headquarters at Charleston, S. C.

Mr. Orlando Stewart, formerly Superintendent of Motive Power of the Fitchburg, has been appointed Superintendent of Motive Power and Machinery of the Bangor & Aroostook, with headquarters at Oldtown, Me. Mr. Stewart has for a number of years been Treasurer of the American Railway Master Mechanics' Association.

Mr. John Henney, Jr., Superintendent of Motive Power of the New York, New Haven & Hartford, has had his jurisdiction extended over the Old Colony Railroad since the demise of Mr. J. N. Lauder. Mr. Henney's jurisdiction now covers the entire New York, New Haven & Hartford system. His headquarters have been moved to Boston.

Mr. Frank S. Woods, General Sales Agent for the C. B. Hutchins car roof, died at his home in Aurora, Ill., Sept. 24. Mr. Woods was chief clerk to Mr. G. W. Rhodes, Superintendent of Motive Power of the Chicago, Burlington & Quincy Railroad, for a number of years, and was widely known and highly respected in railroad circles. He leaves a widow and several children.

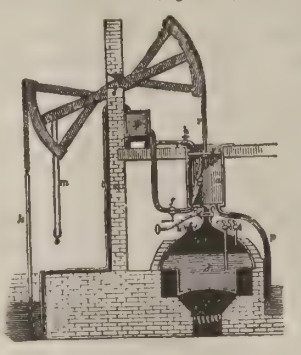
Mr. Robert H. Pratt, for over 13 years Assistant General Superintendent of the Pacific system of the Southern Pacific, has tendered his resignation to take effect in December. Mr. Pratt has been with the Central and Southern Pacific roads since 1865. He was appointed Assistant General Superintendent of the Pacific system May 8, 1881. It is officially announced that no successor will be appointed.

As announced in our October issue, Messrs. R. D. Wade and W. H. Thomas were appointed Superintendent and Assistant Superintendent, respectively, of the motive power department of the Southern Railway. The following further appointments have been made in that department: Master Mechanics: W. H. Owens, Manchester, Va.; C. F. Thomas, Alexandria, Va.; W. A. Walden, Atlanta, Ga.; C. W. Lee, Salisbury, N. C.; J. H. Green, Columbia, S. C.; J. B. Michael, Knoxville, Tenn.; W. H. Hudson, Atlanta, Ga.; W. L. Tracy, Birmingham, Ala.; W. A. Stone, Selma, Ala.; V. R. Lang, Louisville, Ky. Foremen: William Anderson, Charlotte, N. C.; J. C. Holt, Burlington, N. C.; L. C. West, Neapolis, Va.

The Oldest Existing Steam Engine.

The engraving of an old pumping engine appearing below is interesting not only because of the quaint appearance of the long since useless machine, but also because it is probably the oldest steam engine in existence. The illustration is reproduced from the pages of *Engineering*, to whom the existence of the forgotten old relic was recently made known.

For years the engine was looked upon as one of James Watt's first productions, but recent inquiries leave no doubt that it is a steam motor of the Newcomen pumping type, single-acting. Nothing is known at all trustworthy as to its history. There are a few old residents in the neighborhood who remember its being occasionally, though not regularly, worked some 60 or 70 years ago (1834) for pumping a mine, about which time it seems to have been allowed to fall into disuse. The date of its erection in Fairbottom Valley, halfway between Ashton-under-Lyne and Oldham, is uncertain, but it was probably toward the end of last century. It is still on the original site.



NEWCOMEN'S ENGINE, 1705.

The small sectional cut shows the design of the type of engine of which this is the only known existing specimen. It was invented by Newcomen in 1705 for pumping water from a mine. Steam was generated in the boiler below and admitted to the bottom of the cylinder, where after pushing the piston to the top it was condensed by an entering jet of water and allowed to escape through the pipe *P*. There being a vacuum in the cylinder after condensation the pressure of the atmosphere drove the piston to the bottom of the cylinder again. The motion of the piston was communicated by a chain to the beam, and through this to the pump.

The old engine recently discovered consists of a solid masonry pillar, 14 feet 6 inches by 7 feet 3 inches at the bottom, carrying the beam, which is made of oak, 12 inches by 14 inches, braced together with iron, and has segmental ends with the balance-weight at one extremity and the piston at the other. The beam, about 20 feet long, rocks on two trunnions resting on the central masonry pillar, and the piston and pump rods are attached to it by chains. The cylinder, of cast iron, is about 27⅞ inches in diameter and about 6 feet stroke, the steam entering only at the bottom. It is cast in one piece, 8 feet 9 inches from flange to flange, and about 1¼ inches thick. As there was no separate condenser, condensation was effected by injecting water into the cylinder by a motion from the beam. It is impossible to say whether there were any rings round the piston, as it has not been taken apart, but probably there was none. A method often employed for keeping the joint of the piston good was to place horse-dung on the top, but other materials that retained moisture, such as turf or tow, were also used. The valve gear was off a few years ago, and the pieces were lying about, but they probably could be collected.

THE OLDEST EXISTING STEAM ENGINE.

The wrought-iron boiler, of the wagon type, is in a very bad condition; it is believed to be of a more recent date than the engine, and that the original was a haystack generator.

The width of the boiler is 6 feet 3 inches at the widest part, and 5 feet 7 inches at the narrowest, the height being 7 feet. There is a steam dome 18 inches in diameter by 14 inches deep, with an 8-inch steam pipe leading vertically out of it. There are five plates in the circumference of the boiler, and 12 rings of plates in its length, the average size of plate being 19 inches by 3 feet 6 inches. The present thickness of the plates varies from $\frac{5}{16}$ inch to zero. The pitch of the rivets is 1½ inches to 2 inches.

It appears probable that this is the oldest engine in existence, but it is in a most dilapidated state. Having been so long exposed uncovered to all weathers, the beam has nearly fallen on its side, and the boiler is worn away till it is no thicker than paper in parts, with many holes. The grievous condition of neglect and disrepair into which the engine has fallen is an object of much concern to the people in the neighborhood, who would gladly co-operate in efforts to save it from rot, rust and total destruction. The engine is the property of the trustees of the late Earl of Stamford and Warrington.

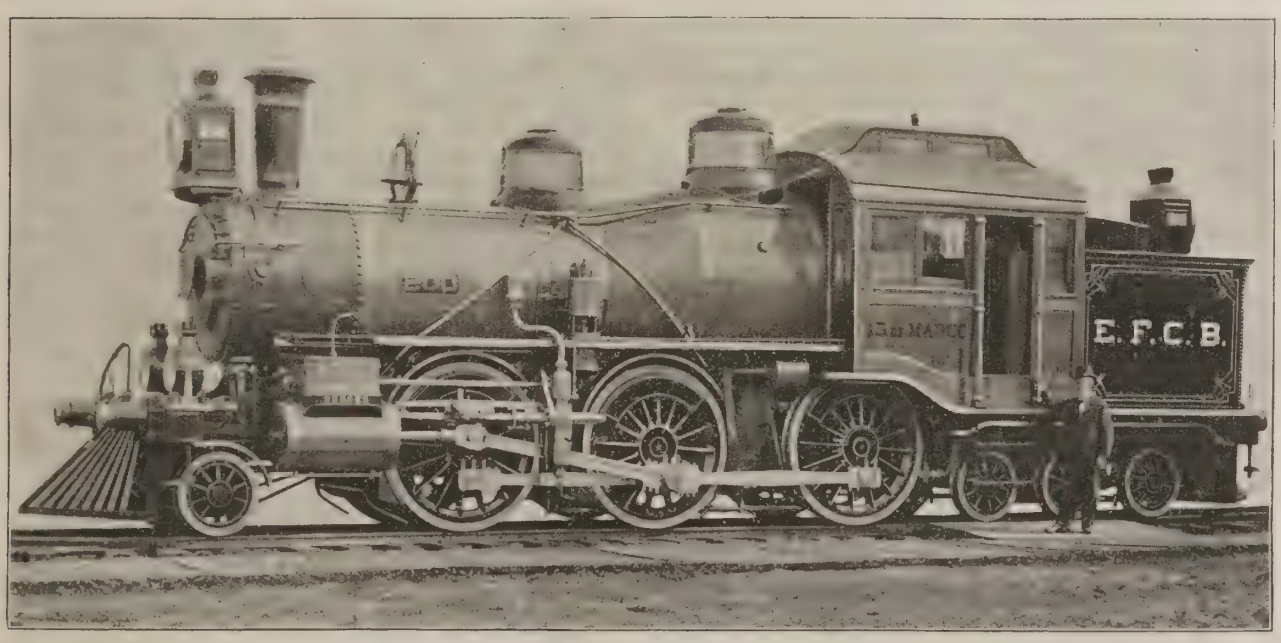
Postal Cars.

(*Continued from page* 133, NATIONAL CAR AND LOCOMOTIVE BUILDER *for September.*)

The extent to which the railway postal cars facilitate the quick transportation of mails can possibly best be appreciated by contrasting these days of rapidly moving postoffices, complete in every detail, to the old days of distributing offices along the line. Then, little or no attention was paid to schedules of railroad connections; the mail was made up at mailing divisions and consigned in bulk to the largest postoffice within a certain territory, where it was again handled, resorted, tied up in smaller bundles and directed to the neighboring postoffices. Some of these offices would in turn redirect it to a still smaller office, and so on, probably taking in all three days for a letter to reach its destination within a radius of 100 miles, whereas now, by the advent of the postal car, the time required for the same distribution is shortened to a single day.

In the old days of distributing postoffices, the railroads carried the mail locked up in pouches which were handled much the same as trunks or any other form of baggage. On roads where the daily transportation of mail was sufficiently large, requiring the entire space of one or more cars, special cars were built and called "mail cars," in contradistinction to what we now have as "postal cars." These mail cars were in design and structure the exact counterpart of a baggage car, as indeed they were nothing more than baggage cars intended simply to carry the mails. And a baggage car is not especially designed with a view to appease the constant and exhaustive work of its inmates, so much as it is to store away a certain amount of baggage.

The purposes of a postal car are decidedly different, and the design of the car should be different. The equipment of the interior is more elaborate; the work of the inmates is vastly of more importance, more exacting, and the facilities for doing this work and turning it out on time should be of the very best. Yet of the three thousand or more postal cars now in use it is safe to say that, with possibly few exceptions, the framing is a duplicate of the baggage cars on the same road. It may be argued that as the exterior and general dimensions of a postal car are similar to those of a baggage car, there is no need of a different framing, but this argument, however feasible from a building standpoint, is faulty when the effects on the nervous system of the respective inmates are compared. It is seldom we hear of a baggage master being laid off on account of nervous prostration from excessive and prolonged mental labor, failure of eyesight, loss of memory, etc., but such is not at all uncommon among the inmates of postal cars. In fact, so pernicious is the action of the postal work in breaking down the nervous systems of clerks, that the General Superintendent of the Railway Mail Service in his last annual report recommends the establishment of a "Railway Mail Service Relief Fund" to be retained for the injured and debilitated employes of the service. The fact is that in the one case the railroads hire and look after the baggage men, whereas the Government hire and care for the mail clerks; consequently the depreciation of physical energy caused by the swaying motion of the cars, the jolting and racking movements, is not fully appreciated by the builders of postal cars.



BROOKS SUBURBAN LOCOMOTIVE FOR BRAZIL.

The Postal Department at Washington, however, has for some time realized the importance of having better postal cars, the design of which would surpass in every way that of baggage cars and be equal, so far as steady riding is concerned, to a sleeping or dining car. Designs are at present being studied out with the advice and criticisms of some of the best car-builders of the country, and a much better car is confidently predicted to be the outcome. In the last annual report above referred to occurs the following:

"It, however, seems to me essential to the lives and limbs of our clerks, and to the safety of the mails, that as these cars run next the engine, they and the tender should be vestibuled, as well as the cars following them, especially upon trunk lines, where the vestibule feature is applied to every car carrying passengers, and where the trains run on fast schedules. The objects to be obtained by this are very important to the service. The whole train will acquire that solidity and evenness of motion while running at a high rate of speed which are conductive to comfort and to quick work, and which will require the minimum, instead of the maximum, outlay of muscular force by those who are compelled to work standing, and who can only accomplish the maximum of good service when surrounded by the best conditions possible. A clerk cannot work with satisfaction or rapidity who is assigned to duty on a line abounding in sharp curves and in steep grades, unless some system is provided which will overcome the oscillating and jerky action of the cars, because he cannot distribute his mail with precision, and, perforce, must make many false motions before landing it where it belongs. While attempting to do this he is liable to be thrown against the side of the car, case or rack, and to receive serious injuries. This can be avoided by instructing that every postal car built shall be vestibuled as strongly as possible, and that the tender ahead of it be also vestibuled, thus making the whole train solid, regulating the side motion of the cars, and preventing their being crushed by others in collisions."

The superintendent does not give the number of vestibuled postal cars in service. His report classes cars merely as whole cars and apartment cars, showing a total of 3,059 cars under the control of the Postal Department. It is to be hoped, however, that in the forthcoming report, for the fiscal year ending June 30, 1894, much more data will appear concerning the postal cars in use—their respective lengths, for instance, the number that is vestibuled, the number that has six-wheeled trucks, also the increment of cars built each year. The additional cost of applying vestibules to a postal car is nearly $850—that is to say, as the vestibule is now constructed—and to apply vestibules to all the postal cars would indeed entail a great outlay.

There seems, however, no inherent necessity for equipping postal cars with the same style of vestibules as is applied to passenger cars. A postal car is as a general thing built without the usual end doors, so that the feature of protecting people from inclement weather in passing from one car to another does not obtain in the mail service. The most important features of the vestibule, that of preserving steady riding cars, and also a protection against telescoping, can be accomplished in a much more satisfactory manner than by erecting a great iron arch plate in a vertical position. The abolishment of the end platforms will make it possible to apply long heavy buffer plates in a horizontal position, presenting near the same area of rubbing surface and even more leverage than is obtained by the present type of vestibule. The cost of this arrangement would be very much less than the vertical arch plate, and would on postal cars be much more serviceable, not only on account of presenting a longer leverage and more rubbing surface, but also the buffer plates of opposing cars could be held under greater compression, as all the strain would be in line with the sills.

The new cars under consideration will also have the floor frame greatly strengthened by reinforcing the sills, as a fortification against telescoping. The end platforms will in all probability be abolished, so that the extra strong floor framing will be of great use in coupling square up against its neighbor car, and not prove an actual detriment, as it would be in case end platforms were bolted on at each end.

Locomotives for Brazil.

The Brooks Locomotive Works are making rapid progress toward the completion of the 30 passenger and 30 freight engines ordered for the Central Railroad of Brazil. Ten of the mastodon engines, with cylinders 21 × 26 inches, have been shipped. The next shipment will be ten 18 ×

BROOKS MASTODON LOCOMOTIVE FOR BRAZIL.

six-wheeled connected suburban type passenger locomotives, and the balance will follow in lots of ten. The accompanying engravings are made from photographs furnished us by the locomotive works, and show the two types of engines mentioned. The letters on the tanks, "E. F. C. B." stand for "Estrada do Ferro Central do Brazil." The following table gives some of the particulars of the mastodon or 12-wheel engines:

Gage	5 ft. 3
Weight on drivers	140,000 lb
" " truck wheels	30,000 lb
" total	170,000 lb
" " engine and tender	252,000 lb
Drivers, number	Eight
" diameter	54
Driving axles, diameter	9
Cylinders, diameter	21 in.
Piston, stroke	26 in.
Steam ports, length	18½ in.
" " width	1⅝ in.
Exhaust ports, width	3½ in.
Valves	Richardson balanced
" lap	⅞ in.
" lead in full gear	1/16 in.
Boiler	Improved Belpaire (Player's patent)
" material in barrel	Steel
" thickness of material in barrel	½ in.
" diameter of barrel	68 in.
Length	28 ft. 7½ in.
Tubes, number	
" material	Iron
" diameter	2¼ in.
" length	13 ft. 10½ in.
Firebox, length	114 in.
" width	38½ in.
" material	Copper
" thickness of sheets	½ in.
" " flue sheets	⅝ in.
Grate	Water tube

These engines are equipped with the screw reverse lever arrangement, which is a feature common to all or nearly all locomotives in Brazil and is specified by the railway company. They also have a brick arch in the firebox, supported by water tubes. An important peculiarity of the engines is the improved Belpaire firebox patented by Mr. John Player, mechanical engineer of the Brooks works. The top of this is arched, as is the crown sheet, and the crown stays are radial.

The engines have both pumps and injectors, and are fitted with the Westinghouse airbrake apparatus and American equalized driver brakes, and are provided also with the Le Chatelier water-brake.

The following table gives some particulars of the construction of the suburban engines, of which there are to be 25:

Gage	5 ft. 3 in.
Weight on drivers	110,000 lb
" " truck, 2 wheels	16,000 lb
" " " 6 "	50,000 lb
Total	176,000 lb
Drivers, number	
" diameter	62 in.
Cylinders, diameter	18 in.
Piston, stroke	24 in.
Boiler, diameter of barrel	58 in.
Firebox, length	96 in.
" width	38½ in.

These engines have copper fireboxes, and the headlight and cab lamps will use Pintsch gas.

The shops and roundhouses of the Michigan division of the "Big Four," at Wabash, Ind., were burned Oct. 25. Over 1,000 men were thrown out of work, and the loss is estimated to reach $100,000.

Communications.

Sloping Crown Sheets.

litor National Car and Locomotive Builder:

Your editorial article in the September issue relative to ɔping or pitched crown sheets is on a very interesting pic. Speaking from the standpoint of an engineer, think a sloping crown is a very desirable feature firebox construction, particularly for passenger engines, r the reason that many times each trip over the road nile making stops the water in the boiler of such engines ll be carried ahead by the sudden checking of the speed, d there is no question but that a flat crown sheet is ade bare many times on its back end from this cause. ny passenger runner knows that, in coming into a station, his water is a little low and he makes a quick stop, will not see it again until the train comes to a stand-ll. During the period (brief as it is) that the water is t of signt, and probably off the back of the sheet, the id and scale-producing matter lying on the sheet harden d finally the sheet bags, and she is "mud burning" over e fire door. With a sloping crown you have a greater lume of water over the back end, and you are not so apt throw the water off of it in making stops.

William A. Midlam.

Smokeless Forges.

litor National Car and Locomotive Builder:

In your October number, page 150, under "Car Shop ɔnomy," a paragraph appears under the heading of *ɔokeless Forges*, in which the statement is made "that all rts of contrivances have been tried—blowers, ventilators, ɔokepipes, etc.—to remove the smoke and keep the air of acksmith shops clean, but that they all failed to hit the ark." This statement is so far from the facts that we not want to allow it to pass without criticism. This mpany is furnishing outfits consisting of an exhaust fan th suction piping and hoods for removing the smoke ɔm forges in all kinds of blacksmith shops; not only ɔse used by railroad companies and car and locomotive anufacturing concerns, but manual training schools and sorts of small industries in which forges are used. We e also furnishing an outfit which will remove the smoke thout using the boiler iron backpiece mentioned in e article named.

The effect of local air currents is overcome by a special ɔod designed and constructed by us in which the larger rtion of the suction is brought down to the lower edge of e hood. This hood consists of an inner and outer cone. s a result any smoke tending to curve down around the n is at once caught by the strong inward current and rried up the pipe. One of the shops of the Schenectady ɔcomotive Works, containing 100 forges, and another tfit of the same size placed in an adjoining building, e each equipped with an exhaust fan and our system of ods. This plant has been in successful operation for er five years.

We have also supplied a plant for 100 forges at e Juniata shops for the Pennsylvania Railroad at ltoona, Pa., and another of the same size for the Pull-an Palace Car Company, Pullman, Ill. Also a plant of forges for the Burlington & Missouri River Railroad at avelock, Neb.; 40 forges for the C., C., C. & I. at Belle-ntaine, O.; 35 forges for the Philadelphia, Wilmington Baltimore at Wilmington, Del.; and 22 forges for the itchburg Railroad at Fitchburg, Mass. We have under ɔnstruction at the present time an outfit for the new ɔps of the Boston & Albany R. R. at West Springfield, ass. There are many manual training schools and tech-cal schools in this country which are supplied with from to 30 forges, and the rooms are kept perfectly clean and ee from smoke. We have for years supplied outfits of is kind, large and small. Their success is unquestioned. Several months ago an outfit for 50 forges was shipped Buda-Pest, Hungary, for the Royal Hungarian State ailway, this order coming from the engineers of the ɔmpany, who visited the United States last year, and ho saw the advantages of the system from their careful spection of the many large railroad shops of this country.

B. F. Sturtevant Company.

The Northern Pacific Strike Injunction.

Last December a federation of the employes of the orthern Pacific threatened to strike. The road was in the ands of receivers, and these at once applied for an injunc-on to restrain the employes from striking. Such an in-uction was issued by Judge Caldwell. Judge Jenkins f the Court of Appeals sustained the injunction and de-ded that the clause of the same restraining the employes from combining and conspiring to quit with or without otice the service of said receivers, with the object and in-nt of crippling the property in their custody or embar-assing the operation of said railroad, and from so quitting ne service of said receivers with or without notice as to ripple the property or prevent or hinder the operation of aid railroad," was justifiable. This decision was reversed n part by a full bench of the Court of Appeals sitting at Chicago, Oct. 1, and it was decided that the court below hould have eliminated from the writ of injunction the vords "and from so quitting the service of the said re-eivers, with or without notice, as to cripple the property r prevent or hinder the operation of said railroad."

Locomotive Injectors.*

BY GEORGE H. BAKER.

As the title chosen for this paper is somewhat ambiguous, it is proper to state at the outset that the treatment of the subject herein will be confined in its scope principally to questions of operation and management, and these will be considered principally as affecting the coal consumption of locomotives.

As is generally well known, the injector was invented by Henri J. Giffard, a French engineer, in 1858, and patented in the same year. Messrs. William Sellers & Co., of Philadelphia, began the manufacture of injectors in America in 1860, and the veteran locomotive builder Mathias Baldwin was the first to apply one to an American locomotive. For 15 years following their introduction in this country injectors made but poor progress in supplanting pumps as a means of feeding water to locomotive boilers.

The eighth annual convention of the American Railway Master Mechanics' Association, held in this city in 1875, appointed a committee to report on the subject: "Is it economical to use injectors on locomotives, and to what extent?" This committee, reporting to the next convention, held at Philadelphia in 1876, stated that in answer to its circulars of inquiry 15 master mechanics, representing 1,361 locomotives, stated that of this number 508 engines had pumps and injectors, 769 had pumps and no injectors, and 22 engines had injectors and no pumps. This may be considered as showing the relative standing of pumps and injectors in the estimation of master mechanics at that time. The replies alluded to expressed the opinion also that injectors were valuable auxiliaries to pumps but not so reliable, that they saved no fuel, and that they cost about the same as pumps to construct and maintain.

Up to this time no experiments had been made to determine the comparative merits of pumps and injectors for general locomotive service. The committee named (of which Mr. E. T. Jeffery, now President and General Manager of the Denver & Rio Grande Railway, was chairman) made a carefully conducted test with a freight engine on the Illinois Central Railroad to determine the respective merits of pumps and injectors as regards reliability of action and economy of fuel. The test was made by running the engine eight trips, of 128 miles each, using the pump exclusively; and the same number of trips over the same piece of road in the same service, using an injector exclusively; making a run of 1,024 miles with the pump and the same number of miles with the injector. The injector used was a No. 6 Friedman. The coal and water used by the engine during this time were carefully measured, and a record was kept of the load hauled and of the steam pressure in the boiler. The load hauled by the engine during the trial was nearly the same while using the pump and while using the injector. With the pump the load was 2.42 per cent. greater than with the injector. With the pump the engine burned 9.8 per cent. more coal and evaporated 4.28 per cent. less water per pound of coal than with the injector. The variations of boiler pressure were fewer with the injector than with the pump, and the engine made steam more freely while using the injector. After making due allowance for the delays and switching at stations, the committee decided that the use of the injector effected a saving of coal of 6.21 per cent., making no allowance for the small excess of load hauled by the engine while using the pump. The committee tested the capacity of the injector practically by a hard fast run on the road, and also while the engine was standing still in the roundhouse. During the run the injector put 21.38 gallons of water into the boiler per minute, with 114 pounds steam pressure. The supply of water was ample for the hardest work the engine could do. The standing test was made with 110 pounds boiler pressure, and the injector forced 18.19 gallons per minute into the boiler. It was found that the injection could be graduated to about half the maximum feed.

The committee considered other phases of the use of injectors which do not need to be mentioned here. Its final conclusions were that injectors were as reliable as pumps for feeding locomotive boilers with the tank water at normal temperature, and that a saving in fuel was effected by using the injector, the boiler pressure was kept steadier and the boiler itself was subjected to fewer changes in temperature. This report formed the basis of the movement toward the general adoption of the injector for feeding water to locomotive boilers. Within the following 10 years pumps disappeared almost entirely from locomotives, and now they are a rarity. It is now generally recognized that the findings of this committee report, rendered 18 years ago, were in the main correct, and that injectors are reliable boiler feeders, that they are economical of fuel, and that they are conducive to economy in boiler repairs.

As these two reasons—economy of fuel and economy of boiler repairs—constituted the basis of the injector's success in gaining favor and general adoption, it may be interesting to briefly analyze the reasons for its superiority to the pump in these respects. The reason for the injector reducing boiler repairs as compared with those necessary while using pumps is due to its principle of action. In the injector a jet of steam mingles with a stream of water, and, imparting its velocity and all of its heat (both sensible and latent) to the water, forces it into the boiler at temperatures ranging approximately between 200 and 300 deg. Fahr., or only about 100 deg. below the normal working temperature of the boiler and its contents of steam and water. In using pumps, the feed-water was forced into the boiler at the ordinary temperatures of water that stands in ponds and wells, ranging from 40 deg. in winter to perhaps 80 deg. in summer—about 300 deg. colder than the working temperature of the boiler. Naturally, this difference in the temperature of the feed-water entering the boilers by the two means employed caused considerable difference in the severity of service to which the boilers were subjected. They were subjected to less variation of temperature by the hot feed-water from injectors than by the cold feed-water from pumps. There being less variation of temperature, there was necessarily less of the movements known as expansion and contraction of the parts of the boilers, and this prolonged the life of these parts and reduced the frequency of needed repairs.

The reason for the fuel economy effected by the substitution of injectors for pumps was also due to the facts just stated, although, perhaps, not so evidently. Why should a locomotive make steam more freely and burn less coal when its boiler is fed by an injector than when fed by a pump? The Master Mechanics' committee did not attempt to explain this, nor does the writer know of the explanation ever having been made. Theoretically, the injector is more efficient than the pump. In the injector the steam employed imparts all its energy of motion to the water, and when this is spent it gives up all the heat it possesses to warming the water—a most perfect application of heat to the performance of work. Not a unit is lost except by radiation from exposed surfaces. All the heat not converted into useful work reenters the boiler for further use. The pump was made to work by the motion of the engine, and the portion of the engine's energy absorbed by the work of the pump (though small) was no more economically utilized than the balance of the engine's energy absorbed in hauling the train. Compared with the performance of the injector, this was very wasteful. The friction of the stuffing-box packing on the pump plunger absorbed some power at the expense of fuel. These items detracted from the economy of the pump, but as their influence was necessarily small, it is evident that we must look further for the real or principal reason for the injector saving coal. The pump could not be worked while the engine was standing, and the injector could be. It was found injurious to the boiler to work the pump while the engine was running shut off down hills; therefore while using pumps the practice was to always supply the boiler with a quantity of water equivalent or more than equivalent to what was being used as steam. It is the belief of the writer that the reason of the injector's ability to save coal in locomotive service rests almost entirely on the fact of its frequent use while the engine is standing or running shut off. There is no other evident reason than this and, as mentioned, the simple higher efficiency of the injector compared with the pump.

If these views are correct it is evident that they should be generally understood, and that in service injectors should be operated so as to secure the most economical results that they are capable of effecting. Generally this is not done, and many enginemen who operate injectors do so much as they would a pump, regulating it to supply an equivalent of water to the boiler as used, and suspending injection as much as possible when the engine is not working steam. The practice is wasteful of fuel, and no good results from it. With pumps such practice was necessary for the preservation of the boiler. This may be illustrated as follows: A locomotive running some distance shut off with the pump working would apparently suffer no diminution of steam pressure until the throttle was opened, when the pressure, as shown by the gage, would immediately fall anywhere from 20 to 60 pounds; the amount depending on the quantity of cold water that had been pumped into the boiler while the engine was running shut off. Of course, the change of temperature, accompanying so great a change of pressure, caused damaging consequences to the boiler, which showed themselves in broken staybolts and leaking flues. The cause of the apparent rapid change of pressure was due to the fact that the cold water pumped into the boiler while no steam was being used, and, consequently, when there was practically no circulation in the boiler, sank to the bottom of the boiler, by its gravity, leaving the hot water in contact with the steam at the top. Heat almost invariably travels upward. Under these conditions the cold water could not impart its cold to the hot water above it, or mix with it, except very slowly, and neither could the hot water impart its heat downward to the cold water below, or mix with it except very slowly. This state of affairs allowed a large quantity of water to be pumped into the boiler while the engine was running shut off, without affecting the steam pressure as indicated by the gage, even if the fire was at low heat. But immediately steam was used, either by the cylinders or the blower, circulation was established, the steam resting on the hot water was rapidly used up and the pressure as rapidly fell, so that by the time the hot and cold wator became thoroughly mixed a considerable fall of pressure had taken place. The writer remembers one instance which occurred while he was employed as a fireman, in which the gage pressure fell nearly 80 pounds within five minutes. The blow-off cock had been opened while running down a hill and the boiler had then been filled by up both pumps. The fireman's ignorance prevented him from understanding the situation or taking steps to prevent a fall of pressure. The steam-gage pointer stood immovable at 140 pounds. On the application of the blower the pressure fell to nearly 60 pounds. The engine had to wait awhile before being able to start the short train on a level.

The operation of the injector being entirely different from the pump, no such evil result as this follows its use when the engine is standing or running shut off. The steam used in the injector causes a constant circulation within the boiler, and any fall of temperature of its contents is immediately made manifest by a fall of pressure, shown on the gage. The economical advantage of putting water into a locomotive boiler while the engine is idle or running shut off results from the fact that in this way the necessary rate of combustion is lowered. The fire may be kept hotter while the engine is stopping at stations, and it need not be made so hot when the engine is working hard. This equalization of the rate of combustion is highly conducive to economy of fuel. Injectors should be operated so as to replenish the boiler as much as practicable while the engine is not using steam, and should be adjusted to the finest practicable feed while the engine is working hard.

The widely variable character of a locomotive's work requires that its injectors should be of wide range of capacity

* Read before the October meeting of the New York Railroad Club.

TABLE I.—PERFORMANCE OF INJECTORS IN STARTING.

Injector.	No.	Temp. Feed.	Min. pressure at which injector will Start.	Min. pressure at which injector will Work.	Waste of water in starting. 140 lbs steam Approx.	Time lost in starting after use, as heater 140 lbs. steam. Approx.	Remarks. (Jar has no effect on any of these injectors.)
Lifting.							
A	8	65°	35	26	.15 gal.	1¼ min.	Injector starts promptly and surely. Can be started fine or coarse feed instantly. Restarts if feed is broken.
B	8½	60°	32	31	.1 "	¾ "	Same as A.
C	8	56°	40	35	.3 "	2 "	Starts promptly. It is best to start slowly to catch water.
D	8	57°	25	20	.4 "	1½ "	Starts promptly at max. or min. It is best to start slowly to catch water.
F	8	57°	35	35	.3 "	1½ "	Starts promptly. It is best to start slowly to catch water.
G	8	74°	45	40	.2 "	2 "	Is difficult to start, and is uncertain if not properly adjusted.
Non-lifting							
E	8	59°	30		1.3 "	¾ "	Starts promptly at max. or min. It is best to start slowly to catch water
H	8	67°	30	25	.9 "	¾ "	Starts promptly at max. or min. It is best to start slowly to catch water.
I	8	65°	30	20	1.5 "	1 "	Uncertain except at low pressure, and cold water. Unsuited for locomotive use.

and of possible adjustment. The master mechanics' committee of 1876 declared that injectors should be capable of being adjusted to one-tenth of their maximum feed. No injector was ever made that accomplished this, and the best of those in use at the present time are adjustable to only about half of their maximum feed with the same boiler pressure. This fact deserves recognition in placing injectors on locomotives, and care should be taken to have them of different capacity so as to afford a wider range of possible adjustment of feed to suit the varying requirements of service. This is not the general practice, as it is customary to equip engines with two injectors, one on either side, and both of the same capacity. This is not the best practice, and positively and frequently leads to unnecessary consumption of coal.

The following tables and diagrams give the results of a series of carefully conducted tests of most of the injectors in present use in this country. The tests were made by a disinterested person, and in conducting them the suggestions of the makers were followed carefully, and every effort was made to secure the most satisfactory record possible for each injector. The information is given here simply to put on record some interesting data concerning injector performances, and not to help or hinder the sale of any particular make of injector, and for this reason the names of the different injectors tested are withheld, and they are merely designated alphabetically. The principles of the best kind of an injector for locomotive service may be named, and those who seek the best can make their own selection. The diagrams show that some of the injectors in ordinary use have a wide range of adjustment, while others have a very small range of adjustment, as illustrated by A and D. Fig. 1 shows graphically this quality of the different injectors, and Fig. 2 is a diagram in which the lines showing the maximum and minimum performances of the different injectors with different steam pressures are plotted in juxtaposition for easy comparison. It will be noticed that six lifting injectors were tested and three non-lifting injectors. The table and diagram give full information respecting the comparative performances of each injector, and respecting the same of the two different kinds of injectors. It has been said that "with non-lifting injectors, the feed-water is nearly always delivered at a higher temperature than with the other kind." The results of the tests show that this is not true. The average temperature of delivery of the lifting injectors was found to be 194 degrees, at 140 pounds boiler pressure; and the average temperature of the delivery of the non-lifting injectors at the same pressure was found to be 180.8 degrees—a difference of 13.2 degrees. The tests showed that the maximum range of action and temperature of delivery were attained by the lifting type of injector, while the maximum delivery was attained by a non-lifting injector. The tests show that injectors A, F, C and H have high delivery and range of action, and that injectors B and D attain a high delivery temperature at the expense of range of action and maximum delivery. The non-lifting injectors are shown to have less range of action than the lifting injectors. The non-lifting injectors have high maximum capacity, but cannot be finely graduated. The deficiency in possible graduation is due in some degree to the want of a proper regulating device. Another objectionable feature of non-lifting injectors is their necessary location, which is usually out of sight of the engineer. This leads to loss of water through the overflow, which is not serious. An advantage of non-lifting injectors consists of their being below the water level of the tender, and that their supply of water will surely reach them at a colder temperature than the supply of water reaches lifting injectors. The latter having to be "primed"—having to induce their supply by a small jet of steam—the heat of this is imparted to the supply, and in some injectors this delays proper action, especially when the injector is hot from having been used as a heater or from having its action "broken." It is noticeable, however, that the restarting injectors are of the lifting type. The injectors having a closed overflow when working are objectionable in this respect. The injector may break, and the accident may not be noticed by the operator. This may lead to serious results in two ways—lowered water in the boiler, and heated water in the tender. The forms of injectors that are apt to prove most economical to maintain are those in which the flow of water is most direct. Adjustments of the interior parts of injectors that cause the swiftly moving water to strike against these parts subject them to rapid wear with water that contains grit in any form.

TABLE II.—PERFORMANCE OF INJECTORS WITH VARYING TEMPERATURES OF FEED.

Injector.	No.	Steam, 140 pounds. Delivery, gallons per hour. Max.	Min.	Rate.	Temperature, Fahr. Feed water.	Delivered water. Max.	Min.	Steam, 100 pounds. Delivery, gallons per hour. Max.	Min.	Rate.	Temperature, Fahr. Feed water.	Delivered water. Max.	Min.	Steam, 45 pounds. Delivery, gallons per hour. Max.	Min.	Rate.	Temperature, Fahr. Feed water.	Delivered water. Max.	Mi
Lifting.																			
A	8	1,890	1,116	41	65°	178°	185°	2 256	966	57	63°	133°	161°	1,464	510	70	68°	124°	16
B	8½	1,800	966	46	60°	162°	218°	1,692	828	52	67°	153°	218°	696	698	0	57°	157°	15
C	8	1,944	1,026	47	55°	141°	195°	2,040	918	55	55°	126°	199°	1,698	690	59	59°	138°	15
D	8	1,740	1,105	36	60°	215°	278°	1,728	936	46	58°	174°	247°	1,140	690	40	53°	138°	18
F	8	1,980	1,200	39	56°	182°	200°	2,088	960	54	56°	144°	182°	1,338	624	53	59°	133°	16
G	8	2,328	1,284	47	73°	175°	196°	1,980	930	53	74°	166°	191°	1,134	750	34	74°	172°	16
Non-lifting.																			
E	8	2,046	1,176	43	60°	167°	190°	2,332	936	58	59°	137°	174°	1,314	960	27	59°	124°	13
H	8	1,824	1,482	19	67°	164°	188°	2,050	1,35[illegible]	34	67°	140°	160°	1,470	1,086	26	68°	124°	14
I	8	2,052	1,704	17	67°	178°	198°	2,134	1,500	30	66°	156°	180°	1,638	828	50	61°	125°	16

TABLE III.—PERFORMANCE OF INJECTORS. WITH UNVARYING TEMPERATURE OF FEED.

Injector.	No.	Steam, 140 pounds. Delivery, Gallons per hour. Max.	Min.	Rate.	Temperature of water. Feed.	Delivered. Max.	Min.	Steam, 120 pounds. Delivery, Gallons per hour. Max.	Min.	Rate.	Temperature of water. Feed.	Delivered. Max.	Min.	Steam, 80 pounds. Delivery, Gallons per hour. Max.	Min.	Rate.	Temperature of water. Feed.	Delivered. Max.	Min.	Averages. Delivery in per cent. of 2,200 galls. per hour. Max.	Min.	Rate.
Lifting.																						
A	8	1,764	1,158	34	80°	196°	198°	1,956	1,056	46	80°	174°	179°	2,160	912	58	80°	151°	178°	89	47	42
B	8½	1,704	1,068	37	"	190°	237°	1,626	936	42	"	172°	232°	1,704	864	49	"	162°	223°	76	43	33
C	8	1,830	1,332	27	"	175°	205°	1,806	1,146	37	"	163°	205°	1,836	1,116	39	"	154°	197°	83	54	29
D	8	1,614	1,176	27	"	232°	279°	1,644	1,080	34	"	213°	272°	1,584	1,014	36	"	196°	251°	73	50	23
F	8	1,908	1,272	33	"	189°	210°	1,890	1,032	45	"	190°	206°	1,908	1,101	42	"	168°	192°	86	52	34
G	8	1,842	1,686	8	"	198°	198°	2,292	1,356	41	"	171°	197°	1,956	1,056	46	"	171°	197°	92	62	30
Non-Lifting.																						
E	8	1,854	1,266	31	"	191°	200°	2,082	1,128	46	"	169°	203°	2,112	1,020	52	"	162°	188°	92	52	40
H	8	1,854	1,554	16	"	179°	198°	1,854	1,470	21	"	166°	182°	1,998	1,326	34	"	157°	171°	86	66	20
I	8	Won't work						1,818	1,818	0	"	182°	182°	2,106	1,584	25	"	168°	187°	.....	.....	.....

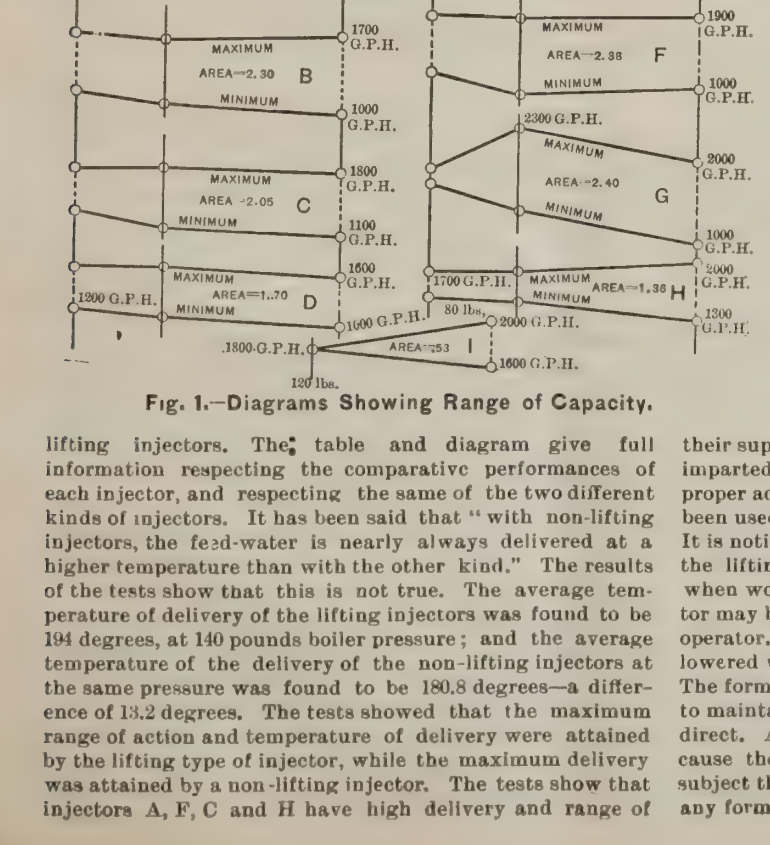


Fig. 1.—Diagrams Showing Range of Capacity.

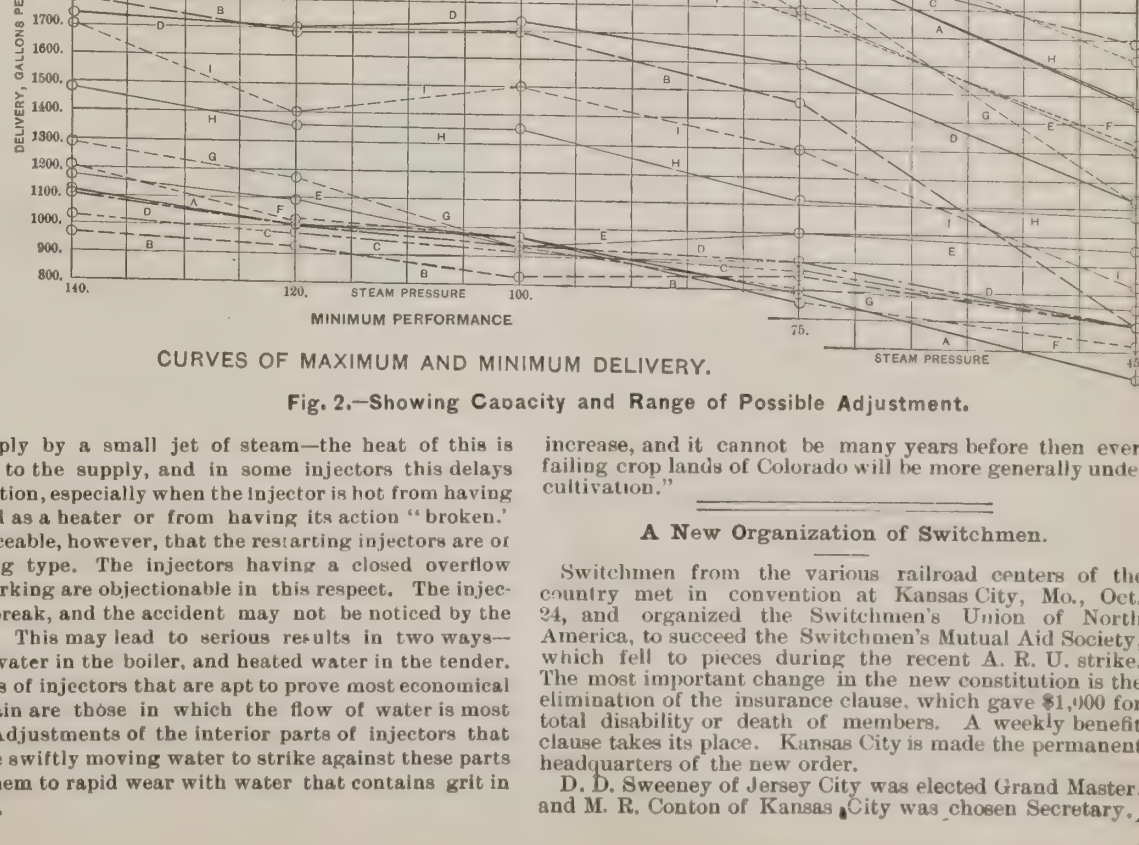


Fig. 2.—Showing Capacity and Range of Possible Adjustment.

To summarize: The best injector for locomotive service i that which has the widest range of capacity, will handle th warmest water, is most easily manipulated, will alway declare its action and is most economical to maintain.

An Echo of the Ann Arbor Strike.

During the Ann Arbor strike in March, 1893, a Lak Shore & Michigan Southern engineer by the name of Ler non violated the injunction restraining various railroad and their employes from refusing to handle Ann Arbo cars. He was ordered to haul a train of cars from Alex Junction to Toledo. He refused to do so until ordered b Chief Arthur, of the Brotherhood of Locomotive Engineer The Ann Arbor officials then caused his arrest an he was fined $50 by Judge Ricks, of the United States Di trict Court. He refused to pay the fine and was taken ou of jail on a writ of habeas corpus, and an appeal was mad to the United States Supreme Court. That body declared i had no jurisdiction, and the case passed to the Unite States Court of Appeals. On Oct. 2 this court hande down a decision in which the action of Judge Ricks wa sustained.

Good Prospects for the Denver & Rio Grande.

At the annual meeting the stockholders of the Denver Rio Grande Railroad held at Denver, Oct. 16, Mr. Georg Coppell, chairman of the board of directors, on presentin the annual report, made a few comments on the financi showing. He said in part:

"Fortunately, the dawn of a better condition of affai in Colorado is quite apparent, as is evidenced by the im provement in the earnings of the property in the last fe months. The coal output shows remarkable developmen The agricultural interests of the State are steadily on th increase, and it cannot be many years before then ever failing crop lands of Colorado will be more generally unde cultivation."

A New Organization of Switchmen.

Switchmen from the various railroad centers of the country met in convention at Kansas City, Mo., Oct 24, and organized the Switchmen's Union of North America, to succeed the Switchmen's Mutual Aid Society which fell to pieces during the recent A. R. U. strike. The most important change in the new constitution is the elimination of the insurance clause, which gave $1,000 for total disability or death of members. A weekly benefit clause takes its place. Kansas City is made the permanent headquarters of the new order.

D. D. Sweeney of Jersey City was elected Grand Master and M. R. Conton of Kansas City was chosen Secretary.

Piston Travel on Cars.*

BY F. B. FARMER.

The possible extremes of piston travel are 3½ inches and 2 inches; that of 3½ inches being only sufficient to insure the brake from releasing through the leakage groove, and 12 inches permitting the piston to bottom on the cylinder head. It is, however, unnecessary to say that neither of these is desirable. The question is, therefore, what *is* the most desirable travel, what increase should be permitted before readjustment, and should the same limits apply to both passenger and freight cars?

We will first consider in a general way the relative merits of a long or short travel. With a short travel the quickest application and the highest cylinder pressure can be obtained, and the least air is consumed to produce a given retarding power or cylinder pressure; the reason being, as is well known, because of the lesser space to be filled in the cylinder. The quicker application, or development of cylinder pressure, coupled with the pressure being higher, means an increased safety in shorter possible stops. In the ability to more quickly recharge after an application, owing to the lesser reduction in auxiliary pressure to produce a given cylinder pressure, and also in the higher reserve of power, lays additional safety; and in the smaller consumption of air to perform a certain amount of work rests the possibilities for a greater saving than might at first seem possible. Tests conducted by a railroad company showed that the consumption of steam by the air pump on a passenger engine running 172 miles per day on a level road, and making 17 stops, would, in a month, be equivalent to four tons of good coal.

While not vouching for the accuracy of these results, it is to be supposed that they are not far wrong; and they indicate the possibilities of a considerable saving, not only in fuel, but in wear to the compressor, coupled with an increase in its efficiency, where on any train, and especially those in local, suburban or mountain service, the piston travel can be reduced. To illustrate this, suppose the piston travel on the train mentioned to have been near nine inches. A 10 pound reduction from the train-pipe pressure would have given a cylinder pressure of about 18 pounds; where, if instead the piston travel had been six inches, a reduction of five pounds would have given almost the same pressure. Here, then, with a reduction in travel of three inches, nearly one-half less air is consumed to produce the same result.

The objection that some might urge against a short travel—that of there being a greater possibility of causing severe jerks in applying, or that brakes would be more likely to trip and slide the wheels—seems to be a weak one that tends to put a premium on careless work by engineers. Should it ever be demonstrated that as short a travel as was otherwise practicable would develop too high a braking power, it would certainly be better to reduce the pipe pressure or leverage rather than increase the travel and thereby the consumption of air.

Another advantage of the short travel is a quicker release; this being desirable to the extent possible with a short travel over a long one. The decrease in efficiency resulting from the longer travel is not only because of the increased space to be filled, but it actually requires a slightly higher cylinder pressure to perform an equivalent amount of work; the reason for this being because of the loss of developed cylinder pressure through the increased resistance of the cylinder release spring. Though this loss is a small one, it is yet believed worthy of mention. It is true that with a long travel less care need be exercised in applying, in order that brakes may not be set too hard, but the increased sensitiveness of a moderately short travel is not such as would militate against its successful use, were the engineer only a mediocre one; and the greater reserve in power wherever brakes had to be released and soon reapplied would more than compensate for the difference.

As it is the general rule to brake passenger cars at 90 per cent. and freight cars at 70 per cent. of their light weight (a difference of 20 per cent.), and as decreasing the piston travel on a freight car to 4 inches would only increase the developed cylinder pressure in quick action about 10 per cent. over that used in calculating the leverage, it is recommended that the minimum travel for this class of service should be 4 inches. With the passenger car braking at 90 per cent. this would not be advisable as the percentage of braking force would be too great, and also, on account of the difficulty that would often be encountered in reducing it to this amount. With a 6-inch travel, however, the increase would not be considerable, nor should it be difficult to regulate it to this amount. Were this impossible on any cars it would be due to weak brake rigging, lost motion due to live levers striking truck frame, lost motion in boxes or pedestals or too small a cylinder for weight of car. (Cars whose light weight exceeds 75,000 pounds should have 14-inch brake cylinders.)

The statement has been made by several airbrake men that many cars under their charge could not be made to travel less than 8 inches without the brakeshoes dragging on the wheels in release. This is mentioned to show that the trouble is not an imaginary one. On one trans-continental line the increase in piston travel between east and west terminals is said to be about 1¾ inches, and this with a good sized cast-iron shoe. It has also been ascertained that on cars in what may be considered good condition, equipped with well-trussed wooden brakebeam and M. C. B. standard levers, rods and pins, the increase in piston travel when running, over the same when standing, was 1½ inches. It follows, then, that such cars, if adjusted at 8 inches would in service travel 9½ inches at the start, and where the length of run and other conditions are such as on the trans-continental road referred to, it follows that without readjustment en route the travel of piston near completion of run would be over 11 inches. The additional amount of air used to hold this train is of lesser importance than the loss in safety through decreased ability to stop quickly in case of necessity, or to hold the train on a descending grade.

* Read before the Northwest Railway Club, Oct. 9.

Let us suppose that in a lawsuit growing out of an accident from a moving train, it developed that the brakes were in such a condition as just referred to. What answer could the defense make to show that the railroad company had not been negligent? If it were only known in how many accidents the brakes for the reason just given (not to mention others) had not stopped the train in the distance they should have, the need for improvement in this direction would be very apparent.

Referring again to the difference in travel running over standing, and which is believed to be due principally to the increased deflection of brakebeams and greater absorption of lost motion in boxes and pedestals and the less loss of developed cylinder pressure through friction, the question is suggested, "Would it not be well to, in as much as possible, compensate for this in the yard test by employing more than standard pressure?"

Because of reasons given, and that eight inches is the travel at which the pressure is developed on which we base all calculations in equipping cars, it would certainly seem right that we should not exceed that amount for either freight or passenger. It should not be understood that these limits are offered in the belief that they cannot be improved upon, for there are objections to even as much variation as these would permit of.

The principal difficulty encountered in making good stops with long airbrake trains is that of preventing severe shocks, due to unequal reduction in speed at different parts of the train, and resulting from, among other causes, the unequal distribution of load and retarding power. It is difficult to conceive of any system whereby the load can in all cases be equally distributed throughout the train, but as the variation in piston travel is one of the principal causes of unequal distribution of retarding power, it becomes apparent that here is one of the points we must look to for a lessening of the possibilities of shocks. Do not, however infer it is meant that, even with a considerable variation in travel, shocks are unavoidable; for if the braking power be gradually applied the train will by degrees assume a condition as regards bunching or stretching, in accordance with the distribution of load and braking force throughout its length, and this without any shocks taking place; but in careless handling, or where, on account of danger, a sudden application becomes necessary, the decrease in shock resulting from a more uniform travel would be more apparent. Then, too, we all recognize the fact that the less the amount of braking power applied, in the same ratio is decreased the tendency of wheels to slide.

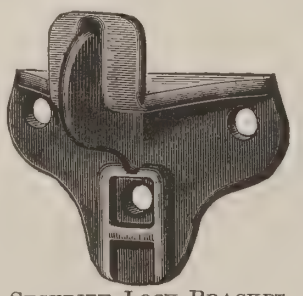
To illustrate this point: Suppose two engines to be pulling a train. If through lack of steam, or intention on the part of the engineer, one engine should do less than its share of the work, thereby compelling the other to be worked harder, would it not increase the tendency of the second engine mentioned to slip? Just so with car brakes; for where by any reasons, among which is the variation of piston travel, one brake does less than its share of the work, an equally greater amount is imposed on the others, with the consequent increased possibility of wheels being slid.

It seems altogether probable that the time is rapidly approaching when the travel of pistons will be automatically regulated—at least on passenger cars; for though this is as well to be desired for freight service, yet on account of the greater percentage generally braked at, the necessarily heavier applications because of faster time and the more previous character of its burden, the passenger train should be the first equipped with such a device.

For the reasons given in the foregoing, I would recommend that a travel of from four inches to eight inches be employed for freight cars, and from six inches to eight inches for passenger cars. This would imply that in all readjusting they be reduced to the lower limit of travel mentioned for each respectively, or as near this amount as possible, and again readjusted before the further limit was exceeded. If for any reason it is impossible to approach closely to the lower limit, the cause for this should be ascertained and remedied.

Security Lock Bracket.

The cut shown herewith illustrates a lock bracket for freight car doors manufactured by the Chicago Grain Door Company, of Chicago, Ill. It is simple in construction and application, and renders doors, when properly sealed, thief-proof. At the base of the bracket is an indentation that fits the head of the lag screw used. This is used as a wrench to force the lag screw to place, and when this is accomplished the screw head is countersunk and cannot be grasped by a wrench. The door being closed and sealed renders the removal of the bracket impossible, and the bracket renders the prying openof the bottom of the door imposible. In this way it makes a door thiefproof.



SECURITY LOCK BRACKET FOR FREIGHT CAR DOORS.

The Bickford Drill and Tool Company, of Cincinnati, O., reports a great improvement in its business. Among other orders it has received is one from England for a No. 3 radial drill (the largest size made). This is the second order within six months from the same parties.

We quote below verbatim the award granted the Cleveland Twist Drill Company, of Cleveland, O., for its exhibit at the Columbian Exposition: "Most extensive exhibit and greatest variety of well made twist drills, exhibited as they are manufactured and furnished to the trade. The workmanship on all of these drills is of the highest order, and especially meritorious are the twist drils in millimeter diameters."

Magnolia Metal's Important Connections.

The Magnolia Metal Company has just received an order from Messrs. J. I. Thorneycroft & Co., Admiralty machinery contractors, of Chiswick, to be used in the torpedo destroyers they are building for the British Navy. The following is a list of vessels in the British Navy in the bearings of which the Magnolia metal is used:

Fervent,	*Hood,*	*Boxer,*
Ardent,	*Hawke,*	*Bruiser,*
Zepher,	*Crescent,*	*Edgar.*

Testimonials given by some of the most eminent marine institutions of this country, which are builders of the war vessels of the United States Government, and for steamers of private corporations, show that the Magnolia metal is used in the highest class of marine work, and is more meritorious and successful than any other anti-friction metal for that kind of work.

The Pope Light.

In order to meet the demand for the Pope light, which is interchangeable with the "Pintsch," now in wide use, the Consolidated Car Heating Company has added considerably to its plant and is about to manufacture lamps for compressed oil gas and fittings on a large scale. The compressed gas plant of the latest pattern recently erected shows most excellent results, 17,600 cubic feet of gas of 50 candle-power having been obtained from 160 gallons of oil; that is, 110 feet per gallon, whereas the usual make is somewhat under 90 feet. The Consolidated company is preparing to notify railway men from all over the country to witness an exhibit of Pope lighting apparatus at Albany, carrying out a similar plan to that it adopted in 1892 with reference to steam-heating apparatus, when special trains were run hourly to Troy and return during two days, and many prominent railway officials from all parts of the country and Canada were present to observe the operation of the Sewall coupler and commingler storage systems.

The Chicago Grain Door Company has just equipped 500 cars for the Great Northern with its well-known grain door; also a number of cars for the Illinois Central.

The Boston Belting Company has just issued a handsomely illustrated catalogue of its specialties in fire hose and accessories. The list comprises every form of hose in general use and devices for their convenient manipulation.

The A. B. Pullman Company, of Chicago, manufacturer of the well-known Pullman freight-car door, has moved its offices to 945 Old Colony Building, Chicago. This company is now equipping 500 cars for the Baltimore & Ohio Southwestern Railway with its car door.

The immense shops of the Westinghouse Electrical Manufacturing Company, at Brinton, Pa., near Pittsburg, are now completed and the company is prepared to do all its manufacturing work at that plant where the facilities for rapid and economical manufacture are in every way adequate.

Messrs. Beaman & Smith, of Providence, R. I., designers and makers of machinery and tools, have issued a new catalogue of the machines they manufacture. They were given an award at the Columbian Exposition for "Combining novelty in design, originality in construction, convenience of operation and first-class workmanship."

The receivers of the South Baltimore Car Works have been directed by the court to pay to the creditors a dividend of 25 per cent. and interest. The dividend amounts to $66,000 and is the third paid so far, making a total of 75 per cent. received by the creditors. It is the expectation of the receivers to pay a final dividend of 25 per cent. in December.

The Cleveland Twist Drill Company has been granted a gold medal at the Antwerp Exposition for the excellent quality of goods comprising its exhibit at that fair. A letter recently received from this company said: "It seems to us that business is steadily improving. We are running our full complement of men 10 hours per day, and have been doing so for some time."

The Boston Belting Company, of 256-60 Devonshire street, Boston, Mass., makes a specialty of "Imperial" spiral rubber packing for stuffing boxes, which is excellently adapted for pistons and valve stems. It is made in the form of a continuous ring and is shaped to the rod and box, thus rendering unnecessary the trouble of bending to fit its place. Each piece is coiled in a box made especially for it.

The Brown & Sharpe Mfg. Co., of Providence, R. I., has issued a very neat and nicely illustrated pamphlet, showing a number of forms of stock cutters made by it. This company now makes 19 varieties and 349 sizes of stock cutters, and it can make any size or shape, or arrange for any combination of cutters that may be desired. A copy of this pamphlet will be sent to any one interested in the subject, on application to the manufacturers.

The new Norwich Line steamer *City of Lowell*, engaged in the Long Island Sound service, has again demonstrated her right to the title of "Greyhound of the Sound." On Wednesday last she easily broke all records on the run between New York and New London, covering the 122 miles in the remarkable time of 5 hours 32 minutes. The fastest time was between Cornfield and Bartlett, the speed being 23.4 miles. Bartlett's Reef was reached at 10:47, and the *City of Lowell* reached her dock at 11:05. The quickest trip ever made to New London before was made by the Norwich Line steamer *City of Boston* in 1861; her time was 6 hours 5 minutes. Seven hours is the usual time.

The Tower Coupler.

The illustrations on this page show the Master Car Builders' type of coupler now being manufactured and put on the market by the National Malleable Castings Company, of Chicago. It is known as the "Tower" coupler, and is of the knuckle-opening class. In operating the knuckle from the corner of the car no additional parts are required, either in the unlocking gear or the coupler itself. It has been very carefully designed and the metal properly distributed to meet the strains encountered in service. The merits of the coupler may be concisely stated to consist in its simplicity and great strength, combined with a meritorious knuckle-opening device which does not add any parts to the coupler and which cannot get out of order.

The body of the coupler is made of malleable iron, and the knuckle, lock and pivot pin are made of steel. The shank is square for its entire length and the liner bocks are cast on. The walls of the shank are thick and well ribbed, but sufficient room is left for the use of a tail bolt if desired, and a slot for the American continuous draft rigging can be added. The knuckle is fulcrumed back far enough to give great strength to both it and the head,and yet smooth action is obtained even on the sharpest curves. The face of the tail on the knuckle is so shaped as to come in contact with the outer face of an opposing knuckle when in the act of coupling, so that it is swung into the closed position through that contact. This is conducive to smooth action in coupling, which is further promoted by the fact that the lock does not have to be raised as the knuckle swings in. Fig. 2 of our illustration shows that the buffing strains received by the knuckle are transmitted to the head by means of a broad flat bearing at the end of the tail of the knuckle. A tendency for the knuckle to rotate inwardly under these blows is also resisted at the same point and by a bearing against the vertical wall of the head at a point considerably nearer the fulcrum pin. Because of its shape and size the knuckle is amply strong to receive and transmit without damage any strains encountered in service.

The conspicuous part of the coupler is the lock, which also serves to throw the knuckle open. Its shape will be readily understood from Figs. 1 and 6 in the illustrations. In Fig. 1 the full lines show the lock in the normal position, and it will be seen that when receiving the pulling strains, the lock is firmly supported by a vertical wall on the guard-arm side of the head, so that it is subjected to no strain other than one of compression. To uncouple, the lock is raised until it strikes the under side of the top wall of the head, being guided vertically in this movement by the bearing of its stem in the bottom wall of the head. If it is desired to simply unlock the knuckle, the lock is held in this position by the unlocking gear in the usual manner. If, however, it is desired to swing the knuckle open, the lever of the unlocking gear is lifted still higher, and the lock, pivoting on

KNUCKLE OF THE "TOWER" COUPLER.

a ridge on the top wall of the coupler head, is rotated about that point as shown in Fig. 1. The stem of the lock disengages from the hole in the lower wall of the head, and slides along a groove provided for it. This motion of the lock swings the knuckle open in a way that is shown clearly in Fig. 1. The lock remains in the position shown by the dotted lines after the operator has dropped the unlocking lever, and only falls into its normal position when the knuckle closes.

The operation of the lock cannot be interfered with by ice, dirt or cinders. It is provided with ample bearing surface on the knuckle, the area of contact being 4½ square inches. This also prevents the binding and failure to couple to which certain couplers are liable. It cannot be struck by coupler links, as they cannot enter the head far enough owing to the size of the tail of the knuckle.

All parts of the coupler are carefully inspected and made to conform accurately to standard contour lines. It has been repeatedly tested under the drop, and for a considerable period in service, and has fulfilled all requirements.

The Niles Tool Works, of Hamilton, O., have been awarded a contract for $49,000 worth of machinery, to be placed in the West Springfield shops of the Boston & Albany Railroad.

Mr. F. G. Kretschmer has established an office at Room 503, 136 Liberty street, New York City, as the agent of the Brown & Sharpe Manufacturing Company, of Providence, R. I.

The Hinckley brake slack adjuster, made by the Hinckley Brake Company, of Trenton, N. J., has been ordered for 100 box cars for the Delaware & Hudson Canal Company, now being built by the Jackson & Woodin Manufacturing Company.

The Consolidated Car Heating Company, Albany, N. Y., has just received orders for the entire equipment of the Norfolk & Western Railway with its Commingler Storage System and Sewall Steam Coupler. It has also received orders for the entire equipment of the Ulster & Delaware Railroad with its Direct Steam System No. 2 and the Sewall Steam Coupler. The orders include the fitting of all locomotives on both these roads with this company's improved locomotive equipment.

Parlor cars on street railways are what we are coming to now. The West End Street Railway Company of Boston has just constructed two elegantly appointed special cars which are to be placed at the disposal of private parties. They are 20 feet long by 7 feet 4 inches in width, and were made by J. M. Jones' Sons of West Troy, N. Y. They are equipped at each end with sliding doors similar to those used in the elevated railway cars. When one of each pair of doors is open, the other door is opened also. The bodies are mounted on West End trucks, which were constructed by the Laconia Car Company, of Laconia, N. H.

Fig. 1

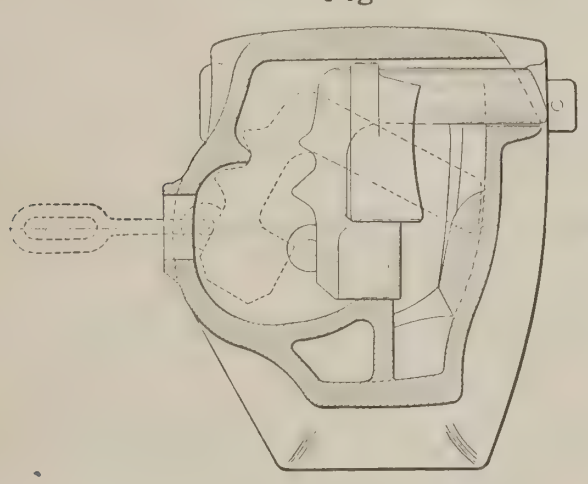


Fig. 2

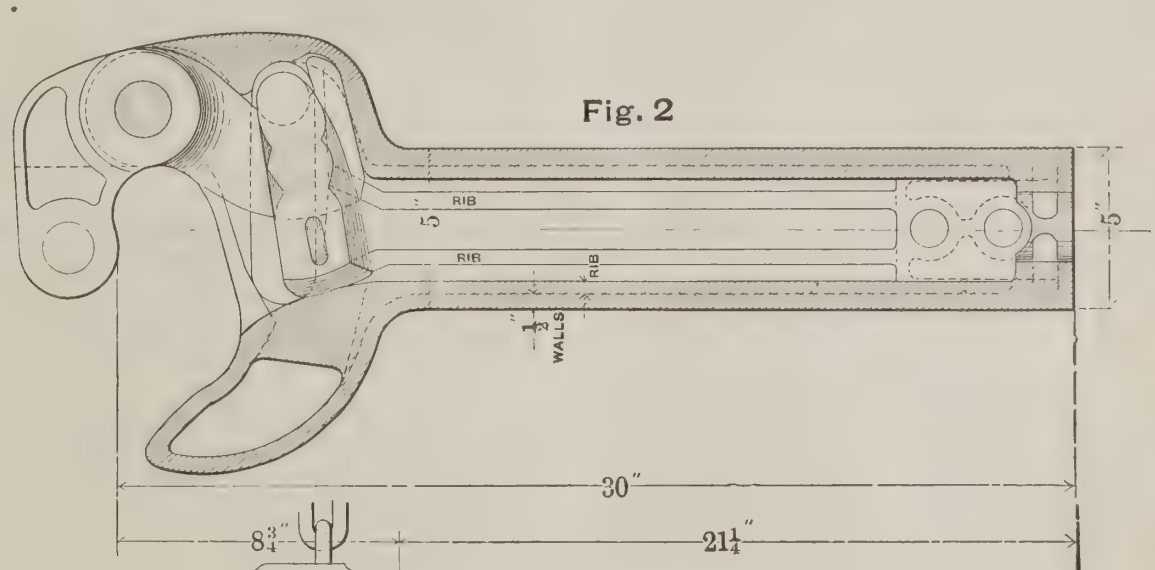


Fig. 3

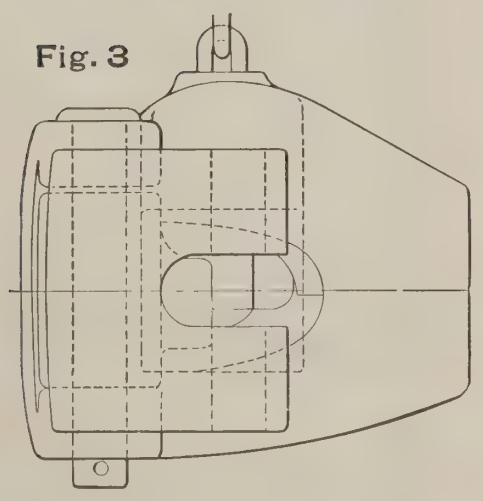


Fig. 4

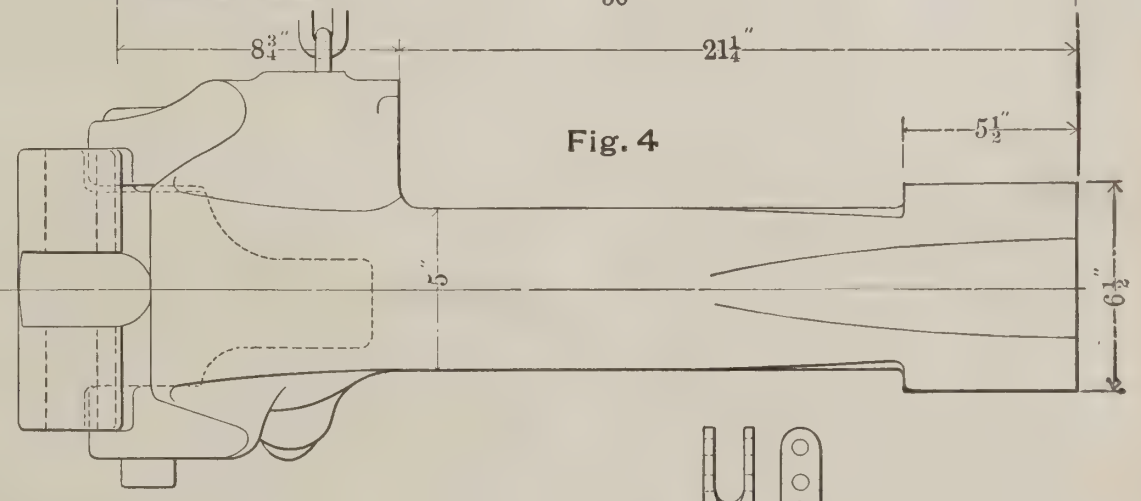


Fig. 5

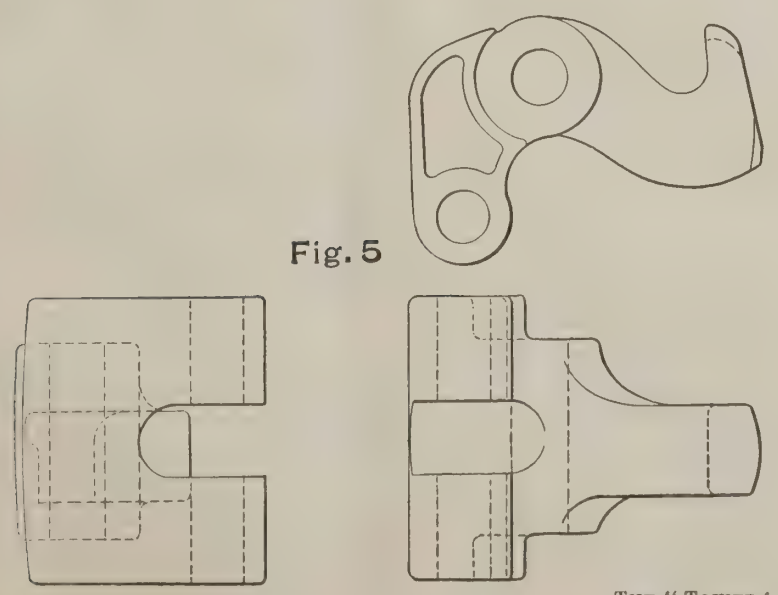
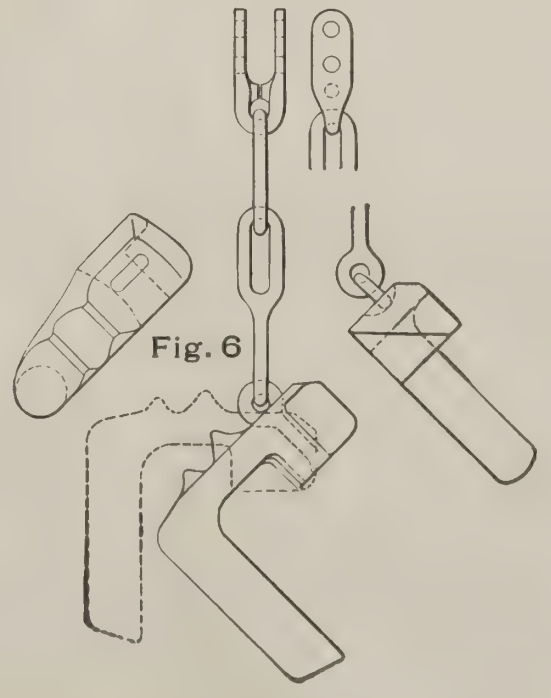


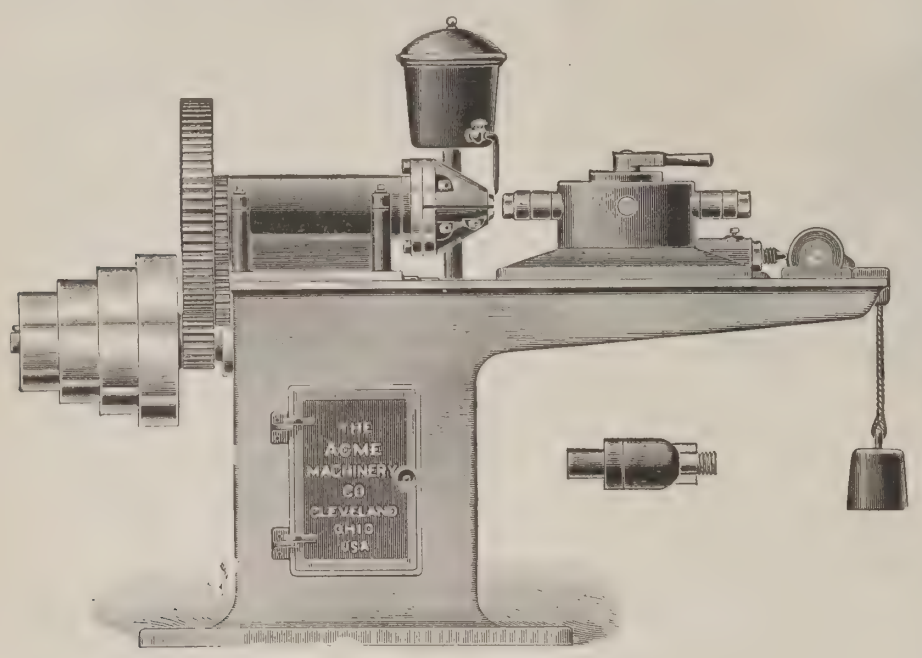
Fig. 6



THE "TOWER" COUPLER.

A Turret Nut Facing Machine.

The machine illustrated herewith has many new and valuable improvements over those made heretofore for chamfering and facing nuts and bolts. The cutting head is arranged to hold three tools made of bar steel, one for facing, one for chamfering the corners, and a third to remove the first thread in the nut. They can be removed, ground and replaced in a few minutes.



ACME TURRET NUT FACING MACHINE.

The spindle to which the cutter head is attached is driven by a four-step cone pulley and geared 4½ to 1, thus having sufficient power to face the large nuts with ease, and the additional advantage of facing the smaller sizes at the proper speed.

On the carriage is mounted a turret with a broad key to keep it in line, and a lever-nut to clap it in position as shown. The carriage is moved forward to the cutting head by means of a cam journaled on the ways of the bed. The cam is driven by a worm and a worm wheel, thus giving the carriage a steady forward movement, and the weight hanging from the front end of the bed returns the same after the nut has been faced.

The advantage of a turret to hold the nut arbors is that the nuts can be removed and replaced much quicker and with less exertion than are possible on a machine where the arbors revolve and the cutting head remains stationary.

This machine is made by the Acme Machinery Company, of Cleveland, O., the well known manufacturers of machine tools.

Graham's Standard Passenger Car Truck.

The passenger car truck illustrated herewith, which is the invention of J. H. Graham, president of the Graham Equipment Company, of Providence, R. I., has proved itself to be especially adapted to fast heavy passenger traffic. As will be seen in our engraving the truck is notably neat and simple in design. Perhaps the most interesting feature is found in the spring suspension; which dispenses with the equalizers, equalizer springs, and the bolster springs. The longitudinal truck sides are made of 7-inch steel "I" beams, and the transoms, safety pieces and end pieces are also made of extra heavy 6-inch steel "I" beams securely riveted with angles, which lock all corners of the framing. The principle of the suspension is shown in the longitudinal section. The pedestals and the axle boxes are made of malleable iron, which gives lightness and strength. On each side of the axle box and flush with the top are two lugs which are slotted and recessed to receive the spring hanger.

Interposed between the spring seat and the spring cup are spiral springs 4 by 6 by ¾ inch. The springs are seated at the top; the weight of the car body compresses the spring upward. When the wheel comes to a bad joint or a railroad crossing which allows it to drop, the springs expand, and before the car body can drop in with the wheel the inequality in the track has been passed without any hammering and jumping to the car body. This construction produces a truck that will run for years without squaring up, which is so frequently required of many designs of passenger trucks.

All axles are protected by the safety strap or yoke as shown. This is made of wrought iron. The equalizing bars being dispensed with, and the weight being distributed equally on each side of the oil box, the brasses wear evenly. Brasses worn sideways are a rare occurrence on this truck, and a hot-box is unknown.

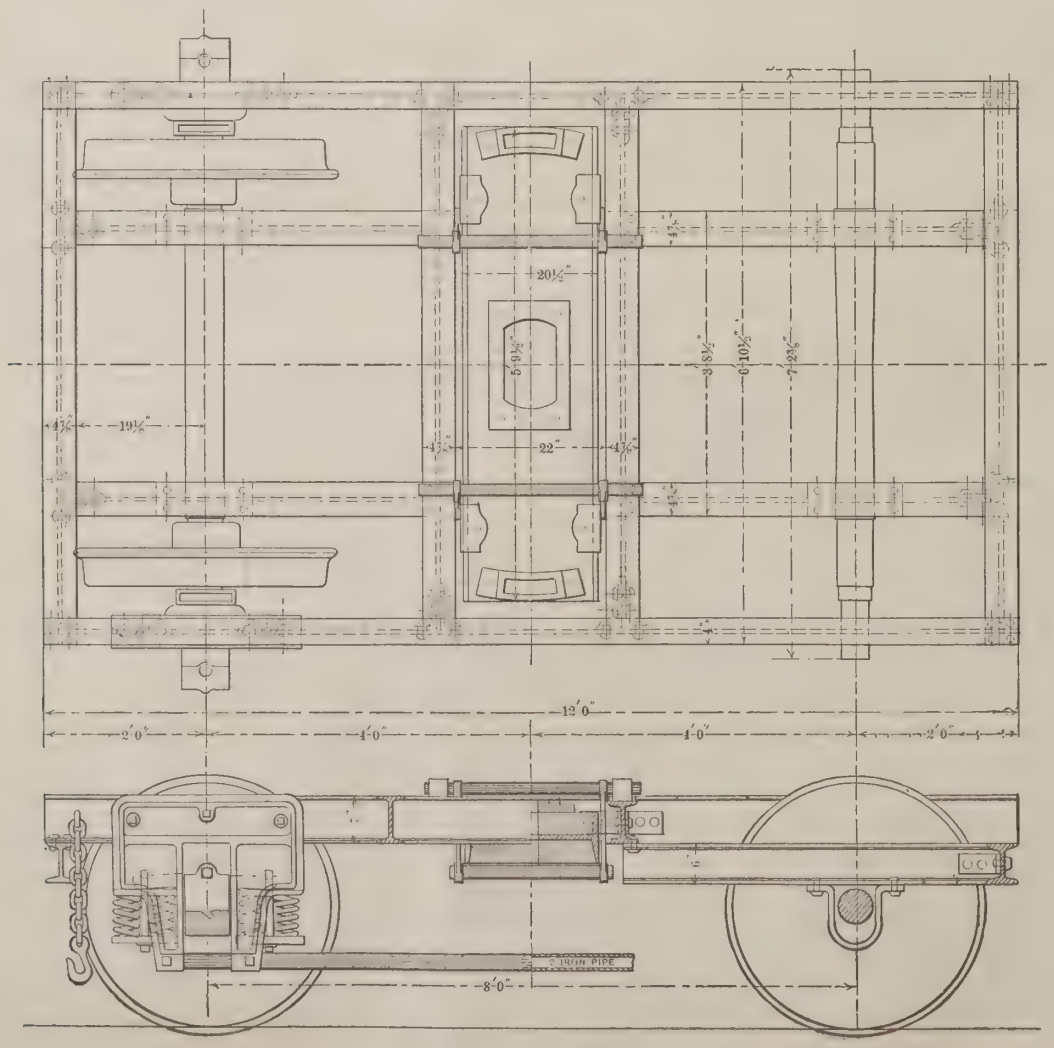
Feminine Voice (from lower berth)—Porter! Porter!
Masculine Voice (from upper berth)—Very sorry, madam; we have nothing but beer.—Truth.

General Manager St. John, of the Chicago, Rock Island & Pacific, recently said that the Rock Island cleared but $200,000 during the World's Fair, and that this did not cover the cost of the additional equipment necessary for World's Fair business.

A fire in a Boulder County, Col., coal mine, which has been burning for thirty years, now covers an area of about 300 acres, and spouts flame, cinders and smoke through numerous outlets. It has destroyed property worth millions of dollars.

Reporter—I have ascertained the exact cause of the accident and described it fully; given the names of all the people killed or injured, and told what disposition was made of them, and given an exact description and estimated value of the property loss to the railroad company. City Editor—That's all very well, as far as it goes, but why in thunder didn't you get the number of the locomotive?

While prospecting for a continuation of the Ropes gold mine vein, in Michigan, a short distance from the main shaft, rock containing bismuth, a mineral entirely new to the Upper Peninsula, was recently discovered. Bismuth has a commercial value of about $2 a pound, and is not mined in the United States at present.



THE GRAHAM CAR TRUCK.

The *Hotel World* publishes the following "rules and regulations" of a hotel on Lake Athabasca, in the far Northwest: "Rules and regulations of this hotel: Board must be paid in advance; with beans $25, without beans $12; salt free; no extras allowed; potatoes for dinner; pocketing at meals strictly forbidden. Gentlemen are expected to wash out of doors and find their own water; no charge for ice; towel bags at the end of house. Extra charge for seats around the stove. Lodgers must find their own straw; beds on the bar-room floor reserved for regular customers. Persons sleeping in the barn are requested not to take off their boots. Lodgers must arrive at 5 a. m.; in the barn 6 a. m. No fighting at the table. Any one violating the above rules will be shot."

Our Directory

OF OFFICIAL CHANGES IN OCTOBER.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Atchison, Topeka & Santa Fe.—The Panhandle Division is abolished, and Superintendent D. H. Rhodes has resigned. Mr. F. J. Easley has retired from the position of Superintendent of the Rio Grande Division at San Marcial, N. Mex., and the office has been abolished. The jurisdication of Mr. J. E. Hurley, Superintendent, is extended over the Rio Grande Division, with headquarters at Las Vegas, N. Mex.

Atlanta & Florida.—E. C. Spaulding is appointed Receiver.

Atlanta & West Point.—Joseph Herrin is appointed Superintendent.

Baltimore & Eastern Shore.—Name changed to Baltimore, Chesapeake & Atlantic; John E. Searles, President; office, Baltimore, Md.

Bangor & Aroostook.—Orlando Stewart is appointed Superintendent of Motive Power. Office, Oldtown, Me.

Buffalo, Rochester & Pittsburg.—The office of General Superintendent R. G. Matthews is removed from Buffalo to Rochester, N. Y.

Chesapeake, Ohio & Southwestern.—F. D. Thomson is appointed General Superintendent. Office, Louisville, Ky.

Chicago & Eastern Illinois.—Superintendent F. L. Corwin has resigned.

Choctaw Coal & Railway Company.—Reorganized, and name changed to Choctaw, Oklahoma & Gulf Railway.

Cincinnnti, Jackson & Mackinaw.—Geo. L. Bradbury is chosen Vice-Bresident in charge of operation. Mr. Bradbury is General Manager of the Lake Erie & Western. Office, Indianapolis, Ind.

Florida Central & Peninsular.—J. J. Bossinger is appointed Master Car Builder. Office, Fernandina, Fla.

Great Northern.—T. F. Corwin is appointed Superintendent of the Cascade Division, with headquarters at Spokane, Wash.

Interoceanic (of Mexico).—E. W. Jackson is appointed General Manager.

Kansas City, Fort Scott & Memphis.—H. W. Diggins, Superintendent of the Springfield Division, has resigned.

Kentucky Midland.—George B. Harper is appointed Receiver.

Lake Erie & Western.—S. R. Kramer has been appointed Superintendent of the Peoria Division, with office at Lafayette, Ind., to succeed O. E. Grady.

Minnesota & Wisconsin.—H. E. Burt is appointed General Superintendent, vice Jas. Menogue. Office, Spring Valley, Wis.

New York, New Haven & Hartford.—The jurisdiction of John Henney, Jr., is extended over the entire system.

New Orleans & Southern.—L. R. Brooks is appointed Superintendent of Motive Power, vice Thos. Crow, resigned. Office, New Orleans, La.

Pennsylvania.—Chas. Potts and Robert Redding are appointed Division Master Mechanics at Erie and Sunbury, Pa., respectively. Superintendent Western Pennsylvania Division James Reed has resigned, and is succeeded by D. M. Watt, of the Monongahela Division. D. H. Lovell, of the Columbia & Clearfield Division, succeeds Mr. Watt, and is in turn succeeded by F. F. Robb, of the Bedford Division. Victor Wierman is appointed Superintendent of the Bedford Division.

Philadelphia, Reading & New England.—J. N. King has been appointed Superintendent, to succeed G. T. Royer, resigned.

Saginaw, Tuscola & Huron.—Sanford Keeler is apponted General Manager.

Seaboard Air Line.—Office of Division Superintendents abolished. T. W. Whisnant is appointed Superintendent of Roadway. S. G. Dickerson is appointed Superintendent of Transportation. James Maglenn is appointed Superintendent of Motive Power, with office at Raleigh, N. C.

Seattle, Lake Shore & Eastern.—Daniel O'Leary is appointed Master Mechanic, vice George Gabriel.

South Carolina & Georgia.—Edmund S. Bowen is appointed General Manager. Office Charleston, S. C. Jas. F. Blackwood is appointed Acting Superintendent of Motive Power, vice E. M. Boberts resigned. Office, Charleston, S. C.

Southern Pacific.—Robt. H. Pratt, Assistant General Superintendent of the Pacific system, has resigned. J. D. Begg is appointed Division Master Mechanic at Houston, Tex. Mr. William H. Haydock, Superintendent of the Coast Division, has resigned. J. L. Frazier, Superintendent of the San Joaquin division, has been transferred to the Coast division, and the former division is abolished. J. H. Whited, Superintendent of the Truckee division, has also resigned, and he and Mr. Haydock have been assigned to other duties.

Southern Railway.—The following have been appointed Division Superintendents: J. S. B. Thompson, Danville, Va.; W. B. Ryder, Charlotte, N. C.; E. Berkeley, Columbia, S. C.; F. K. Huger, Knoxville, Tenn.; W. R. Beauprie, Atlanta, Ga.; (acting) J. N. Ross, Birmingham, Ala.; Geo. R. Loyal, Louisville, Ky. For appointments of Division Master Mechanics and Foremen, see personal column, page 172.

Union Pacific.—J. P. Bay is appointed Division Master Mechanic at Denver, Col.

Employment.

SITUATION WANTED.—Experienced brass molder on locomotive, steam, hydraulic, bronze and mill work; good mixer of metal. JOHN E. STANTON, 7212 Finance street, E. E., Pittsburgh, Pa.

Wanted.

WANTED—By a large manufacturer, some new specialty to manufacture for the railroad trade. Address "ADVERTISER," care of the NATIONAL CAR AND LOCOMOTIVE BUILDER.

NATIONAL CAR AND LOCOMOTIVE BUILDER

DECEMBER, 1894.

CONTENTS.

The Mexican Central has ordered 225 box cars of the Mount Vernon Car Manufacturing Company.

The shops of the new Ottawa, Arnprior & Parry Sound Railroad are to be located at Ottawa, Ontario.

Two train robbers pleaded guilty to the charge of murder in the first degree at Waukegan, Ill., on Nov. 14.

The employees in the car shops of the Philadelphia & Reading, at Reading, Pa., now work on the piecework plan.

The Chicago & Northwestern is substituting 36-inch cast iron wheels on its suburban passenger cars, in place of steel-tired wheels.

The Baltimore & Ohio has begun the erection of general repair shops at Zanesville, O. A force of 200 men has been put to work on the job.

It is announced that the shops of the Chesapeake, Ohio & Southwestern, now located at Paducah, Ky., are to be removed to Louisville, Ky.

The Baltimore & Ohio is building new car shops in Zanesville, O. The new plant will be used for general repair work, and will employ about 200 men.

Stronger springs are being adopted for Russian freight cars. By this means it is found possible to increase the capacity of the cars from 21,000 to 27,000 pounds.

It is announced that the Russian commission in charge of the Siberian Railroad has approved appropriations amounting to $10,000,000 for the purchase of rolling stock.

The New York, New Haven & Hartford has ordered 100 box cars of the Keith Manufacturing Company. An order for 100 gondola cars is about to be placed by the same road.

The new shop of the St. Louis Southwestern Railway at Pine Bluff, Ark., is building a number of new freight cars, and is at present turning them out at the rate of 20 per month.

After a careful canvass of the unemployed in Denver a committee has reported that 215 families of American Railway Union men are on the verge of starvation and 400 unmarried men are destitute.

Mr. L. Severson, of Washago, Mich., was blown from a passenger train on the Chicago & Eastern Illinois Railroad while passing from one coach to another near Chicago Heights, Nov. 5, and instantly killed.

The Toledo, Ann Arbor & North Michigan road is going to build 600 new freight cars during the winter. It is pushing the equipment of its old cars with M. C. B. couplers at the rate of about 50 cars a month.

A Missouri, Kansas & Texas express train was stopped and robbed at Wybank, I. T., Nov. 14. The notorious Cook gang of outlaws committed the act. Failing to gain entrance to the express car they robbed the passengers.

Some time ago the Cleveland, Cincinnati, Chicago & St. Louis Company made a proposition to build new shops at Indianapolis. There is now a fair chance of the schene being carried out next spring. The plans are fully completed.

About 200 feet of the track and roadbed of the New York, New Haven & Hartford Railroad was swept away by the bursting of a reservoir at Ansonia, Conn., Nov. 3. The escaped water flooded the surrounding country and did much damage.

A judge at Louisville, Ky., has rendered a decision in which it is held that Pullman's Palace Car Company, not being a common carrier, is not therefore responsible for any injuries that might be sustained in a wreck by passengers on its cars.

It is stated that the Intercolonial Railroad Company intends to renew all its locomotives and to replace them by new engines for which Parliament will probably be asked to make an appropriation next season. The Canadian government controls this line.

The Philadelphia & Reading Railroad Company has prepared plans for two large new buildings adjoining its present shops at Reading, Pa. A machine shop 200 feet long will be built, and the second structure, 282 feet long, will be used as a car paint shop.

The general freight agent of the Pennsylvania Railroad system west of Pittsburgh states that the freight traffic on his lines is steadily increasing, and the demand for empty cars is becoming so urgent that there are hardly any available on the system at present.

The Galesburg, Etherley & Eastern was opened for regular service on Nov. 1. The road is 12 miles long and starts from Wataga, on the C., B. & Q., and runs east to Etherley, the new mining town growing up at the mines of the Galesburg Coal Company.

The railroads in Indiana, Illinois and Ohio are said to be experiencing great difficulty in filling the demand for freight cars, more especially stock and coal cars. The demand from shippers is referred to as showing an extraordinary increase since the election.

S. D. Worden, one of the strikers charged with murder in connection with the wrecking of the train near Sacramento, July 11, which resulted in the killing of the engineer and four United States soldiers, has been convicted of murder in the first degree and sentenced to hang Feb. 12.

The Pennsylvania Railroad Company has decided to increase the standard weight of rails on its main line from 85 pounds to 100 pounds, and after this year all new rails laid on the 443 miles of double and quadruple track road between Jersey City and Pittsburgh will be of the latter weight.

The Southern Pacific Company announces that "The Mexican International road has made a new departure, running an elegant Pullman sleeping car through San Antonio to the City of Mexico, via Eagle Pass, making the time from New York to the City of Mexico in five days, in connection with the Sunset Route."

The Consolidated road is experiencing such a heavy freight business that a sufficient number of engines cannot be procured to haul trains. For that reason heavy passenger engines have been pressed into the service. Officers of the company say the freight business from New England manufacturing points never was better.

According to a recently issued report there were purchased in the United States last year for use on naval vessels 42,190 tons of coal, at a cost of $178,163. Abroad, 52,146 tons were purchased for our navy at a cost of $462,192. Seventy-one per cent. of this was used for steaming purposes, the balance for auxiliary purposes.

The Pennsylvania Railroad Company has issued orders on the Camden and Amboy Division for all departments to resume work on eight hours' time, six days each week. For the past 13 months the shipyards, machine and car repairing shops only worked five days each week, while the trainmen worked only half time.

The famous Alpine tunnel on the South Park Railroad, which is the connecting link between Gunnison and Denver, will be reopened for travel in the immediate future. The tunnel was built by the Union Pacific several years ago, but, on account of the decline in business, it was practically abandoned and has become filled with ice and snow.

E. V. Debs and eight other directors of the American Railway Union, and sixty other alleged conspirators who took part in the recent strike, were arraigned in the United States Court at Chicago recently. Clarence S. Barrow, counsel for the defendants, made a motion to quash all the indictments. Judge Grosscup named Jan. 8 as the date for the trial.

The annual report of the Railway Commission of Georgia for the year ending June 30, 1894, shows gross earnings of Georgia railroads of $17,208,825, as against $16,632,192 in 1893; expenses, $12,411,322, against $12,776,867; and net earnings, $4,797,503, against $3,855,325 in 1893. The commissioners look forward confidently to a further increase in earnings.

Arrrangements were completed at Indianapolis on Oct. 23 for the formation of the Federated Metal Trades of America, as it is to be designated. The new body will include every branch of the iron, brass and steel industries in America. The purpose of the promoters is to bring into a closer relationship all of the national organizations of employés in this branch of labor.

Mr. R. M. Galbraith, Master Mechanic of the St. Louis & Southwestern Railway, recently succeeded in exhuming a locomotive belonging to his road from the bed of the Red River at Garland City, Ark. The engine had been buried in the sand of the river-bed seven years last August. It is said that the engine is very well preserved and can be put in running order with slight expense.

The Indians about Wenatchee, Wash., have been expressing their disapproval of what they consider a great act of sacrilege on the part of the Great Northern Railroad. The cause of the complaint is that the Great Northern has occasion to blast out some large rocks which were covered with hieroglyphics. These rocks the Indians regard as sacred, the hieroglyphics being a record of the Wenatchee Indian tribe, their battles, deaths, etc.

The Georgia Southern & Florida Railroad will be sold at receiver's sale on the first Tuesday in March, under a decree from the Superior Court. The upset price fixed is $4,500,000; but if this amount is not bid the road is to be again offered for sale on the third Tuesday at $3,750,000; and if not sold then, to be offered again on the first Tuesday in April, at $3,000;000; and if still not sold, to be sold on the third Tuesday in April to the highest bidder.

In trying to prevent an electric street railroad at Abington, Mass., from crossing the tracks of the New York, New Haven & Hartford Railroad in August, 1893, a riot ensued, for which Mr. John C. Sanborn, Division Superintendent of the New York, New Haven & Hartford, together with the Roadmaster and several subordinate officers, were recently sentenced to serve four months in jail. Strong efforts are being made to secure their pardon, but so far without success.

The Pennsylvania Railroad has just approved the model for the large map which is to adorn the north wall of the main waiting-room of the Broad street station at Philadelphia, submitted some time ago by the American Bank Note Company, and that company is now at work on it. The map will be 120 feet long by 15 feet wide, and when completed will be the largest in the world. It will be painted in oil on the finest canvas, and will show the lines of the Pennsylvania Railroad and its connections through all the States of the Union.

As showing the retarding effect of barnacles on the hulls of ships, and the resulting increased coal consumption, the commander of the United States warship *Bennington* reports that that vessel, with a clean hull, steamed from Acapulco to La Libertad, 675 miles, at the rate of 7.85 knots an hour on a coal consumption of 67 tons. Two months later she ran back, 688 miles, at only 6.2 knots per hour, and consumed 129 tons of coal, the excess being due to marine growths which there was no means of clearing off without docking the ship.

The New York Central pursues an original method of disposing of the woodwork of its condemned freight cars. Instead of employing labor to separate the wood and iron work, and instead of setting fire to the cars and burning the woodwork up, a number of cars are placed on a side track and the poor people are invited to help themselves to the woodwork, with the provision that none of the iron shall be taken. At East Buffalo recently nearly 100 old cars treated this way were stripped of nearly every vestige of timber between sunrise and sunset of a single day.

In Chili the Ministry of Public Works has approved a resolution of the State Railway Council to allow private persons to run their own freight cars on the State lines. The railroads, says "La Estrella," will load, clean and oil the cars. Owners of cars having sidings into their properties will hot be required to convey their freight to a station. They will be entitled to a reduction of 25 per cent on tariff rates; but they will be required to pay the cost of sidings, and the cars will have to be built according to plans to be furnished by the railways. It is to be hoped that by this plan the everlasting clamor for cars by agriculturists and others will cease.

The annual meeting of the stockholders of the Baltimore & Ohio Railroad Company was held in Boston Nov. 19. It was the largest in point of attendance in the company's history. The report of the president and directors for the year ended June 30 shows the gross earnings to have been $23,502,662.35; operating expenses, $15,560,689.07; net earnings, $6,941,973.28. The earnings decreased $3,712,144.90 and the expenses $3,481,292.78, as compared with 1893. In view of the unusual depression in all classes of business prevailing throughout the country during the entire fiscal year of 1894, the stockholders regarded the annual report as gratifying. The old board of directors was re-elected.

In his annual address to the Knights of Labor, at New Orleans, Nov. 15, Grand Master Sovereign closed his review of the Pullman strike with a severe criticism of General Schofield and his recommendations for an increase of the Army, as well as the action of "Chicago's millionaire aristocracy, who were permitted to present a stand of colors to the Fifteenth Infantry," which, he said, was an indication of an "uneasy desire to subjugate labor through the military powers of the nation." He urged that the assembly "advocate a decrease in the Regular Army and the abolition of the State militia, for from them are coming to the surface the sentiments of a military despotism

Arbitration Committee's Decisions.

The Arbitration Committee of the M. C. B. Association met in Buffalo, N. Y., Nov. 7, and considered Cases 249 to 260. Messrs. Rhodes, Martin, Marden, Mackenzie and Potter were present.

The Georgia Pacific Railway Company did some work on cars carded by the Illinois Central. The latter complained of excessive labor charges, and that a charge for a brake chain applied to a car was without authority. The Georgia Pacific explained that the brake chain was attached to the top brake connecting rod, which the defect card said was "gone." As to excessive labor charges, it claimed that in the cases involved the M. C. B. rules do not specify limits, that the time specified was actually consumed in the repairs, and that its statement should be accepted.

Decision: When a road issues a defect card it implies preference to have the repairs made by the owning road, and to pay for them. The charges of the Georgia Pacific were sustained.

The Philadelphia & Reading charged the Pittsburg & Western $12.50 for a Buckeye coupler, the price set by the rules for an M. C. B. coupler. The P. & W. admitted that the Buckeye is an M. C. B. coupler, but stated that its price is but $11.

Decision: Rule 26 provides a specific figure for couplers, including attachments and labor of replacing. The figures are $13 for a yoke bar and $12.50 for a tail-pin bar. The charge of $12.50 for the Buckeye coupler is sustained.

The Lake Shore & Michigan Southern charged the Jacob Dold Packing Company $4.80 for a Janney coupler and four hours' labor. The packing company declined to pay because the replaced coupler was 4 inches too long, and further because the car was new and the coupler could not be worn out or broken by fair usage. The L. S. & M. S. claimed that the coupler it applied was of the proper length and passed inspection between Buffalo and Kansas City; therefore the too-long coupler must have been put in by some other road.

Decision: Evidently the improper bar was not the one applied by the L. S. & M. S. The packing company's protection in case of improper material is to exact a defect card from the delivering line. The charge is sustained.

The St. Louis & San Francisco charged the Gulf, Colorado & Sante Fé for replacing two wrong link and pin drawbars carded for by the G., C. & S. F. The latter claimed exemption under Rule 19 from all charges except for attachments, admitting that the bars had tailpin attachments instead of pocket attachments, as noted on the cards.

Decision: The objection that a tailpin drawbar cannot be applied properly to a car originally fitted with a yoke link and pin bar cannot be sustained, especially in view of the fact that they are applied, that they do pass cars successfully over railroads, and that the rules contemplate that such changes would be made. The bill of the St. Louis & San Francisco should be canceled in so far as the charge for drawbars is concerned.

The Louisville, Evansville & St. Louis Consolidated carded one of its own cars for defects, including "three boards of running board gone." The Louisville & Nashville returned the car with a bill for 90 ft. of lumber at three cents per foot for the running board. The charge was objected to by the owner, as its card was simply for "three boards," its running board being composed of six boards, joined in the middle. The L. & N. claimed that it renewed the running board complete; that it had no evidence that these running boards were spliced in the center, and claims that the running board on L. & N. cars, as on most other cars, is composed of three pieces of board only, and it therefore considers that the card is authority for the charge made, as it covers the work done on the running board.

An inspection nine months afterward showed that the running board appeared to have been put on at one time, but that it was composed of more than three boards.

Decision: The card for "three boards of running board gone" cannot be construed into meaning all of the running board. The charge should be reduced one-half.

The Burlington & Missouri River road carded a C. R. L. car for "one end board broken." The Cudahy Packing Company rendered a bill based on this card for 43 cents, including another charge for $2.50 for an inside icebox cover missing, although the latter item was not covered by the card. The B. & M. declined to pay for the icebox cover, claiming that such inside covers are at owner's risk, the same as grain doors.

Decision: It is not the practice to inspect cars for inside fixtures. The inside icebox covers should be treated the same as grain doors. The charge for same is not correct. (Mr. Rhodes was not a party to this decision.)

The Peoria, Decatur & Evansville delivered an L. E. & St. L. car to the Cleveland, Cincinnati, Chicago & St Louis at Kansas, Ill., placing it beyond the midway point on the transfer Y. The C., C., C. & St. L. accepted the car, and on the following day attempted to take it off the Y, when one truck left the rails. It was dragged 50 or 60 feet in this condition and over the frog. It was then backed on to the Y again and left. The C., C., C. & St. L. thereupon asked the P., D. & E. to repair the bent axles under the car. This the P., D. & E. declined to do, claiming that the axles were bent during the derailment, after acceptance by and when being moved by the C., C., C. & St. L., claiming, further, that the car was in good condition while on its line and when delivered to the C., C., C. & St. L. The C., C., C. & St. L. claimed that as but one truck was derailed and both trucks had bent axles, this was evidence that the axles were bent before it handled the car.

Decision: A railroad's protection against defective cars is to either refuse them or to exact cards before handling them. Failing to do so, it cannot evade responsibility for resulting accidents. There being no evidence that the axles were bent prior to the derailment, and the car being at that time in the possession of the C., C., C. & St. L., that road is responsible.

A Chicago, Milwaukee & St. Paul double-deck stock car was destroyed on the Fitchburg Railroad in April, 1893. The C., M. & St. P. asked $343.10 for the car. This allowed for five years' depreciation plus $40 for airbrakes. The Fitchburg objected to the high price which was claimed by the owner to be the actual cost of the car. The owner claimed that the charge should be allowed under Rule 23, which says that special stock cars shall be settled for at present cost prices. The Fitchburg claimed that as the car was destroyed in April, 1893, the case should come under the Rules of 1892, wherein special stock cars are not named.

Decision: The rules of 1892 allow nothing extra for double decks. Other parts being equal, a double-decked stock car is worth more money than a stock car without double deck, but under the rules of 1892, as no provision is made to allow for the double deck, the only way to obtain a fair valuation is to place such cars under the clause providing for cars designed for special purposes. The charge is correct. (Mr. Marden was not a party to the decision.)

The Winona & Southwestern charged the Chicago, Great Western $1.25 plus one hour labor, 20 cents, total $1.45, for a new air hose authorized by a card. The C., G. W. objected on the ground that the price of air hose is 30 cents per foot, which makes the value of this hose 60 cents, plus 20 cents for labor: 80 cents, instead of $1.45. The W. S. W. claimed that $1.25 is the price it paid the Westinghouse Air Brake Company for the hose.

Decision: Hose can be bought for from 20 to 70 cents per foot, depending on quality. The rules give no specific price for hose, although they do for hose and couplings. Failing information to the contrary it is fair to assume that the price a railroad pays is the market price for the quality of material used. The charge is correct.

The Choctaw Coal & Railway Company carded an Atchison, Topeka & Santa Fe box car for one outside sill, 13 pieces of siding, etc. The owner charged for 84 pieces of siding and 1½ gallons of paint. The C. C. & Ry. Co. objected to paying for more than the 13 pieces of siding carded, and objected to paying for 1½ gallons of paint, which is sufficient to paint the whole side of a car. The owner replied that in renewing the side sill all the siding on that side of the car had to come off, and was damaged so that it could not again be used.

Decision: It is practicable and customary to remove box cars side sills without removing the siding. No reason was shown in this case for not doing so. The charge should be altered to cover only the 13 pieces mentioned on the card.

A car belonging to the Burlington system came home from the Chicago & Erie Railroad with a card for "one slid flat wheel over 2½ inches." The C., B. & Q. charged $8.50 for putting in a new pair of wheels. The C. & E. objected, claiming that it was being charged for betterments and it only wished to pay for one wheel.

Decision: The C. & E. should have renewed the damaged wheel, but as it preferred to give a card for the defect, the owner had a right under Rule 12 to renew the pair of wheels. The charge was correct.

Another controversy between the same roads arose from the question of the proper charge for steel knuckles. The C. & E. put a steel knuckle on a C., B. & Q. car and charged $2.80 for the same. The C., B. & Q. objected to the knuckle as wrong material and to the price as excessive. It offered, however, to accept the steel knuckle at the net charge for one Janney knuckle, less scrap, $1. The C., B. & Q. claimed that the charge of $2.80 is excessive; that it purchases steel knuckles for 4½ cents per pound and that these knuckles weigh about 37 pounds, and that the cost, therefore, would be only $1.57. The C. & E. replied that $2.80 is what it pays for Janney steel knuckles. It developed later that this charge covered a guaranty that each knuckle failing on the C. & E. within two years would be replaced for $1.

Decision: The price paid by the C. & E. for steel knuckles is based upon a replacement guaranty, and is not current market price. The objection of the C., B. & Q. to the charge is proper, and bill should be corrected so that the net charge for one Janney knuckle, less scrap, should be $1.

(Mr. Rhodes was not a party to either of the last two decisions.)

Thirty-four families left Pullman, Nov. 5, for Hiawatha, Kan., to join the new co-operative colony there. They included a number of mechanics, former employes in the Pullman shops

Notes on the Different Kinds of Processes Used on the European Continent for Preventing Incrustations in Locomotive Boilers.

A correspondent in Brussels, Belgium, who is connected with one of the departments of the Belgian State Railroads, sends us the following notes on scale prevention in European locomotives:

As is well known, the calcareous matters contained, whether as carbonates or sulphates, in waters intended for use in locomotive boilers, sink to the bottom all the quicker and easier as the temperature of the water is higher, and, consequently, as the pressure in the boiler is higher. It is, therefore, highly important when there is a question of high-pressure boilers, to find a remedy against the formation of these deposits, which not only lessen the conductibility of the heating surfaces, but may also cause overheating of the plates and lead to serious consequences. The diminution of conductibility also causes want of power in the boiler.

With a view to avoid these drawbacks recourse may be had to two systems, one consisting in rendering purer the water previous to being introduced into the boiler; the other in putting into the boiler itself certain ingredients having the effects, either of preventing the adherence of the deposits to the plates, or of facilitating their decomposition, or their transformation into non-adhering slushy matter which in this state is easily got rid of in the usual way.

The first system is evidently the more radical and certain in its working. The different methods in use for the previous purifying of the water are all derived from Clark's process; to the water there is added a quantity of lime sufficient to decompose the bicarbonate of lime and cause it to sink in the form of insoluble carbonate. The sulphate of lime is precipated by carbonate of soda.

Beranger's and Stigl's apparatus, as well as those of Porter and Allen in use on several English railways, notably on the Taff Vale Railway, and the London & North Western, and those used extensively on the French Northern Railway and described by Messrs. Carcenat and Deraune in the 1890 October number of the "Mémoires des Ingénieurs Civils de France," are all based on this principle. They give satisfactory results, but necessitate heavy outlay at first for the apparatus.

The American system of Messrs. Seales and Carroll does not require these first heavy expenses. It is so well known that it needs no description here. Only this remark may not be out of place—that the results obtained from it have not in every case proved satisfactory. Thus, while in England, where the apparatus is working on two of the locomotives belonging to the London & Southwestern Railway Company, the trials have proved satisfactory; in France, on the other hand, on the Eastern Railway Company's lines, the result was absolutely negative—and not only has the formation of scale not been got rid of, but incrustation was found in even greater quantity.

The same apparatus has also been fitted onto one of the locomotives of the Lancashire & Yorkshire Railway, with fair results, but, according to Mr. Aspinwall, it requires too great a degree of attention on the part of the engine-driver to make its use generally adopted.

The second system consists in the use of anti-tartrates which are introduced into the boiler, and is more generally adopted; these anti-tartrates act both chemically and mechanically.

A good anti-tartric mixture which has been used for over 30 years by the French Orleans Railway Company is composed of: Carbonate of soda, 60 kilograms = 132 pounds English; logwood (Campeachy wood), 75 kilograms = 165 pounds English; quebracho wood, 25 kilograms = 55 pounds English; together with a sufficient quantity of water, so that after concentration the liquid obtained be of 8 degrees to 10 degrees of the salinometer. [An instrument for measuring the amount of salt present in any solution.]

Mention may also be made of the liquid used against the formation of scale on the French Western Railway, which is made by boiling together a lye of 100 kilograms of caustic soda, 200 kilograms of powdered quebracho wood and 500 kilograms of water. This incrustation preventive is put into locomotive boilers after each cleaning, in the proportion of one kilogram (2⅛ pounds English) to every 5,000 gallons of water.

As belonging to the same order of ideas we will mention Harmay's Electrogen, which is composed of a ball of zinc of about 18 kilograms in weight (39⅝ pounds English), fitted between the two sheets of the firebox. This ball is joined, by means of a copper wire, either to the tubes or to the staybolts of the firebox. The zinc together with the boiler forms a galvanic compound, and the hydrogen is deposited on the surface of the boiler plates, thus preventing the contact of tartar with them, and in this way the deposits do not adhere to the boiler and are easily removed from it in the form of slush.

In England this apparatus has been very little used on locomotives, but is much employed on marine engines, where it has produced excellent results. In France a great many trials of this Electrogen have taken place on the Northern Railway, and, generally speaking, have proved successful.

In conclusion we may also mention the use of rolled plates of zinc as a preventive of incrustation and oxida-

tion in boilers. A number of zinc plates of 12 inches by 6 inches by 1 inch are suspended in different positions from the sides of the boiler by means of iron rods, which make a perfect contact between the zinc and the boiler sides. In this case also an electric phenomenon analogous to that of Harmay's Electrogen is the result.

Proposed New Arrangement for Car Interchange at Chicago.

At the October meeting of the Western Railway Club, Mr. J. N. Barr, Chairman of a committee consisting of Messrs. Barr, Waitt and MacKenzie, presented a preliminary report on the interchange of cars at Chicago. The opinion was expressed in the report that the present method of inspecting cars at interchange points and requiring cards for all minor defects, merely to protect the road receiving the car, causes serious delay to traffic, necessitates the employment of a large number of men who spend their time in finding defects when it should be spent in repairing the same, and necessitates frequently repairs to pass inspection which are not required by any consideration of utility or safety, thus increasing the cost of car repairs; and that the interchange of cars will be facilitated, and the cost of repairs reduced, by owners of cars assuming responsibility for a larger number of items than at present.

With this end in view the report suggested that the railroads at Chicago agree to interchange cars with the understanding that, in addition to the defects enumerated in Rules 7, 8 and 9 of the M. C. B. Rules ,of Interchange for which owners are responsible, the following items shall also be treated in the same way, viz.: Couplers or drawbars, drawbar springs, drawbar pockets or spindles, drawlugs and attachments, draw timbers, deadwood or buffers, end sills, longitudinal sills, cracked posts, all parts of trucks, center plates and all body castings, all bolts.

A form of agreement was presented, which provided that the cars of the roads parties to the agreement should be interchanged without requiring cards for such defects as named above, the M. C. B. rules to prevail in regard to the cars of roads not parties to the agreement. If found necessary for safety, repairs could be made and billed for according to M. C B. figures, excepting when damage was due to wreck. Such repairs should be in strict accordance with the construction of the car. Any road could withdraw from the agreement on 30 days' notice.

There was no action taken in the matter further than to discuss and criticise some of the particulars of the suggestion.

Electric Locomotives for the Baltimore Tunnel.

The electric locomotives intended for service in the Baltimore & Ohio tunnel, which the General Electric Company has been building, are now finished and it is expected that they will be in service before Christmas. They weigh in working order 100 tons and are of 1,200 horse power traction. The plan of the 80-ton electric locomotive exhibited at Chicago last year has been followed approximately. They consist of two trucks, each truck having two axles, and on each axle is mounted a 300-horse-power motor. The motors are gearless, and are supported on spiral springs resting on the frames of the trucks. This method of suspension leaves the wheels free to adjust themselves to the irregularities of the roadbed, and consequently tends to diminish the wear of both trucks and motors. They are fitted with airbrakes, the air being compressed by a small auxiliary motor in the cab. This electric air compressor will also operate the whistle. The regulation is such that the speed can be varied from one up to thirty-five or forty miles an hour. The tunnel will be painted white as there will be no smoke, and will be lit by 2,000 incandescent lamps, the illumination of which is expected to render lamps in the car unnecessary.

Northwest Railroad Club Banquet.

The Northwest Railroad Club held its third annual banquet at the Ryan, St. Paul, Tuesday evening, Nov. 13. Preceding the banquet there was a business session at which the following officers were elected for the ensuing year: President, E. A. Williams, Mechanical Superintendent of the Soo Line; First Vice-President, George D. Brooke, Master Mechanic of the St. Paul & Duluth; Second Vice-President, George Dixon, General Foreman of the Great Northern; Secretary, C. A. Seley, Mechanical Engineer; Assistant Secretary, T. A. Foque, Engineer of Tests, Soo Line; Treasurer, J. O. Pattee, Superintendent of Motive Power, Great Northern. Arrangements were made to hold alternate monthly meetings in Minneapolis, beginning with the next meeting, which will be held on the second Tuesday in December at the West Hotel of that city.

Fire destroyed the car shed of the Central Vermont Railroad at St. Albans, Vt., Nov. 16. The shed contained 16 vestibuled coaches, parlor and sleeping cars. They were all destroyed. The fire was discovered soon after 9 o'clock in the "Bellevue," the private car of President Smith. A general alarm was rung, and the entire fire department was soon on the grounds, but too late to save the railroad property. The car shed was, of course, seasoned thoroughly, and more or less saturated with oil. It burned furiously. The lamps in the cars exploded in succession.

The Mechanical Engineers.

The programme of the annual meeting of the American Society of Mechanical Engineers has been announced. The first session will take place on Monday evening, December 3, at the house of the Society in New York. On Tuesday morning the principal business will be the reporting of committees on Methods of test, Gages for thickness of metal, Standard flanges, etc. The papers of this session will be that by W. J. Keep on Relative tests of cast iron, and by George M. Sinclair entitled Notes on steel forgings. On Tuesday evening, and on Wednesday, Thursday and Friday mornings, the following papers will be read and discussed:

The Application of Brakes to the Truck Wheels of a Locomotive. W. F. M. Goss: An Experimental Study of the Effect of the Counterbalance in Locomotive Drive Wheels Upon the Pressure of Contact Between Wheel and Rail. A. W. Robinson: Drawing Office Appliances. L. S. Randolph: Strength of Railway Car Axles. Geo. R. Henderson: A Graphical Method of Designing Springs. C. J. Field: Present and Prospective Development of Electric Tramways. Thomas D. West: Relative and Special Tests of Cast Iron. M. P. Wood: Rustless Coatings for Iron and Steel. George W. Bissell: The Effect of Clearance on Economy of a Small Steam Engine. D. S. Jacobus: Results of Experiments to Test the Accuracy of Small Throttling Calorimeters. John H. Bar: Experiments on a System of Governing by Compression. Joseph C. Platt: Straightening a Leaning Chimney 100 Feet High. Samuel and S. S. Webber: Trials of a Vertical Triple Expansion Condensing Pumping Engine at the Trenton Water-Works. Peabody Miller: Tests on the Triple Expansion Engine at the Mass. Inst. Tech. (Second Paper). F. W. Dean: Trial of a Leavitt Pumping Engine; Trials of a Recent Compound Engine with a Cylinder Ratio of 7:1; Changing the Suction System of a Pumping Engine. Gaetano Lanza: Tests of the Strength of Spruce Columns. C. V. Kerr: On the Theory of the Moment of Inertia. Charles T. Porter: Comparison of the Action of a Fixed Cut-off and Throttling Regulation with that of the Automatic Variable Cut-off on Compound and Triple Expansion Engines; Description of a Cam for Actuating the Valves of High-speed Steam Engines; Description of an Improved Steam Separator and an Improved Steam Jacket; Description of an Improved Centrifugal Governor and Valve. Gaetano Lanza: Stresses in the Rims and Rim Joints of Pulleys and Flywheels.

Railroad Progress in Japan.

Our English contemporary the "Railway Engineer" publishes in its last issue an abstract of a consular report dated at Tokio, May 18, 1894, which gives considerable information relative to the progress of railroads in Japan. Railroad construction in Japan has made steady progress since 1872, when the Tokio-Yokohama line was completed. The total mileage of all railways in operation on March 31, 1893, was 1,877 miles. Of this 557 miles are government lines, averaging a cost of $60,667 per mile. The most costly portion was the Tokio-Yokohama section, begun in April, 1870, and completed in September, 1872, its length being 18 miles, and the average cost per mile $163,457. The cheapest was the Otsu-Nagahama section, begun February, 1888, and completed July, 1889, its length being 48 miles, and the average cost $34,008 per mile.

Private railways were commenced in 1888, much attention being devoted to them till 1892, when financial reasons intervened, and the ardor temporarily cooled off. Toward the end of 1893, however, some 62 applications were under consideration by the Railway Council, who, according to Japanese journals, are somewhat perplexed how to deal with these numerous schemes. The total mileage is some 1,400 miles representing a capital of $56,200,000. Six applications were accepted and five rejected. The remainder were held over for further consideration.

It is also stated that, exclusive of the above, several other private lines, with lengths varying between 9 miles and 43 miles, have been sanctioned, the total mileage being 264, and the capital involved $9,245,000.

Heated vs. Heating Surface.

A correspondent of *Engineering* points out the fact that in the case of Serve tubes it is improper to regard the increased area of the tube surface exposed to heat as heating surface. The enlargement of such surface does not increase the heating surface, but the efficiency of the heating surface. The writer says:

The *heated surface* is where the heat from the furnace gases is taken up by the material of the tube, whereas the *heating surface* is where the heat is transmitted from the material of the tube to the water in the boiler. In a flat plate, such as a firebox plate, neglecting the stays, the two surfaces are identical in area, but in an ordinary tube the *heated surface* will be less than the *heating surface* in the following ratio: $\frac{d-2t}{d}$, where d is the outside diameter of the tube, and t is its thickness. Now in a Serve tube this ratio is increased, and may be even greater than unity; consequently a given amount of heat taken up by the *heated surface* would be intensified by falling on a smaller area of surface.

Some Economical Improvements.

The following list names some improvements that have been made recently on a large, carefully managed road that have effected economies aggregating a very large amount of money:

Material.—The stock of miscellaneous material has been reduced from $1,600,000, in round numbers, to about $900,000. There is now but little dead or useless stock. The methods of caring for and carrying all kinds of material have been improved, and the storehouse accounts are in better shape. Old material is promptly picked up and sold. The number of sizes carried of various articles has been reduced, especially as regards lumber. (Fifty sizes saved.)

Train Service.—Arrangement of cars in freight trains, speed of trains and the loading of cars and freight trains are now being closely watched. Increased joint runs of baggage and express men. Old ties used for coach and engine wood.

Engine Service.—Checking methods of keeping wages have made reductions. The oil mileage and cost per mile have been improved on all lines. Tied edgings are now largely used for firing instead of cordwood, in places where it can be done. Engine runs being adjusted. Use of mine run coal in place of screened at some points. One hundred and fifty degree headlight oil instead of 175 degree. More care taken in use of coal generally. More attention to uniformity of coal furnished at coaling stations.

Road Repairs.—Standard list of switch ties has been adopted for whole system. The iron cattle-guard adopted. A list of standard frogs practically adopted for whole system. Elm instead of ash in handcar frames. Maintenance of standards watched. Quality of oil used by section men watched.

Bridge Repairs.—Caps protected by scrap tin in some places. A standard list of bridge ties and all other bridge timbers adopted for whole system. Iron bridges have been brought to a standard, especially in length. Heavier and more durable piling called for for wooden bridges.

Engine Repairs.—Specifications for boiler-shell steel allows a cheaper price. Improvements in the use of fuel in stationary boilers in shops. Simple methods of construction. The eight-wheel engine has fewer parts. Increased use of exhaust steam in heating.

Car Repairs.—Grades of lumber adapted for use in cars. Freight car pool. Cheaper grade of plush for seat backs. Blinds instead of curtains in coaches. Cheaper wheels. Better wheel inspection. Cheaper style of way car as to plan, finish and painting, especially in the use of cheaper finishing woods. Plain ground glass in deck lights. Plain glass in coach doors. Temporary coal doors to be made from old car siding instead of new material.

Fence Repairs.—Seven-foot posts instead of eight-foot. Alternate posts to be spreaders. Old car draw woods used for fence posts.

Printing and Advertising.—Having all printing bids and bills come through the stationer. Grades cheapened on various items of printing material, such as time cards, tariff sheets.

Telegraphing.—Reducing number of operators and improving service. Testing of all wires has improved condition of lines. Physical conditions closely watched. Time service consolidated with the telegraph department.

General Expenses.—Simpler methods of auditing being introduced in some offices.

Rent of Cars.—Simpler methods used in car accountant's office.

Water Service.—Cheaper oils used for pumping machinery in some places.

Building Repairs.—Grades of material closely watched, and in many cases cheapened without impairing efficiency.

The foregoing is interesting as indicating the wide range of possible economies that may be effected on a large railroad by careful supervision. A study of this list will show that a good many leaks that eat into possible dividends have been discovered and stopped.

Air Pump and Piston Rod Packing.

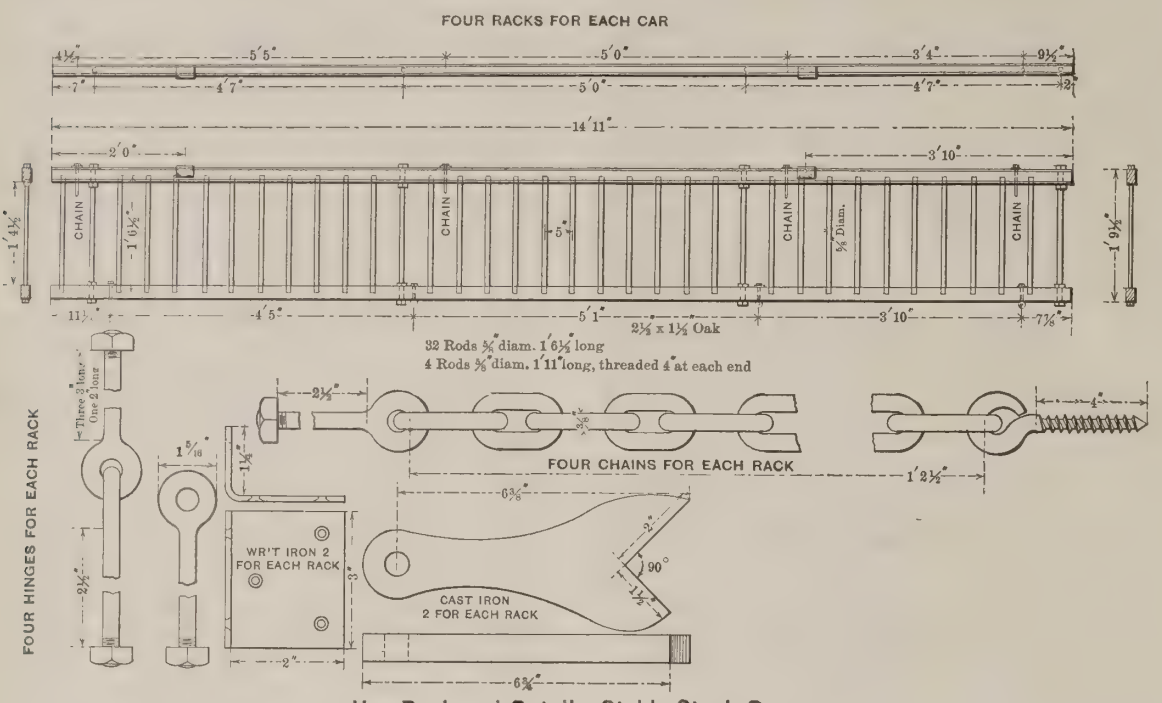
A committee of the Air-Brake Men's Association, of which Mr. C. B. Conger, of Grand Rapids, Mich., is chairman, is seeking information of the extent to which fibrous, rubber and metallic packing, respectively, are being used for packing the piston stuffing boxes of air pumps. The committee is trying to learn also to what extent the wear of rods is affected by the different kinds of packing, and what kinds are most easy to manipulate.

A 10 per cent. reduction in the pay of all Lehigh Valley employees who receive $1,000 per annum or over will go into effect on Dec. 1. The cut is the result of poor coal trade.

An engineer on the Illinois Central Railroad saved his train from being robbed near Memphis, Tenn., Nov. 18, by not heeding a signal to stop, although given with a red light. He submitted himself and fireman to a heavy fire at close range from the band of six robbers who wanted him to stop. The fireman was wounded.

Standard Stable Stock Car, C., M. & St. P. Ry.

We conclude in this issue the description and illustration of the standard stock car of the Chicago, Milwaukee & St. Paul Railway, begun in our November issue. We therein presented drawings of the side and end elevations, and cross and longitudinal sections, together with a number of details of this car. Drawings showing the arrangement and details of the feed boxes were presented in our previous issue, and we present in this issue the drawings of the hay racks and their details. Each car has a dozen feed boxes and four hay racks. The feed boxes are placed at regular intervals in the roof, at the sides on each side of the doors. The hay racks are placed beneath these at a convenient height for the animals.



Hay Rack and Details, Stable Stock Car.

As before mentioned, we are indebted to Mr. J. N. Barr, the Superintendent of Motive Power of the road, for our drawings and information of these cars. Mr. Barr and Mr. J. J. Hennessey, the Master Car Builder of the road, devoted a great deal of study to the design and construction of these cars to make them as perfect as possible for their intended purpose—the carrying of live stock in as safe and comfortable a way as can be done to assure their arrival at market in the best possible condition. Indeed, the efforts to make the car perfect in this respect extended beyond the officers of the rolling stock department. The traffic and operating officers contributed suggestions as to the arrangement and perfection of details.

Going still further, advice and suggestions were sought from the shippers of live stock along the company's lines. These were all carefully considered, and every idea advanced that could be utilized in perfecting the car was taken advantage of, with the result that a car was designed that, as we have said before, is excellently adapted to its purpose, and that stands as an example of the best practice of stock car construction in America, and that means in the world, for our live stock traffic is greater than that of any other country, the distances of its necessary transportation are longer, and these conditions have spurred American roads to improve the cars engaged in this traffic.

In the interior of the car we are describing, there is not a sharp corner or a projecting nut or bolt head to even slightly injure its occupants. Doors are provided at the sides as usual, and at each end, the end doors being intended for the easy entrance of stock men to the car to raise fallen stock or give any other needed attentions while the train is running.

The draw arrangement of these cars, as illustrated herewith, is standard for these and 60,000 pounds box cars. The Janney drawbars are used, and continuous draft timbers are placed beneath the center sills. The method of attaching the draft rigging to these is very plainly shown in the plan and sectional views.

The trucks used, and illustrated herewith, are the standard freight car trucks on this road for cars of 60,000 pounds capacity. They are of the swing bolster type, with the bolster, transom and spring plank of white oak, of the dimensions shown in the drawings. The wheel base is five feet, the axles are of hammered iron, and the wheels are cast-iron, 33 inches in diameter, with chilled threads. The body bolsters rest upon pressed steel center-plates, shown herewith, that are also standard for box cars of the same capacity. The body bolster is made of wrought iron, and is illustrated herewith. The lower plate is one inch thick, and 8 inches wide by 8 feet 2½ inches long, the finished length being 8 feet 2 inches. The upper plate is ¾ inch thick, 8 inches wide and 9 feet 3 inches long, sawed to length, the finished bolster being 8 feet 8 inches long over all.

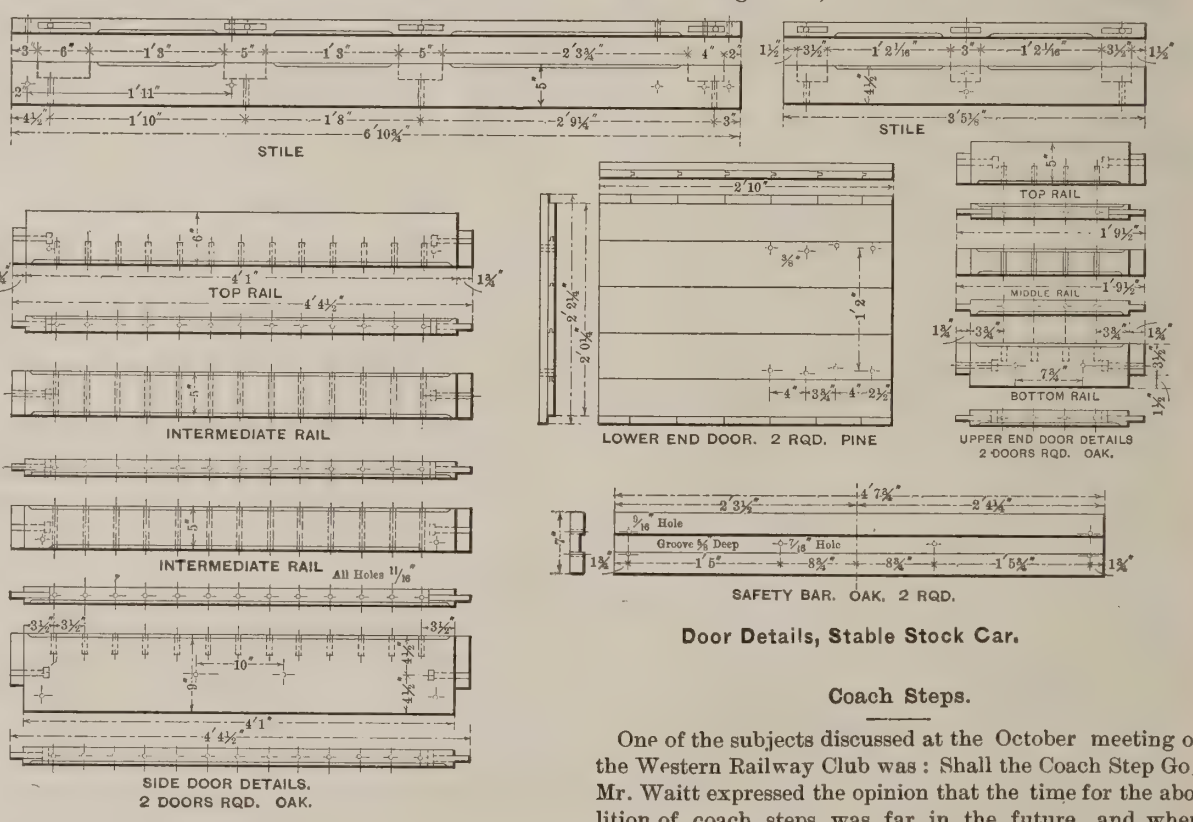
The draft timbers, which are of white oak, are 4½ inches × 7 inches × 9 feet 10 inches. The deadwoods, also of white oak, are 4½ inches × 8 inches × 1 foot 9 inches.

Our engravings of the wooden details and the cast-iron and forged round iron details, illustrate the design of these and give the necessary details. While the drawings of the flat forgings give numerous dimensions, yet the following table is subjoined to furnish such dimensions as are not given on the drawings:

Forgings.

No. of Pieces.	Name.	Size of iron.
	Flat Iron.	In. In. Ft. In.
2	Body bolster, lower plate, finished 8′ 2″ long	1 x 8 x 8 2½
2	" " upper plate, sawed to length	¾ x 8 x 9 3
2	Safety bars for side doors	⅝ x 2 x 6 1
2	Slides " "	½ x 2 x 10 5½
8	Latches " "	½ x 2 x 1 1¼
4	Hangers for side doors made of {4 pieces / 4 "	⅝ x 2 x 1 5 / ⅝ x 2 x 0 7
8	Eye bolts for side door } See eye bolts	½ x 1½ x 0 4
2	" " " lower end door } See eye bolts	½ x 1½ x 0 3
2	Slides for upper end door at bottom	⅝ x 2 x 5 4¼
2	" " " " " top	⅝ x 2 x 4 10
2	Stops " " " "	⅝ x 1½ x 0 8
2	Latches " " " "	⅝ x 1½ x 0 6½
4	Corner plates	¼ x 7 x 1 6
2	Center pin plates	¼ x 5 x 0 5
4	Cheek plates for lower end door	¼ x 3 x 3 0
2	Sill " " " " "	¼ x 3 x 2 0
2	" " " upper " "	¼ x 2 x 2 1
2	Hasps for lower end door	¼ x 2 x 0 11½
7	Hanger plates for hand rail pipe	¼ x 2 x 0 8¾
2	Washer plates for safety bar (with chain)	¼ x 1½ x 0 6½
2	" " " " "	¼ x 1½ x 0 4⅝
4	Hinges for lower end door made of {4 pieces / 8 " / 4 "	¼ x 2½ x 1 5¾ / ¼ x 1½ x 0 7¾ / ½ Rd. x 0 7
8	Chafing plates for hay rack	⅛ x 3 x 0 3¼

These cars are equipped with the Westinghouse air-brake for freight cars, and National Hollow brakebeams.

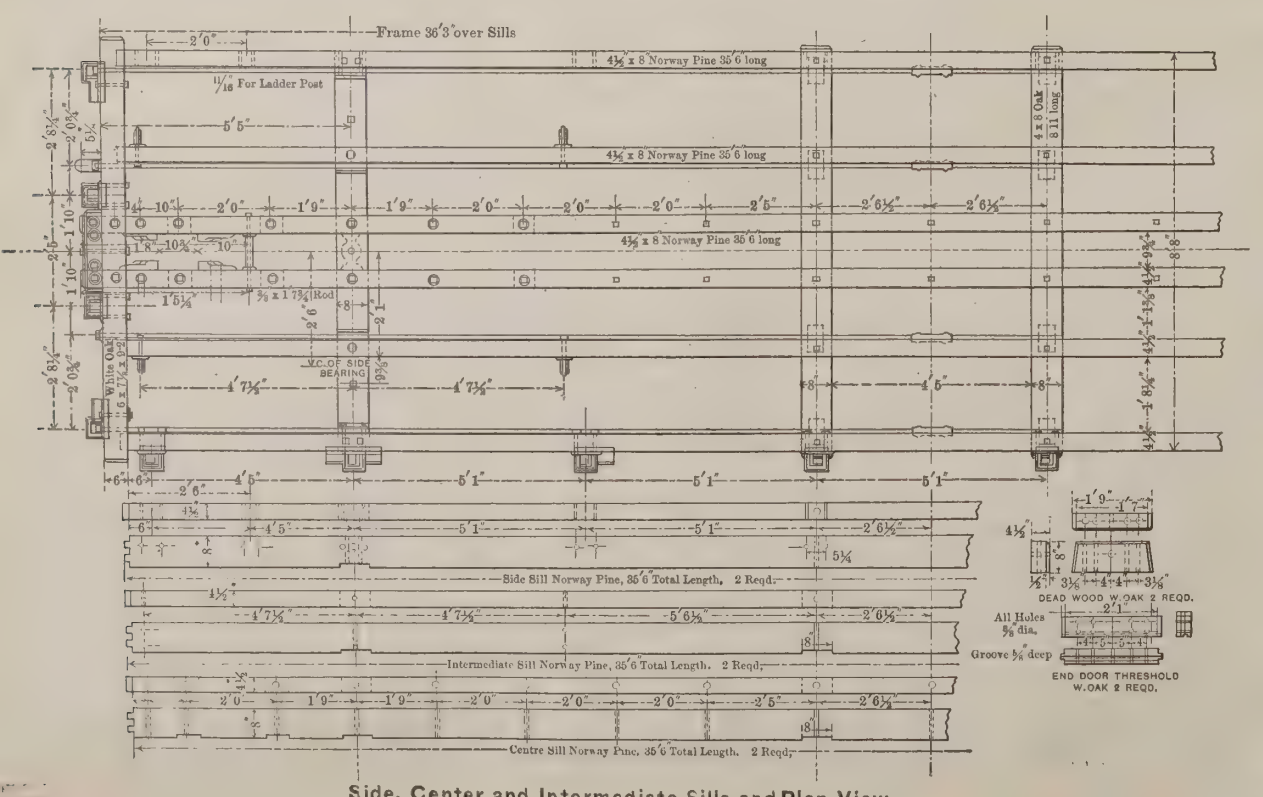


Door Details, Stable Stock Car.

Coach Steps.

One of the subjects discussed at the October meeting of the Western Railway Club was: Shall the Coach Step Go? Mr. Waitt expressed the opinion that the time for the abolition of coach steps was far in the future, and when American railroads are much better off financially than now. In suburban service they can be abandoned with advantage, but this will require station platforms to be level with car platforms, and these could not be used very well in connection with through service. With the through service it would be expensive and very inconvenient if we should attempt to change our platforms and carry on the unloading of trains with raised platforms in terminal stations, and it would be quite a problem to figure out just the way in which it could be done, so that inspectors would have an opportunity to test the brakes, and the switchmen an opportunity to get in and cut off cars, and give their signals, etc., with the passengers going in and out at the same time. On postal, baggage and express cars there is already a move in the direction of leaving off the platforms and steps, but on coaches and sleeping cars it seems that for a great many years to come steps will have to be provided.

Experiments carried out on one of the German State Railroads between a simple and compound locomotive of the same general dimensions showed favorable results for the compound when running at speeds exceeding 25 miles an hour. With increasing speed there was a steady increase of economy. With speeds below the above figure, the simple locomotive showed the better results. All the working conditions were exactly the same in the trials. The simple engine had cylinders 17.2 inches in diameter and the compound engine had cylinders 17.6 inches and 26.4 inches, respectively.



Side, Center and Intermediate Sills and Plan View.

Railway Coach Varnishing.

BY J. H. PITARD.*

There is no part of the coach painter's art upon which so much depends for beauty of finish as that of varnishing. How much otherwise beautiful work has been spoiled with the varnish brush? How many rough, thick, saggy and unsightly coats of varnish are daily applied under the nom de plume of varnishing? How much has the reputation of good varnish suffered at the hands of an incapable varnisher? If varnish could but speak out in its own defense, all these questions might be answered, and what a doleful tale it would tell of the wrong treatment received; of being repeatedly consigned to Hades, the place of which the varnisher himself was more justly deserving, for palming himself off on an unsuspecting employer as a capable varnisher!

It is an unmistakable fact that among the car painting fraternity capable and efficient varnishers are the exception and not the rule. The best varnishers are to be found among those who make varnishing a specialty. But in those shops where the painter is compelled to do general work it is rarely the case that all are expert varnishers.

The deficiency in such cases may in some instances be due to a lack of sufficient practice, as the time consumed in varnishing a car, as compared to all the other painting, is short; therefore, the painter may justly or unjustly claim that the practice he receives is insufficient to enable him to keep his hand in. But is this a sufficient excuse? Why should not a workman be as proficient in one branch of the art as another? It is true that varnish is by nature very different in all respects from paint; the conditions nor the same manipulations of the brush necessary to produce a good job of painting would not suffice for a good job of varnishing, and this very fact ought to elicit sufficient thought and study on the part of every painter to acquaint him with all the characteristics of varnish, which knowledge would in a great measure compensate for lack of practice or lack of experience.

The idea of flowing varnish originated with the carriage painter, and from him the idea has come to the car painter. The car painter, in many instances, is possessed with the delusion that his efficiency as a varnisher is measured by the amount of varnish he can apply to the surface of a car, which fact largely accounts for much of the faulty varnishing done. He seems not to consider the fact that the conditions surrounding the carriage painter are vastly different from his own, and in every way more propitious. The finishing varnish uesd by carriage painters is usually lighter bodied and slower drying than that used by the car painters, which qualities are indispensable to a flowing varnish. Then again the large amount of fresh air that is being constantly admitted, and the large volume of air in the car shop, as compared with that in the comparatively small varnish-room of the carriage shop, is unfavorable to the car varnisher, as it is a fact well known to the expert varnisher that as much air as possible should be excluded from the varnish-room while varnishing. Otherwise the varnish will "set" before the process of flowing out is complete, in which case runs, sags, wrinkling and other devil-tries are the result, to say nothing of the injury to the durability of the varnish.

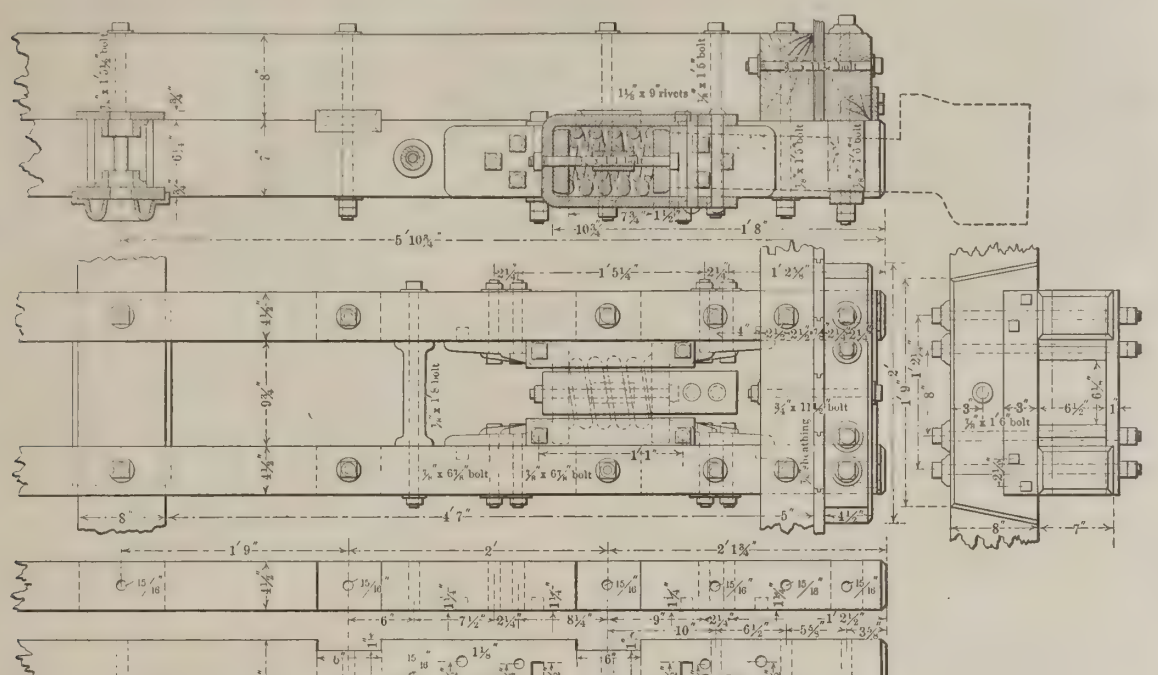
A finishing coat of varnish that has been flowed on in an excess of air is often very deceptive in appearance; it may appear to be smooth and free of runs, but if it be examined after having had the misfortune to sustain a "sweat," hundreds of little runs or sags will be seen that were not visible before, and which go to prove conclusively that a flowing coat of varnish cannot be successfully applied in an excess of air. Therefore, where the conditions are not favorable, the last coat, as well as the preceding coats, should be fairly well brushed out. If any flowing at all is done it should be only the final coat, as the process of drying is greatly retarded by flowing any of the under coats. To the inexperienced varnisher a few words just here on the subject of runs, sagging, etc., may not be amiss.

In applying the varnish upon a panel or fascia, running and sagging may be largely avoided if the varnish be so applied that the volume of varnish shall be slightly heavier at the bottom than at the top; the reason for this is apparent when the fact is considered that it is the heavier body flowing over the lighter which usually causes runs or sagging, the reason of which is that the heavier body can sustain the lighter, but the lighter cannot sustain the heavier. Running and sagging is perhaps as much the result of improper manipulations of the brush, as of a disregard of the principle referred to. Many varnishers have the very unworkmanlike habit of jabbing the brush into corners and out-of-the-way places, instead of forcing it by a gentle pressure of the hand, with the result that the ends of the hairs become curled or take the form of a hook, which really scrape the varnish from the surface instead of depositing it. Such brushes may be restored by dipping the point in boiling water.

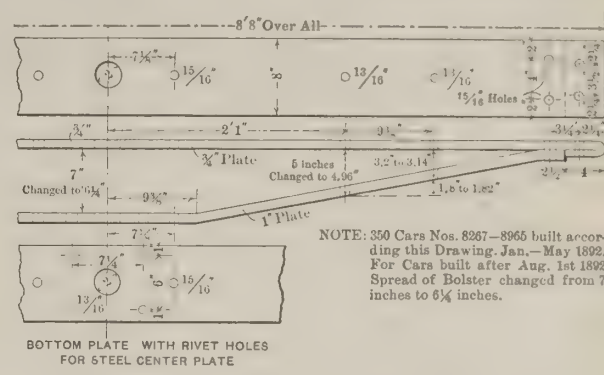
It is impossible to describe all the manipulations of the brush necessary to perform an acceptable job of varnishing, but the runs which usually occur at the top of panels and which are perhaps the most common and most troublesome, can be avoided if, after dressing the varnish perpendicularly, the small brush be laid flat and drawn across the top of the panel with slight pressure on the top edge of the brush, the bottom edge barely touching. If the pressure be too heavy on the bottom edge of the brush it will form a bank of varnish which will not always flow out, but will often terminate in a run.

In order to produce a quick, neat and satisfactory job of varnishing, there should be as much care exercised in the application of the varnish as in the "dressing off." The practice of flowing on an excess of varnish up against the batens, under the crown mold, and in all of the out-of-the-way places, is expensive and unnecessary. It is only a waste of varnish, and much time is consumed in wiping up or removing the excess preparatory to "dressing off," to say nothing of the time lost in watching for runs, which invariably follow such a slipshod method of varnishing. It is such methods as this which give rise to the still more vicious practice of rebrushing of varnish in order to remove runs after it has "set." In which case it were far better to take a varnish brush and take and remove all the varnish from the panel, and then revarnish. A panel that has been brushed over after the varnish has partially set will not flow out smooth again, but will always present a rough unsightly appearance.

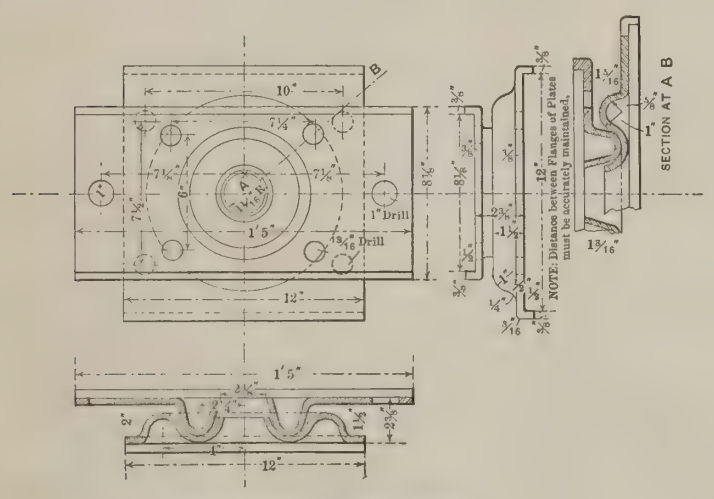
Of all the directions which might be given for the application of varnish there is none that will conduce nearly so much to the perfection of the expert varnisher as a thorough knowledge of all the characteristics of varnish. Varnish cannot be made to perform impossibilities, therefore, to perform varnishing successfully, its application must conform to its characteristics.



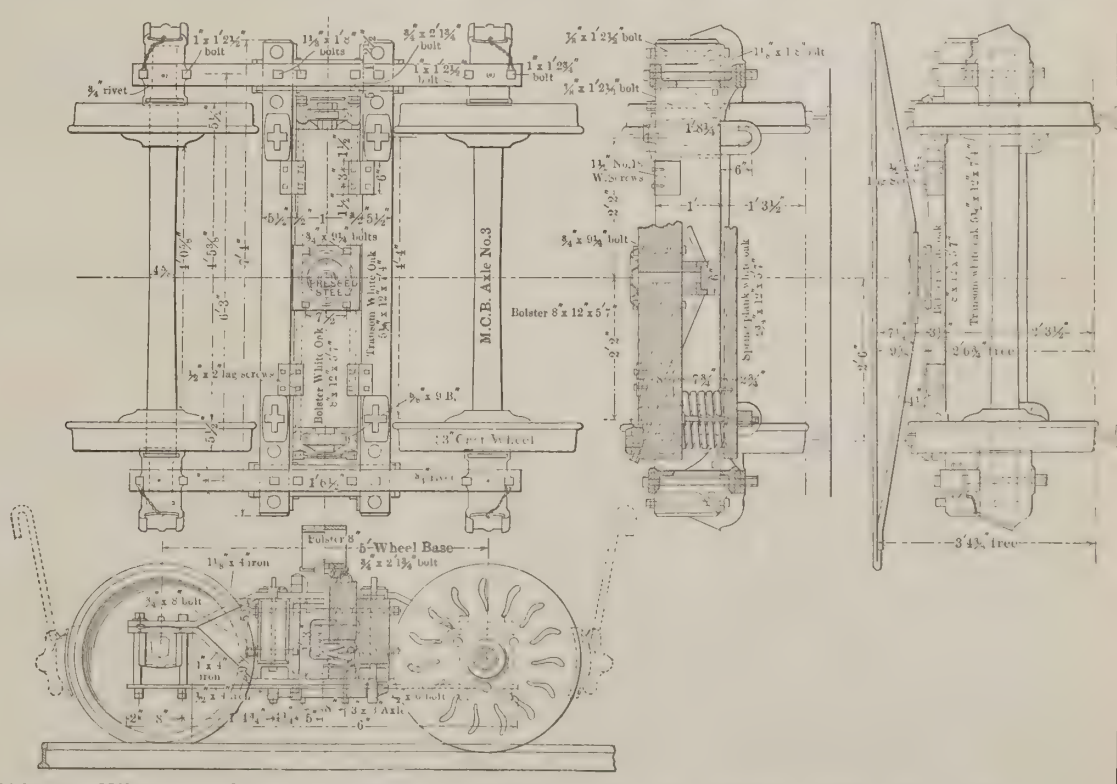
Standard Draw Arrangement, with Continuous Draft Timbers.



Iron Body Bolster.



Pressed Steel Center Plate.



Chicago, Milwaukee & St. Paul Railway Standard 60,000 lbs. Capacity Freight Car Truck.

Mr. W. S. Morris, Superintendent of Motive Power of the Chesapeake & Ohio Railway, is conducting some experiments with coke for passenger locomotive fuel. The coke can be made at very little extra cost over the coal in his territory, and, of course, effectually cures the smoke nuisance.

The Knights of Labor held their annual convention in New Orleans during the latter part of November. Most of the old officers were re-elected, including Grand Master Workman Sovereign.

* In the "Painters' Magazine."

Some Eastern Shop Notes.

During a recent visit to the Allston, Mass., shops of the Boston & Albany Railroad, a representative of the NATIONAL CAR AND LOCOMOTIVE BUILDER noted a vast pile of discarded electrical fittings that had been removed from cars when storage electric lighting was done away with. To quote the words of an official of that road, storage battery lighting had "proved expensive, unreliable and unsatisfactory. Pintsch gas has come to stay." Nevertheless, as good as Pintsch gas proves itself to be, it is probable that electric car lighting will eventually "come to stay." But it will not be storage, or at best not directly; neither will it be from a dynamo driven by an independent steam engine, but from axle-driven dynamos, the fields of which will be excited from a small storage battery, which will also be available when the car is at rest. Active practical experiments are even now under way with a type of "differentially" wound dynamos, which is expected to generate current after the car reaches a very moderate speed. This is possible when the fields are excited from a storage battery or some other external source of electricity, and a trial trip of this device was recently made on the "Congressional Limited" between New York and Washington on the Pennsylvania Railroad.

It is a record of which the Boston & Albany management is pretty proud, that not for 25 years have they had to pay for an accident caused by the failure of a passenger coach steel wheel. This is partly due to the nearly perfect wheel used (Washburn), but chiefly to the rigid system of inspection and time condemnation under which all passenger car wheels are run. After a certain mileage under passenger cars, the wheels are put into freight service, and 90 per cent. of those removed from passenger service are found to be fit for freight use. It is largely to this early removal of wheels from passenger to freight service that the Boston & Albany Railroad owes its immunity from accidents caused by the breaking of steel car wheels. By many railroad men the Boston & Albany officers are said to be over-cautious in this matter, but their example is worthy of imitation by many roads that use wheels so long as to be almost reckless.

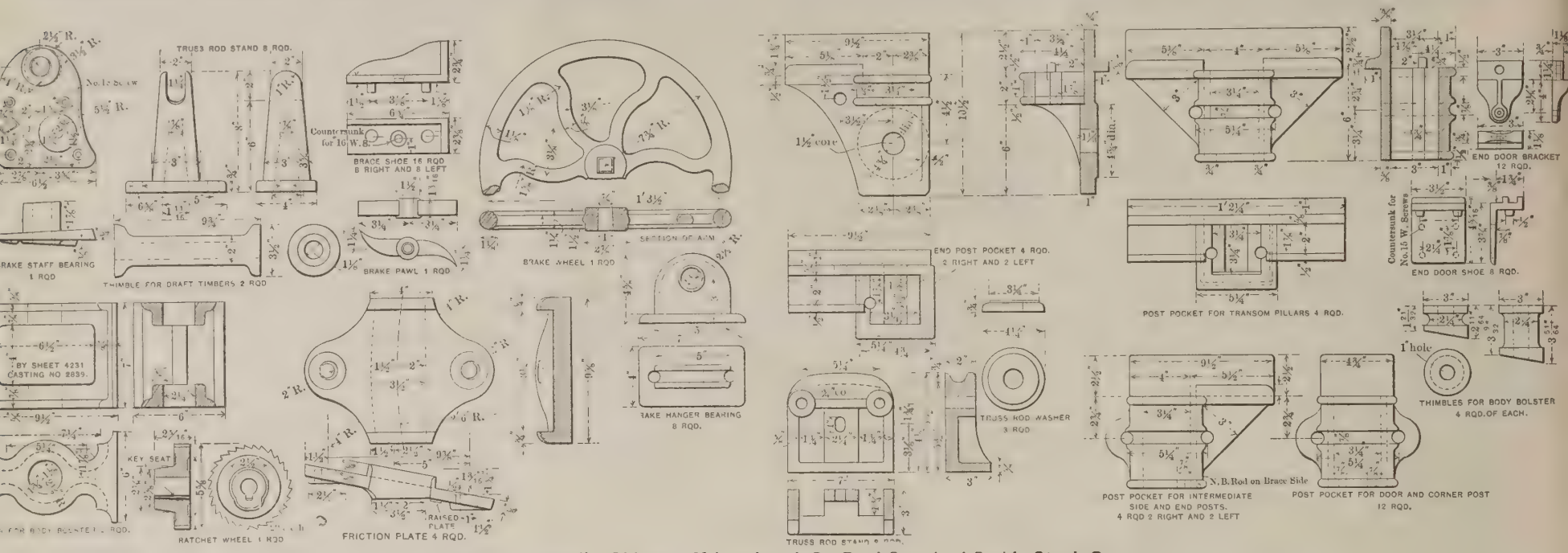
A simple but very effective method of keeping all bolts used on the system up to a certain standard is in use by the B. & A. people. The method in question is simply to tap all the nuts used on the entire road upon one special machine, and let each concern needing bolts make them to fit the nuts thus tapped to standard. By this method, which costs nothing, all bolts and nuts used on all divisions of the road, both in passenger and freight car and locomotive departments, are interchangeable, and give no trouble from odd or special sizes, etc.

Among other handy rigs in these shops is a jig for testing hydraulic jacks. It consists of four iron or steel rods about 1¼ inches in diameter, both ends of each rod being fitted into plates two inches thick and 12 or 14 inches square. It is probable that the rods were shouldered down slightly, and screwed into the plates, nuts were added outside the plates, and they added strength and stiffness to the rig. To test a jack it is placed on one of the plates, a block is put on top of the jack between it and the upper plate, then the jack is pumped up and allowed to stand for some time. In this manner the holding and the "running down" tendency, if any, can be detected. The same press, with a jack as the power, has proved very valuable for forcing in and out arbors of all sizes, and brasses could be handled by the same rig with little trouble.

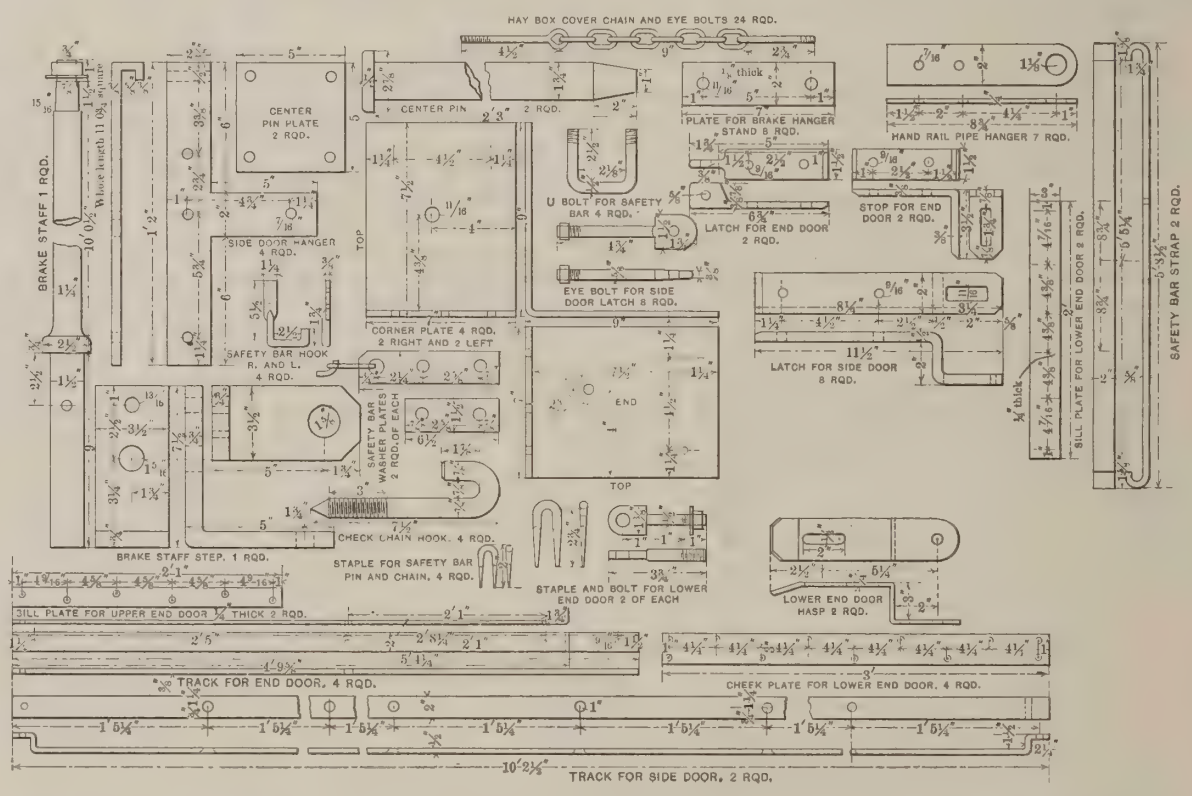
For a long time some railroads have made a practice of drilling the staybolts in all their locomotive fireboxes. A good many ⅛-inch twist drills are annually used up for this purpose alone. Only about one-half of a drill can be used this way, the twist only extending up that distance. To save a little in this direction, Mr. Hamlin, toolroom foreman of the Boston & Albany shops at Boston, hit upon the simple but efficient idea of turning the drills "the other end to," and drawing down the shank into a nice flat drill. By so doing, he gets much more wear out of each drill, and only about 1¼ inches is left after they become too short for further use.

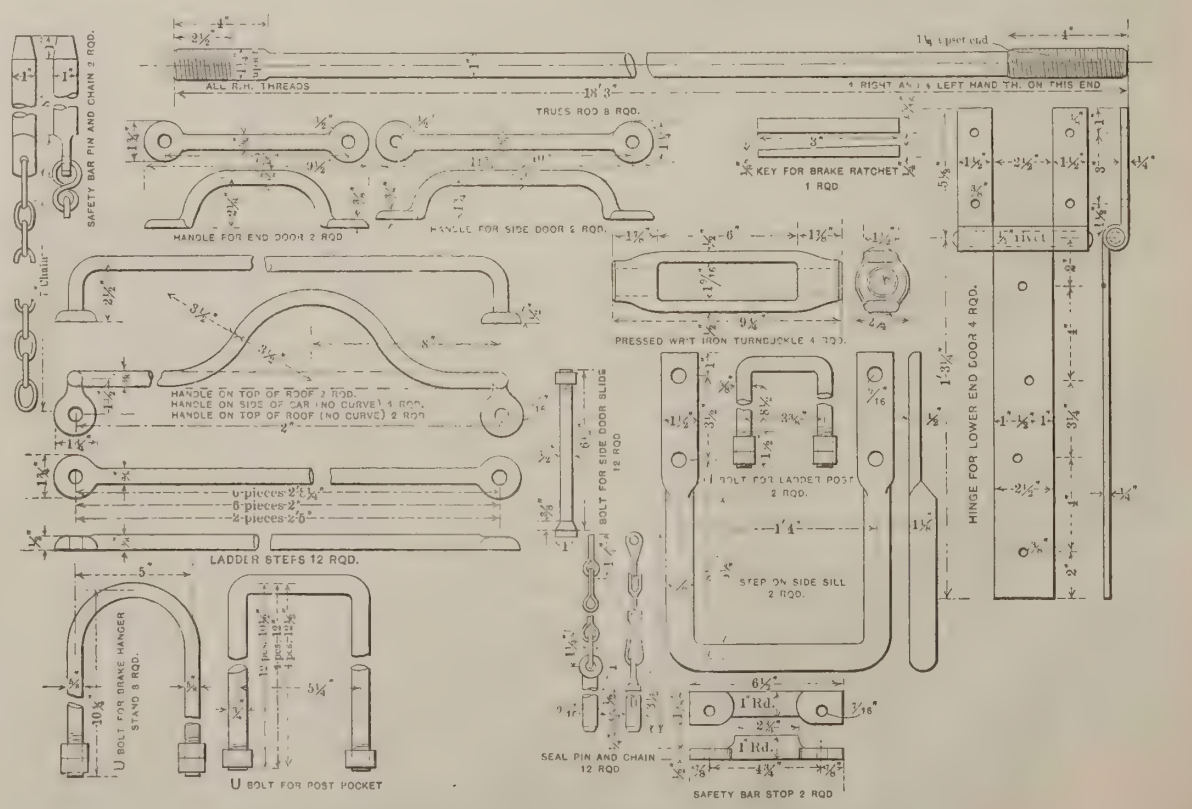
A very neat arrangement is in use in Mr. Adams' shop for getting different sizes of wheels into the press for putting on or pulling off. Blocking suitable for the various sizes of wheels is provided directly under the center of the press just where the wheels must rest, then the floor of the shop, for a distance of several feet, is hinged like the drop of a ferryboat landing. A lever controls the section of drop flooring, and when a certain size of wheel is to be handled, the requisite blocking is put in place, then a movement of the lever causes the wedges to slide forward or back just enough to bring the section of floor level with the blocking. The wheels can then be rolled on without having to skirmish around for planks to run the wheels upon, or without danger of running the wheels off the planking to the detriment of fingers, shins and morals.

A selling agent of the Vauclain wheel told the writer that his company was making quite a departure from the usual methods of wheel manufacture, the novelty consisting of making a complete wheel, and not having to go to several manufacturers for center, tire, etc. The wheel-makers certainly have plenty of time in which to perfect both their wheels and the methods of manufacture, for during a short conversation this agent learned that the Boston & Albany Railroad had only bought 24 pairs of steel wheels during the past year, and that during October only



Cast Iron Details, Chicago, Milwaukee & St. Paul Standard Stable Stock Car.





Forged Iron Details, Chicago, Milwaukee & St. Paul Stable Stock Car.

60 freight and 24 pairs of passenger wheels were purchased, and that no more would be secured during 1894. This very small purchase of wheels by a large railroad company is due entirely to the "depression." However, this agent might have received a grain of comfort had he heard Mr. Adams when he told the writer that he should soon have to commence building and repairing cars on a larger scale, as the constantly increasing business of the road would shortly demand more cars than were in condition for service.

At the shops of the New York & New England Railroad at Norwood, Mass., all box cars that need a little roof-patching are made to pass, but those needing extensive repairs are fitted complete with The Winslow Metallic Roof, which consists of wooden sheathing crossed by battens running crosswise of the car. The inner wooden roof (and the battens) is then covered with tin, over which another roof is placed, so that, in order to leak through into the car, the water must first go through an ordinary roof, then through an air space, a layer of tin, and another wooden sheathing. The air space adds to the even temperature of the car, and the layer of tin makes practically an air-tight roof, valuable for a refrigerator on frostproof cars.

Speaking of car roofs brings to mind a story told by the genial Mr. Adams, of the Boston & Albany road, about one of Mr. Furber's jokes. The Boston & Maine was having 100 cars built at Laconia, N. H., and an agent for a patent car roof, learning of the fact, started post haste from Boston to interview Mr. Furber, in the hope of placing his patent roof on those 100 freight cars. Mr. Furber received the agent in his usual hearty, although bursque manner, and after listening to many praises of that particular roof, dismissed the drummer with the remark: "Just as soon have that roof on the cars as any. You see the foreman at Laconia and tell him so." Away went the delighted drummer to Laconia, and to celebrate the event of a nice trade he indulged in a seat in a parlor car, and a pocketful of the best cigars. Arriving at Laconia, he lost no time in looking up the foreman and making known to him Mr. Furber's wishes. "Why," said the foreman, "*that lot of cars are all coal cars!*"

The New York & New England Railroad is building a single coal car which combines about as many good points as it seems possible to get together in a single car. It is 34 feet long, capacity 60,000 pounds, fitted with 4½ by 8-inch M. C. B. axles, Fox pressed steel trucks, National hollow brakebeam. new Buckeye No. 4 coupler, Westinghouse airbrake and drop sides, and drop doors in bottom of car. This car will be numbered 5001, and is the first of a possible series of numbers of like construction. This road is also fitting all its fast freight cars with the Westinghouse airbrake, as fast as possible, and the Graham draft rigging is also being put on.

Contract work is receiving considerable attention in the New York & New England shops. Mr. Geo. W. Wesley was recently appointed foreman of the machine shops devoted to locomotive work and general repairs. Mr. Wesley received a thorough education in machine work and the contract system in the Reading shops of the Philadelphia & Reading Railroad. He is well qualified to handle the difficult matter of transforming an old "day's work" shop, equipped with good men and machinery, into a first-class "contract" shop, where work will be turned out at the lowest possible cost and the workmen still receive the highest market price for their labor.

The keynote of the situation, as described by Mr. Wesley, is for each man to "work with his brains and hands too." Schedules of rates for the various operations are being prepared and adopted as fast as possible, and as a general thing the men seem to like the change. Of course some friction is unavoidable, but when the ultimatium is for each man to "adapt himself to the new order of things" or to get out," it is significant how many can successfully adapt themselves, and how very few "get out." In fact, only those irretrievably "in a rut" are the ones who leave, and such men can well be spared. The men are not required to work any harder or longer than they did before the change; they are only asked to make each move count, to use fast feeds, short cuts and improved processes; in short, to think and to use their thoughts and the thought of others. If a man can run two or three machines, he is given that number, and they are so arranged for him that he need exert himself as little as possible in operating the two machines.

As an example of what can be done by a well-organized contract system, the following is interesting: There are 212 locomotives to be kept in repair by that shop, and one man and a helper attend entirely to the driving wheels of this number of locomotives. He bores and turns tires, and bores all wheel centres and tires when new tires are put on. He has a quartering attachment to his wheel lathe and quarters all that need it. He also shrinks on all new tires (using a gas ring for heating), and presses the wheels on the axles. To do this, he works with his helper 14 hours per day 5 days in the week, and makes good wages.

Another example in point is the following: Two men pull off all the old wheels, pile the axles, after testing them, one pile consisting of the straight, the other pile of crooked axles. They also roll the wheels out of doors and pack them. All this is done for *three cents per axle.* Two wheels and an axle for three cents. Yet these two men make upward of twenty cents per hour each, and it is safe to say that they accomplish much more, and work little, if any, harder, than by the old day's work method

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A method of washing and renewing plush cushions, seat-backs and other upholstery is in use at the West Fitchburg shops, of the Fitchburg Railroad, which certainly does the business to perfection and with dispatch. This particular method consists of scouring the plush (without taking it from cushion or car seat-back) with a combined dye and washing compound, the liquid being vigorously applied with an ordinary scrubbing-brush. The composition of the liquid is kept a secret by the man who uses it, but, from the odor diffused during the scrubbing of a cushion, it is pretty evident that the green olive-oil soap used by wool manufacturers plays a prominent part in the mixture, which is of a red color and is kept in a tightly covered stone jar. One or two vigorous applications with the brush never fail to remove the smoke, dirt and stains from the blackest plush seat in the car. After the plush has been washed and dried, vigorous brushing with a short, stout brush is in order, to raise the nap which necessarily became badly demoralized during the washing and drying process.

It is a good plan for everybody to have some kind of "knitting work" to take up during idle moments, and car shops are no exceptions. Such work can be profitably kept ready for rainy days especially. In the Fitchburg car shops the work for laborers (outside men) during bad weather is the straightening of car axles. This branch of repairs has been reduced to an exact science on this road, and one machinist with a gang of laborers can straighten about as many axles in a day as he sets out to do.

The press used for axle straightening in these shops consists of a stout old lathe, with slide rest and legs removed. The body of the lathe is laid directly upon the floor, and a stout screw press made to run on wheels upon the lathe bed One gang of laborers will bring in an axle and slide it into the press. Then they retire to fetch another axle from a push car loaded with them on a track near by. The "press gang" raises the axle into position between the lathe centers, and the bent place is quickly located and reduced beneath the press screw. By the time another axle is at hand the "taking away" gang has removed the straightened axle and another one is put in position.

A great difference of opinion exists between master car builders, and master mechanics as well, as to the benefit to be derived from heating old axles. While one road heats every old axle that comes into the shop, and examines it closely while heated, to detect the cracks which become quite plainly visible while under heat, some other roads condemn the practice of heating and say that it hurts the iron. Others claim that heating an axle does more good than harm, for, besides revealing possible cracks, the heating and partial annealing must go far to redistribute and equalize the strains caused by pounding over the rails for thousands of miles. In fact, the tendency toward crystallization is largely corrected by heating and slowly cooling car axles.

In the Fitchburg shops 24 parallel tracks in each shop and a number of outside tracks are served by a large transfer table which is operated electrically. It is fitted with a double trolley and takes current from the incandescent light circuit. The motor is arranged by means of friction clutches, to drive either the table or a capstan placed on the table. By means of a cable and snatch-blocks at each end of the transfer-table cars are readily pulled on and off, and snatch-blocks located far into the shops allow cars to be set directly onto the farther end of all the shop tracks. In winter when the transfer-table pit gets full of snow the table is shoveled full, then it is run to the shop tracks and the snow shoveled directly upon flat cars and hauled out of the way.

In many railroad shops the practice is followed of punching brake levers entire—holes and all—from flat bar iron of the requisite thickness. This method is highly praised by some master car builders, and is just as vigorously condemned by others on the ground that a hole punched cold near the end of a narrow bar of iron is almost sure to crack out. In support of this statement many brake levers with cracked ends were exhibited, and specimens of forged levers with drilled end holes were brought forth with the remark that "they *never* cracked." The objection is also raised that with a punched hole the earing of the pin is not square, owing to the fin raised where the punch leaves the hole and the depression caused where it enters the me al. These matters should receive the attention of master car builders, who must each decide the matter for himself after due consideration.

Self acting, self-registering devices for indicating when cars are fully loaded have been in existence for many years, but they do not seem to fill the "long-felt want." Cars are still badly overloaded, and orders are disobeyed in that respect day after day. A car was recently sent in for repairs with a broken axle (3¼ inches by 7 inches), and the load actually weighed over 50 tons. Undoubtedly very many breakdowns are directly caused by the same thing, and there should be devised by the Master Car Builders' Association some method by which overloading can be prevented, or at least checked to a great extent. Only very stringent rules, and their vigorous enforcement, can avail in this matter, and the sooner such rules are formulated and enforced the better it will be for all concerned.

Some Reasons for the Many Fatalities on American Railroads.

In a paper on "Impressions on European Practice," read by Mr. E. M. Herr to the September meeting of the Western Railway Club, the statement was made that in 1892 1,210 persons were killed and 6,562 were injured on the 21,935 miles of railroad in Ohio, Indiana and Michigan; and that on the 26,207 miles of railroad in Germany but 483 were killed and 2,338 injured. The author considered the large difference in the number of fatalities as "a disgraceful showing for the American roads."

At the following meeting of the club, Mr. F. A. Delano, in speaking of the matter, said that there are some extenuating circumstances connected with the frequent fatalities on American railroads, and that the real trouble is as much, and probably more, with the American people as a whole, and with public opinion as a whole, as it is with railroads. It seems to be the right of every free-born American citizen to walk on the railroad track; and it is a fact that if you should arrest a man for walking along the railroad track, and could not prove that he had been robbing you or injuring your property in any way, any justice would dismiss the man and lecture the railroad official for being so hard on a poor man.

Even out in the country it is a well-known fact that the railroad right of way is used as a short cut, a path from one place to another; and if you wanted to fence it up and then patrol it in such a way that no one could use the right of way for that purpose, you would meet a storm of public opinion at your little towns and country stations that you could not stand up against.

Another way in which a great many people are killed, and which seems to meet with popular approval, is the way people crowd on the freight trains, stealing rides. It is safe to say that there is not a freight train running that has not ten or a dozen people on, stealing rides; and in the cities in the morning and evening you will see the switching trains and switching engines and the freight trains simply loaded down with workingmen and boys going to and from their work. Now it does not seem that the casualties arising from these practices ought to be laid at the door of the railroads themselves. It seems that there is a want of education of the public at large.

Superheated Steam.

Between 1860 and 1870 superheated steam was very extensively adopted, especially for marine engines. After 1870 its use was soon discontinued. The reasons for this were probably these: (1) As the steam pressures used were increased, the range of superheating possible within the limit of danger to the lubricant was decreased, and the advantage of superheating correspondingly diminished. (2) The large superheaters in the uptake proved, in some cases, to be dangerous and liable to become overheated. (3) As the designing of steam machinery became more a matter of routine, and competition reduced the profits of engine building, the construction of engines fell into the hands of engineers who understood the action of the steam less well than the engineers who introduced superheating in 1859-60, and these regarded superheaters as unnecessary complications which it was convenient to abandon.

Probably it has come to be accepted as an axiom by most practical steam engineers that, in modern conditions of working, superheating is useless or impossible. Some reasons for such a belief, arising out of difficulties experienced, no doubt there are. But if engineers generally had fully appreciated the magnitude of the loss due to condensation in the cylinder, it is difficult to think that superheating would have been abandoned with so little of a struggle to overcome the difficulties, and that, for so long, while every other means of securing economy has been tried, superheating has been neglected. It is sometimes said that the quantity of heat in superheated steam in excess of that in saturated steam is very small. That is so, of course. But the earlier experience showed that this small quantity produced a disproportionately large beneficial effect.—*Prof. W. C. Unwin, in Cassier's Magazine.*

Ventilation Provided for Congress.

In describing the system of ventilation employed for the House of Representatives in the national capital, the Hartford *Times* says that for this purpose 16 steam fans are employed, the largest of them being 16 feet in diameter, and resembling the paddle-wheel of a steamboat. Standing in one of the tunnels in the basement of the Capitol, through which an artificial breeze rushes continually at the rate of 26 miles an hour, one feels unpleasantly chilled during the hottest hours of a summer day. When the galleries are crowded every member and spectator in the House is provided with 60 cubic feet of fresh air every minute. In order that the air thus supplied shall contain the proper amount of moisture, it is made to pass through stone-lined compartments where fountains of spray are kept perpetually playing.

One of the oldest engineers in the service of the Baltimore & Ohio dropped dead in the cab of his engine while his train was approaching Sandusky, O., recently. Heart disease is reported to have been the cause of his death.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* NATIONAL CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion must be received not later than the 25th day of each month.*

To Subscribers.—*The* NATIONAL CAR AND LOCOMOTIVE BUILDER *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.*

A QUARTER OF A CENTURY.

With this issue the 25th volume of the NATIONAL CAR AND LOCOMOTIVE BUILDER is completed, as is also the 25th year of its existence. A quarter of a century is a long time and brings many changes, especially in such wide-awake and busy times as this country has seen since the advent of this paper. It is not the purpose of this article to describe the changes and advancements that have been made in railroad rolling stock in the last 25 years, although this would be a very interesting theme. What is intended is to make a few remarks relative to the useful and successful career of this paper during its existence. The paper has never been given to blowing its own horn, preferring rather to industriously pursue the aim of its existence: to be the best medium of conveying useful information to those connected with the construction and maintenance of railroad rolling stock, and to leave the matter of praise to others. It is only proper to say that through the kindness of its appreciative readers there has always been enough of commendation to cheer the members of its staff, and to encourage them to feel sure that their frequently arduous efforts in what they believed a good cause were not in vain.

In the salutatory of the first issue of the NATIONAL CAR BUILDER it was announced that the aim of the paper would be:

"To promote the interests of that department of mechanical industry indicated by its name. It is designed to be a medium for such information as will be useful to all who are concerned in the construction and equipment of railways, and especially to those more directly interested in car building. . . . Our columns will be opened for the discussion of all matters calculated to interest the class of readers for whom our paper is designed."

This was a good foundation to build on, as the future of the paper proved. As first published the NATIONAL CAR BUILDER consisted of six pages of reading matter, the pages being 11¼ inches by 8½ inches; and these dimensions continued to be the size of the page for 12 years, when it was found expedient to enlarge the size of the page to its present dimensions—16 inches by 11¼ inches, the largest page of any railroad paper in the world. This was made necessary in order that drawings of new and improved designs of rolling stock could be reproduced sufficiently large to clearly show the general and detail construction, and all necessary dimensions. The paper, being recognized as the best of its class by car and locomotive builders, was furnished with drawings of all new and improved designs of construction, and the publication of these on a liberally large scale in the paper accomplished a very important work in the widespread improvement of American rolling stock, and in the modification of foreign rolling stock to correspond with such improvement. There is constant and gratifying evidence that this very valuable work of the paper continues uninterruptedly.

In 1886, in the seventeenth year of publication, it was found necessary to alter the name of the paper to correspond with the previously enlarged scope of its news matter. The constant improvements in the important details of locomotives demanded considerable notice, the extent of such notices finally equaling those relating to car matters. So the name of the paper was changed to the NATIONAL CAR AND LOCOMOTIVE BUILDER.

When the publication of the paper was begun, its list of subscribers was very short, and the outlook at that time held no visible promise of large increases in this respect. Good management and able editing, however, soon pushed the paper into popularity, and, as the era of industrious railroad building set in, the extension of the subscription list kept pace with that of the railroads. Early in its history it attained the distinction of having as subscribers a greater number of railroad mechanical officers than any other railroad paper, and it is a most gratifying fact that it has never lost this prestige. To-day it counts as its subscribers more American and foreign railroad operating and rolling stock officials than does any other American journal; and what is still more gratifying than the mere numerical strength of this support is the happy distinction that it embraces the most intelligent, considerate and progressive railroad officers of the world. These are not all in the United States, but every issue of the NATIONAL CAR AND LOCOTIVE BUILDER finds them in Japan, Australia, India, Italy, Spain, Portugal, Belgium, Austria, Germany, England, Ireland, Scotland, France, Russia, Denmark, Norway and Sweden, Canada and Mexico, Brazil and Argentina, Uruguay and Paraguay, Chili, Peru, Ecuador, Colombia, Venezuela, Guatemala, Cape Colony, Cuba and the Hawaiian Islands.

The first issue of the paper announced that

"A limited number of advertisements will be accepted for the cover."

The demands of the manufacturers of cars and locomotives, and of car and locomotive appliances and supplies, machine shop tools, and material and supplies, eventually forced the abandonment of this policy and the provision of pages to show their advertisements. It was soon learned that the NATIONAL CAR BUILDER was the most valuable advertising medium, in its respective field, that existed, and it was given a thicker coat of advertising pages, containing the advertisements of reputable manufacturers, than any monthly railroad paper in the world possessed. From early in its career it has been the policy of the paper to publish notices and illustrations of improved machine tools and other mechanical appliances, also notices of articles of American manufacture, that the staff considered of interest to the readers; but no paid advertisement has ever appeared in the reading columns of the paper, except the usual want "adlets" in their assigned regular place. This generally understood policy of the paper continues, as does also its recognized prestige as an advertising medium.

With the first issue of the NATIONAL CAR BUILDER was begun a directory of master mechanics and master car builders. It occupied a page and a-half of the paper. This directory has always continued to be a prominent feature of the paper, and has been extended to include the mileage and the car and locomotive equipments of railroads, and the names and addresses of managers and superintendents and purchasing agents, as well as those of master mechanics and master car builders. Growing with the American railroad system, the directory grew until at the present time it covers nearly five of the paper's present large pages. Special pains are taken to keep it complete and correct in every particular, and in this very generous aid is given by the railroads of the country, over 500 companies sending direct information concerning their officers and the other items noted in the directory.

Another special feature of the paper that has always been maintained is its liberal and accurate personal mention of the changes of railroad officers. In this connection, it is interesting to note that the first personal mention appearing in the first issue of the NATIONAL CAR BUILDER was to the effect that:

"F. D. Adams has been appointed Master of Car Repairs on the Boston & Albany Railroad, in place of Calvin Stebbins, deceased."

As every railroad man knows, this fine old gentleman and typical master car builder is still at the head of the car department of the railroad named.

Among the first requisites of a good newspaper are: Good paper; good clear, easily readable type; good engravings; orderly arrangement, and a minimum of typographical errors and inelegancies. The gratifying and long-standing popularity of the NATIONAL CAR AND LOCOMOTIVE BUILDER is due in a large measure to the fact that in these particulars it has always excelled its contemporaries. It is printed on the best obtainable paper, even the pages of its earliest issues still being firm and fresh, and giving promise to continue so for a century to come. Its engravings of both photographs and line drawings are the most excellent that the engraver's art can produce. The type is selected for its general optical excellencies, and is set by the most expert compositors in New York city. Typographical errors are guarded against by watchful proofreaders and careful editing, and, as is generally conceded, the orderly arrangement of the NATIONAL CAR AND LOCOMOTIVE BUILDER excels that of any American technical paper published. Its readers always know just where to *find* any article of news they seek. The editorials, the communications, the personals, the miscellaneous paragraphs, the literary and trade notices and the notices of official changes all have their permanent and respective places in the paper. These qualities make an easily readable paper, one communicating its information in agreeable ways that do not tire the eyes or the receptive faculties. It is but fair to say that these refinements of journalism are only secured by the expenditure of much money and painstaking effort. Modesty forbids particular mention of other editorial excellencies of the paper, beyond the bare statement that its contents have always been of an essentially practical nature, and that the language of its reading matter is always plain, concise and to the point. Indeed this could hardly be otherwise, as for many years the editors of the paper have been practical railroad men of ripe mechanical experience.

The foregoing briefly reviews the career of the NATIONAL CAR AND LOCOMOTIVE BUILDER, and gives a conservative idea of the character the paper has always had from its inception. It has been zealous in giving the news, conscientious in its advocacy of improvements in the design of cars and locomotives, and of methods of operating calculated to improve the efficiency, popularity and economy of train service. It has always fearlessly upheld the right as it has seen the right; and generally with good judgment. In short, its aim in the past has been, as it will be in the future, to advocate constant improvement, and to disseminate information of a character calculated to benefit and prove useful to its readers.

COMMITTEE WORK.

The appearance on another page of a circular of inquiry from the Master Mechanics' Association committee on the "Causes of Bulging of Firebox Sheets" is a reminder that the time has come for the committees of the Master Mechanics' and Master Car Builders' associations to begin in earnest the investigation of the subjects assigned to them. In work of this kind we are all prone to consider the subject in hand passively for a considerable length of time. Contrary to the belief of many, this time is not wasted, but is probably employed in the most advantageous manner. During this season of passive contemplation the mind is held open to receive impressions from every direction. Figuratively, it is a bird's-eye survey of the field, by which the relative position of the particular matter in hand to other things is observed. This fixes in the mind the proper scope of the investigations and the probable value of their results. This is in many respects similar to an engineer's preliminary survey of a proposed railroad route. The work is absolutely necessary for the best results. The trouble with us is that we are apt to stay in the clouds too long, and to continue our passive survey when we ought to be getting down to hard facts and submitting the details of the matter in hand to close inspection and concentrated attention. This is a common fault, but no less a fault that all workers in a good cause should strive to conquer.

At the last Master Mechanics' convention a good deal was said about the importance of having the committee reports published and sent to the members of the association in time to be read before the meetings of the convention, so that the discussion and treatment of the subjects might be more studied and considerate. It seemed to be the general idea that the secretary of the association was to blame for not having this done, and that he could do it just as easy as not, if he would. It developed, however, that to do this it was necessary that the committees should have their reports finished and sent to the secretary by the first day of May. The complete reports and all the drawings and matter for illustration should be in the secretary's hands by the date mentioned. If sooner, all the better, but not later than this, because about three weeks are needed to have the engravings made and the reports printed and bound. If they are then mailed immediately to the members it will be the first of June before those living in the extreme West, Northwest and Southwest parts of the country will receive them. These members usually leave home about June 1 to attend the conventions, so it is evident that there is very little spare time to do what is wanted when the reports are all in by May 1. If they are later than this it will be almost impossible for the secretary to get them mailed in time to reach the members before leaving home.

In much the same way it can be shown that the committees are not entirely independent in the preparation of their reports. They naturally depend on the assistance of the membership for most of the information they are able to acquire. They issue circulars of inquiry soliciting information, and instead of the members giving these prompt attention and early replies, they are in too many cases pigeonholed until the more convenient time that is uncertain in coming. In this way committees are hampered in the preparation of their reports, dilatory replies sometimes coming in after most of the work of preparing a report has been done, and frequently necessitating much extra labor.

From the foregoing, it is plain that the success of committee work depends very largely on the membership. Circulars asking for information should be issued before the first of the year, and every member who receives one should answer it and contribute his mite of information by the 1st of February. This would leave the committees ample time to digest the acquired knowledge and prepare their reports.

Another phase of this subject that is deserving of attention is the need of more energetic co-operation between the chairmen and members of committees. Some associations appoint a reporter to investigate and report on any subject in regard to which information is desired. He collects the information and makes his report to suit himself. Our mechanical conventions hold the opinion that two heads

are better than one, and that several heads are better than two. Consequently nearly all committees except those on subjects of minor importance are made to consist of four or five or more members. But in many cases the associations are cheated out of the advantages of having these several trained and experienced minds co-operate in the acquirement and digestion of the available knowledge concerning any chosen subject. The bulk of the work is too frequently left for the respective chairmen of the committees to do, the other members of the committees passively delegating to the chairmen their privileges and authority and the labor of investigation. The results in such cases are that the committee *representing the association* is merely nominal, and the chairman is turned into a reporter.

Looking at the matter in this way it appears that the members of committees shirk their share of the assigned work. This is sometimes charged. There are other aspects of the matter, however, that present it in a different light. The presidents of the associations appoint the committees and name the chairmen. Custom in the Master Car Builders' Association, and the constitution of the Master Mechanics' Association, make this naming of the chairmen final. It is not at all evident that this is best. According to parliamentary rules a committee has a right, when appointed, to meet and elect its own chairman. As in the case of the M. M. and M. C. B. associations this privilege does not exist, the appointed chairman of a committee is regarded by everybody as its head, and the other committee members generally await his instructions. Sometimes a chairman will regard himself as the head, front and both sides of his committee, and will call upon his colleagues for slight, if any, assistance. It looks somewhat as if increased interest would be awakened in the members of committees if a different arrangement could be adopted by which committees could be appointed before the adjournment of conventions, so that they could meet and elect their respective chairmen. The chairman being of the committee-members' own selection, they would probably feel more bound to give him their support and assistance in his work than under present conditions. An elected chairman would be more apt to depend and insist upon the assistance of his colleagues, and thus the object of the appointment of a committee would be most likely accomplished.

The value and efficiency of the work of the railroad mechanical conventions depend largely on the efficiency of its committees of investigation. Everything that can be done to increase this should be furthered by all interested in the success of the associations and in the improvement of American railroad service. As we have pointed out in the foregoing, the success of committee work depends l rgely on the co-operation of the membership of the associations and of the individual members of the committees, as well as on that of the chairmen of committees and the secretaries of the associations.

AMERICAN AND ENGLISH LOCOMOTIVES.

The total value of locomotives exported from England during the first nine months of the current year amounted to $1,100,000 less than for the same period in 1892. English locomotive manufacturers are experiencing increasing difficulties in competing with American locomotive builders for export trade, despite the cheaper labor and materials in England compared with the same here. In our opinion this condition is a very natural one, and due principally to the difference in design of American and English built locomotives.

American locomotives have been found cheaper to maintain in foreign countries than English locomotives, and this is largely due to their greater simplicity of construction and more easy accessibility for needed repairs. The American engines are the most comfortable and easy to fire and run, and as a rule they are easier riding. These qualities win the admiration and liking of the train and enginemen, and these constitute a very powerful factor of their success on the railways of the world. English manufacturers are beginning to appreciate the truth of this, and to modify the construction of their engines accordingly, and it follows that in recent built English engines intended for export we find efforts made toward the adoption of some of the popular features of American locomotives. This is generally rather grudgingly done, however, and the results are proportionately disappointing.

It is not our province to tell English locomotive builders how to build engines for export, but speaking from practical experience we can assure American builders that the way to win supremacy in the export trade is to keep on as they have begun, and put good material in the engines and good workmanship on the material, and to make the engines as easy to repair and as easy and comfortable to operate as possible, with the aim always to promote economy of fuel ; and then the American locomitive will demonstrate its superiority in all-around railroad work and its supremacy in the esteem of the railroad men of the world.

RECENT ROBBERIES.

We have been having an epidemic of train robberies on our Western roads during the last two months that is a disgrace to our authorities charged with the preservation of the peace and the prevention of crime. A few bands of outlaws have defied and are still defying the power of the nation. Their fate is certain, but the disgrace is that it should be so long postponed, and that in the mean time their robberies and depredations are permitted to continue. They are as sure of capture, imprisonment, and we trust in some cases execution, as anything can be, but their career ought to be cut short, and our national police organization should be perfected to prevent future depredations of this character.

The frequent robberies have caused numerous suggestions for the protection of trains in like cases. Some propose robber-proof express cars. Others propose a form of fortress on the locomotive tender; and others propose equipping the locomotive with an arrangement of pipes that will eject steam in all directions so as to blind the robbers; and still others propose that hot water should be ejected from a similar apparatus to scald to death the wicked outlaws.

If we are to continue a civilized nation, all such arrangements as this must be made unnecessary by the protection of our laws and by their action and enforcement throughout the limits of their jurisdiction. A train crossing the Rocky or the Sierra Nevada mountains, the deserts of the West or the wildernesses of the Indian Territory must be made as safe from unlawful molestation as a pedestrian on Broadway. The proper enforcement of our laws and the needed perfection of our police will accomplish this, and nothing else will.

CONFERENCE OF MANUFACTURERS.

A number of manufacturers will meet in Cincinatti, O., on Jan. 22 for the purpose of forming a national association of manufacturers to promote legislation that will encourage all classes of manufacturing industries and to promote trade relations with foreign countries, with the aim of establishing in South American capitals and other desirable points permanent expositions for the display of American products.

This is a very commendable undertaking, and if the objects named are zealously pursued the results will prove that there is a very large field in foreign countries, and especially in South American countries, for our manufactures. This has been a long neglected field, and its cultivation will certainly prove highly profitable.

We not only produce the best cars and locomotives for the railroads of these countries, but we also make the best machine tools for their maintenance, and the best agricultural implements and tools of every description. Everything that South Americans need we can supply in much improved quality and form compared with what they now put up with from European countries. As proof of this some of the European manufacturers are sending their goods to South American markets and palming them off as North American articles, of which they are but miserable couterfeits. The field is rich in possibilities for good goods from honest American makers. There are some difficulties to overcome, such as the exorbitant freight rates between here and South American ports, but the best way to regulate such matters is by organized and energetic action, such as we understand is contemplated by this proposed national association of manufacturers.

Apropos of the advice we gave North American railroad men in our last issue to not seek employment in southern foreign countries just now, the following letter, received in this country Nov. 19, from an employee of the Panama Railway at Colon, the eastern terminal of that road, is pertinent :

"There are to-day on the Isthmus crowds of well educated, good intentioned machinists and craftsmen of all kinds who are starving, dying of hunger and sickness brought on by exposure and neglect, and every boat brings more, and there is not work for any of them. Since the revival of work on the canal the canal company has not hired one single man, except negro laborers at 60 to 70 cents a day, Colombia silver. This equals 27 to 31 cents in American money. There are now Americans here starving to death, and many dead, who gave up places at home to come here."

Draft Rigging Between Center Sills.

One of the topics discussed at the October meeting of the Western Railway Club was the relative advantages of placing the draft rigging of freight cars between the center sills instead of the usual arrangement of draft timbers and rigging beneath the sills. It appears that the Chicago, Burlington & Quincy Railroad was the first to try the experiment, which was done with some furniture cars in January, 1890. The results were so satisfactory that the arrangement of attaching the draft rigging direct to the center sills and carrying it between them, thus dispensing with the usual draft timbers, was adopted as a standard feature of freight car construction on the C., B. & Q. During the nearly five years since the change was effected there has been no case of damaged center sills on this road, except in cases of wrecks. Mr. William Forsyth, of the C., B. & Q., in speaking on the topic said : "If other roads had gone into this construction five or six years ago, as we did, we would have a great deal less trouble with repairs to draft timbers and draft gear generally. . . . After an experience of five years with this construction I can certainly recommend it as a very important improvement in the design of freight cars."

Mr. Townsend, of the Chicago & Alton, said that his experience differed from Mr. Forsyth's. A number of low, flat cars on his road, built in this way, did not do well, and he found it was much more expensive to replace a center sill than a draft timber.

Mr. Waitt, of the L. S. & M. S., said that he had 700 cars with the draft rigging between the sills. In these cars, in order to avoid as far as possible the likelihood of the tearing out or breaking of the center sills, in case the cars should get a severe blow that would knock the draft rigging out, the sills were re-enforced on the inside with pieces about 3 inches by 8 inches that went back beyond the bolster, and were well bolted to the sills. The side castings for the draft rigging were fastened to these auxiliary pieces. But one car had to have the center sills replaced in consequence of draft rigging being torn off, and in this case the damage resulted in a wreck, in which some of the intermediate sills were also broken. Mr. Waitt's observations were altogether favorable to the new construction. Speaking of the matter he said, "When we get our center sills made of steel instead of wood I think perhaps we will have gone a step farther in the right direction." .

Mr. Barr, of the C., M. & St. P., said that while it might not cost more to maintain cars with the arrangement described by Mr. Waitt (with the short pieces on the inside of the sills), yet when the draft rigging was attached direct to the sills he felt satisfied that it would finally result in increased cost of repairs.

Mr. Schroyer, of the C. & N. W., also opposed the new construction, and said that he regarded it as a necessary weakening of the sills. He regarded the resulting increased cubical capacity of the car as more of a bid for traffic than as a measure of improved construction.

Mr. R. D. Smith, of the C., B. & Q., said that after nearly five years' service the draft rigging and sills of the cars with the new arrangement are in practically as good condition as when first applied, and the sills have no reinforce pieces to strengthen them. Speaking in detail of the arrangement, Mr. Smith said :

As first designed, a wrought iron plate was placed next the sill; and on it, and bolted through the sill, were placed the draw lugs which depended entirely on three bolts to hold them. The shrinkage of the wood in the sill would loosen these bolts enough to make a shear of the wrought iron pieces and the result was that, in switching service, the shock given the back or buffing draw lug would shear the bolts. To overcome this trouble, the wrought iron piece placed next the sill was made somewhat longer, and the ends flanged to make a stop, and an oak piece was placed between this flanged end and the iron transom. Since that change, we have not had a bolt to remove on account of shearing or bending. By fastening the draft rigging to the center sills we do not have to maintain the draft timber bolts, which we all know are quite an item of expense.

The Chairman, Mr. G. L. Potter, of the Pennsylvania Railroad, said that a couple of years ago several hundred Pennsylvania furniture cars had been built with the draft rigging between the sills, and he believed these were the most substantial cars in service. No failures had been reported. Speaking further of the improved construction, he said :

In enables us to use a plate on the end sill so constructed that a hole passes through it, through which the drawbar is applied: The metal which is removed to form that hole is in the shape of a flange surrounding the hole which gives a bearing surface for the coupler and also strengthens the plate, making the form of an angle iron. With a construction of that kind the Master Car Builders' coupler could be changed so that it would be very materially benefited; that is, the guard arm could be made so that it would form a bearing on the end sill so that any shock which the guard arms might take up would be transferred directly to the end sill by a pressing strain rather than by the strain that they are now subjected to. When a draft rigging of this kind was first suggested several years ago I was very skeptical about it, but since we have had some experience with it I feel that it is a much more substantial arrangement than where the draft timbers are secured to the under side of the sill.

Mr. Rhodes, of the Chicago, Burlington & Quincy, indorsed what Messrs. Forsyth and Smith had said of the durability of the improved arrangement of placing the draft rigging between the sills. Continuing, he said:

There is always a desire to increase the height of cars. Here is a very easy way of gaining eight inches in the interior of your cars, which must be a great consideration where there are tunnels or low overhead bridges.

Master Mechanics' Association Circular.

Causes of Bulging of Firebox Sheets.

The committee appointed on this subject has issued a circular requesting information that may assist its investigation of the matter. The circular asks :

Is the difficulty caused—

First—By accumulation of mud or scale, preventing the sheet from receiving the necessary protection of the water?

Second—Insufficient water space, preventing free circulation and tending to drive water from sheet?

Third—Bad water; that is, water containing such impurities and other hurtful substances, producing excessive foaming and tendency of water to leave the sheet?

In sections where bad water is prevalent, experience has led to a constant fight to keep boilers clean, and when very little neglect shows itself in the bulging of sheets and other serious results, it seems wise and helpful to get all the practical experience possible. With a view to broadening the scope of the Committee's inquiry, any information relative to the subject, or concerning (a) methods of preventing firebox sheets from bulging, or (b) how to take care of boilers in bad-water districts, will be pertinent and very acceptable.

Answers should be sent to Mr. Pulaski Leeds, Superintendent Machinery, Louisville & Nashville Railroad, Louisville, Ky.

Personal.

Mr. C. Huntington has been appointed General Superintendent of the Iowa Central.

Mr. T. W. Garrett has tendered his resignation as General Manager of the Atlanta & Florida.

Mr. George Donahue has been appointed Master Mechanic of the Mahoning division of the New York, Lake Erie & Western.

Mr. Norman E. Sprowl has been appointed Division Master Mechanic of the Central Railroad of New Jersey, at Phillipsburg, N. J.

Mr. H. R. Nickerson, Assistant General Manager of the Mexican Central, has been appointed General Manager, succeeding Mr. Edward W. Jackson, resigned.

Mr. C. H. Sherman, General Manager of the New Orleans & Northwestern, has resigned, and the duties of General Manager will be performed by Receiver L. K. Hyde.

Mr. John S. McCrum, Superintendent of Motive Power and Machinery of the Kansas City, Fort Scott & Memphis, has resumed his official duties, after an absence of one year on account of poor health.

Mr. S. D. Chittenden has been appointed Purchasing Agent of the Carrabelle, Tallahassee & Georgia Railroad and the Gulf Terminal & Navigation Company, with headquarters at Tallahassee. Fla.

Mr. Walter T. Rupert, heretofore Foreman of Locomotive Repairs of the Detroit, Lansing & Northern, and Saginaw Valley & St. Louis, has been appointed acting Master Mechanic of those roads, with headquarters at Ionia, Mich.

Col. A. H. Waterman, who was Chief Engineer of Construction of the Panama Railroad, died at his home in Chicago, Oct. 26. Colonel Waterman was born in New York State 70 years ago, and has held prominent positions on many railroads.

Mr. Willard Kells, son of the late Ross Kells, and hitherto general foreman of the Meadville (Pa.) shops of the N. Y., L. E. & W., has been appointed Master Mechanic, in charge of the shops at Cleveland, O., to succeed Mr. T. Carmody, resigned.

Mr. Leslie McLachlin, formerly connected with the Wabash, has been appointed Master Mechanic of the Kansas City, Osceola & Southern, with headquarters at Clinton, Mo. He will have charge of the machinery and car departments, succeeding Mr. J. B. Boone.

Mr. Charles H. Schlacks has been appointed Assistant General Manager of the Denver & Rio Grande Railroad, with headquarters at Denver, Colo. Mr. C. H. Schlacks is the son of Mr. Henry Schlacks, the Superintenden of Motive Power of the Denver & Rio Grande.

Mr. D. W. Caldwell, President of the New York, Chicago & St. Louis, has been elected President of the Lake Shore & Michigan Southern. He succeeds the late John Newell. Mr. Caldwell was appointed General Manager of the Lake Shore road immediately after Mr. Newell died.

Mr. James Meehan, who was for many years Superintendent of Machinery on the Queen & Crescent lines, and who resigned that position about two years a o, has been appointed Superintendent of Motive Power and Machinery on the South Carolina & Georgia Railroad. Mr. Meehan succeeds Mr. E. M. Roberts.

In our announcement last month of the extension of the jurisdiction of Mr. John Henney, Jr., to cover the mechanical department of the entire New York, New Haven & Hartford system, we said that his office was moved to Boston. This part of our announcement was an error. Mr. Henney's office continues to be at New Haven, Conn.

Mr. Alfred Walter, General Manager of the Erie division of the New York, Lake Erie & Western, has been chosen President of the Delaware, Susquehanna & Schuylkill. Mr. Walter has tendered his resignation as General Manager of the Erie division of the New York, Lake Erie & Western, to take effect Jan. 1. He has been General Manager since March 1, 1892, and was before that for nearly three years General Superintendent of the Baltimore & Ohio lines east of the Ohio River. He was formerly connected with the Pennsylvania system for many years.

Mr. Charleton B. Hutchins, President of the Hutchins Refrigerator Car Company, of Chicago, and head of the firm of C. B. Hutchins & Son, manufacturers of freight car roofing, died at his residence in Detroit on Thursday night, aged 80 years. Mr. Hutchins was born in Bath, N. H., in 1814. He went to Ann Arbor in 1868 and began experiments in car roofing and refrigerator cars. He obtained patents on both, and then went to Detroit and organized the car roofing firm and later the Detroit Refrigerator Car Company. This was moved to Chicago, and is known as the Hutchins Refrigerator Car Company.

Mr. George A. Haggerty, Master Mechanic of the Atlantic Division of the Canadian Pacific, has resigned. This division was formerly the New Brunswick Railroad. Before and at the time of its absorption by the Canadian Pacific Mr. Haggerty was its Mechanical Superintendent, having held that position since 1885. The New Brunswick road was very poorly equipped in every way, and Mr. Haggerty's position has been one of arduous responsibility and hard work, and he lays down the burden with relief. He is a very capable and experienced mechanical officer. He was for some time Superintendent of Motive Power of the Chesapeake, Ohio & Southwestern and for several years was Superintendent of Motive Power of the Texas & Pacific.

"The Thunderbird."

Wa-ka-ta and his Lanuna
Stood at twilight near the trail;
They had come to see the Thunderbird
That bends athwart the vale.
When at last a light shone o'er them
Through the drab and dewy dawn,
With a crash it flashed before them,
And the Thunderbird was gone.

'Twas the U. P.'s famous flier
That these frightened people saw,
Casting forth a flood of fire
O'er the chieftain and the squaw.
Now each night these patient people
Watch beneath the starry sky
Till the dawning of the morning
When the Thunderbird goes by.

—*Cy Warman.*

The Midland Pacific Railway.

It is announced that Canadian and foreign capital has been secured with which to build the Midland Pacific Railway. A contract has been made with Senator Pettigrew, of South Dakota, to construct the road from Sioux Falls, S. D., to Seattle and Tacoma, Wash., about 1,600 miles. The first section, from Sioux Falls to the coalfields of Wyoming—about 400 miles—will be built in 1895. The second section, from the eastern boundary line of Wyoming to Yellowstone Park, will be completed in the following year. The third section will skirt the western line of the Rocky Mountains and is called the Idaho division. The Washington division, the fourth section, will pass through central Washington and have termini in Tacoma and Seattle.

Explosion of an English Built Locomotive in the Argentine Republic.

The following is an account (translated from the Spanish) sent us by an Argentine railroad official describing an explosion of a Worsdell-Von Borries compound locomotive, built in England by Messrs. Sharp, Stewart & Co. The photographs from which our engravings are made were also sent to us by our correspondent, who, by the way, flatters us by the expression of a very high opinion of the NATIONAL CAR AND LOCOMOTIVE BUILDER, because of the practical and valuable quality of its North American news and its fair and accurate treatment of South American news:

Wreck of Exploded Locomotive, Argentine North Central Railroad.

On the 24th of July, in the shops of the North Central Railroad, in the city of Tucuman, at 7:30 A.M., the locomotive No. 33, compound, was taking in a water supply when the boiler suddenly exploded, killing the engineer and six workmen who were at work making certain necessary repairs. Five other people who happened to be in close proximity were also most seriously injured, two of whom died on the following day. Besides this catastrophe and personal misfortunes, three cars full of cargo and one of passengers were completely overturned. This locomotive was constructed in 1890 in the shops of Sharp, Stewart & Company, of England, and had undergone entire and complete repairs just four days previous to the explosion, and had been in service during those days. It is supposed, according to the information obtained as to the cause of the explosion, that the boiler lacked sufficient water, which did not cover the crown sheet. When the engineer opened the injector, the water covered the crown sheet, which, being at a very high temperature, completely evaporized the water, thus causing the explosion of the boiler. This is the most probable version of the cause which produced the catastrophe. The back sheet of the boiler and the dome were found 500 and 700 feet away, respectively, from the locomotive.

This locomotive, as can be seen in the engraving, was damaged beyond repair. The boiler carried 190 pounds steam pressure. The explosion of this locomotive is the second which has occurred in Argentina since the existence of its railroads (year 1857), the first having taken place in Tunin, in the shops of the railroad from Buenos Ayres to the Pacific. It is about three years, more or less, that the explosion of the locomotive "Chacabuco" took place, and it is a strange coincidence that this one had also been constructed in the shops of Sharp, Stewart & Co., of England, in the year 1884.

BACK SHEET OF BOILER, FOUND 500 FEET FROM THE ENGINE.

Removing Old Paint.

Mr. J. H. Pitard, in a lettter to the *Painters' Magazine*, criticises the use of paint-removing compounds in connection with woodwork.

Mr. Pitard says that five or six years ago his predecessor removed the paint from several passenger cars with some of these solvents, with the result that those particular cars have now to be repainted every two or three years; the cause of which is that the solvents have penetrated the wood, and there remain as a menace to future paint and varnish. It would require a long course of systematic treatment with neutralizing agents to restore the wood to its normal condition.

Continuing, Mr. Pitard says that these solvents find their legitimate field in removing paint from iron surfaces, and possibly from plastered surfaces, as the plaster contains a sufficient quantity of lime to neutralize the solvent and thereby prevent its penetration. But any kind of caustics or alkalis that are brought in contact with wooden surfaces renders the wood unfit for painting ever afterward. Their use also causes delay in painting, as they leave the surface moist, which requires time to dry. The gasoline burner is recommended as being quick, clean and inexpensive, and leaves the surface in condition for immediate painting, and is in every way thoroughly practicable.

Limited Passes.

The following anecdote in reference to limited railroad passes is related:

Those who best knew President Newell, of the Lake Shore, will best appreciate a recent exchange of courtesies between him and President Caldwell, of the Nickel Plate, now also President of the Lake Shore. President Newell would give a man a $100 bill and never think twice about it. When it came to giving passes over the Lake Shore he was adamantine in his refusal. Those he did give were so limited to special trains that a number of the officials of the company have never yet ridden on the limited or fast mail trains.

It is the custom for all railroad presidents to interchange annual passes, and on a recent New Years President Newell made up his list of exchange passes and sent them out. Across the end of the one he sent President Caldwell was printed in red ink the words:

Not good on limited or fast mail trains.

By return mail came President Caldwell's annual pass on the Nickel Plate for President Newell. Across its face in flaring red ink and in the bold handwriting of President Caldwell were written the words:

Not Good on Passenger Trains.

Locomotive Injectors.

The following is a synopsis of the discussion of Mr. George H. Baker's paper on "Locomotive Injectors" read to the New York Railroad Club at its October meeting, and published in the November issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER:

Mr. Griffith said that the economy of injectors over pumps on stationary boilers is about 1.3 per cent. saved, and anything more than that on locomotives is due to the conditions of locomotive service.

Mr. Mitchell asked if it is not a fact that an engineer can always tell when an injector "breaks" by the noise. Mr. Baker replied that when a closed overflow injector breaks there is a sound produced just at that moment, a kind of a click, and if the engineer hears that click he will at once detect the fact that his injector is broken. But if for any reason the engineer did not detect the fact of his injector breaking when it did break, that he might not detect it until possibly the rising steam pressure, the engine blowing off, or something else admonished him of the fact. Mr. Mitchell asked also if, in Mr. Baker's opinion, an engineer would detect any difference in the sound between the breaking of an injector piped to the ash pan with an open overflow, or one closed. Mr. Baker replied that the difference would be quite manifest even if the injector broke and blew into the ash pan.

Mr. Curry: I believe that to an engineer who is accustomed to an injector there is a certain sound while the injector is working that he gets thoroughly accustomed to, no matter if it is only working at a third of its capacity. If it breaks and he does not detect it there must be some unusual noise that prevents him from hearing the injector break. I have found it so in my experience, that if he is running along and the injector is working he detects it almost the moment that it breaks.

Secretary Hill: It is very easy to detect the sound of an injector breaking, even with a closed overflow, if the engine is running slow or standing still. But running fast, say a ten-wheeler with solid side rods, you couldn't hear it under any circumstances. But the snapping of the hose caused by the steam flowing through it would make a noise that a man would detect at once.

Mr. Fowler: I would like to ask whether any one has any data as to the relative economy of constant or intermittent feeding. I have heard a good deal of argument on the subject, but never heard it finally settled. I remember being on an engine at one time on a run of about 125 miles, where the engineer started his injector when he left the terminal and did not touch it until he reached the other terminal. It was a passenger train going about 75 miles and running through a rolling country. The water level ranged from the top to the bottom of the glass. On the other hand, other engineers are constantly shutting off their injectors when they come to a pull, in order to save steam. But I do not know of any experiments having been made as to whether one method is more economical than the other, and I would like to know in regard to it. Has anybody any information?

Mr. Sinclair: Mr. President, I have listened to that talk about identifying the work of the injector by the sound, with considerable interest. I have had some experience of taking care of injectors and feeding boilers with them, and I never could identify the difference in the sound between when the injector was working and after it had broken. The fact of catching that click that you find when it breaks is not very good guidance, because there are so many noises that will easily drown that click, that you cannot depend on it. My own experience with one of these injectors was that as soon as the steam began to get up more rapidly than it ought to do, I would always feel the feed pipe of the injector; then I would know if it had broken. I think that those with a keen ear for musical sounds can tell very readily, but those who have not that keenness of hearing cannot. I never had keenness of hearing, and consequently I was under disadvantage in that way, and I think there are many engineers who are in the same position. I once attempted to learn to play the fiddle; I devoted six months of my spare time to trying to learn to play the fiddle, and I could never tell when it was in tune or when it was not. That is merely a defect of the ear, and it puts one at a disadvantage in catching sounds that are not very different one from another. I have no doubt that Mr. Curry, with a keen ear, could tell when his injector was broken, and if I was just exactly as vigilant as he, I could not tell it so readily. It is a matter that depends upon the person in charge to a great extent, aud a great many people need more than the ear to distinguish that. I cannot see why the injector *per se* can save fuel as compared with the pump, except that with the injector you can regulate the supply to the boiler more exactly than you can with a pump. I never had a pump that you could regulate so finely as you could an injector, and I think the advantage in economy of the injector is that it regulates the supply better than what the pump has ever done. Of course there are incidental advantages, such as Mr. Baker has mentioned, of feeding when the engine is standing at a station and liable to blow off and going down hill. But he mentioned a thing that I have often been amused about; that is, when you are feeding with a pump if you go over a hill you may have your water increasing in quantity and your steam does not seem to go down at all until you open the throttle or do something to make circulation. I have been often amused about a thing that I wrote on that subject when I was foolish enough to publish a book. I said that in going down a hill it was necessary to keep the blower on—do something to keep circulation in the boiler, or you might have 140 pounds of steam at the bottom of the hill and when you opened the throttle you would not have 60 pounds; and that the temperature of the steam and temperature of the water did not coincide. A certain editor, who was well known in this country for his knowledge of engineering subjects, ridiculed that statement to a very great extent in reviewing the book, and he did it to such an extent that I was a little doubtful whether I had not made a mistake, although I had hundreds of times seen the phenomenon, and I am very glad to find that Mr. Baker, an old engineer himself, has had the very same experience as I have had.

Mr. Pomeroy asked if it was true that when an engine was working heavy at slow piston speed a pump was not adequate to keep up the boiler, and that only an injector would do. Mr. Baker replied that if the engine is working very slow the force of the pump is very feeble and does not usually supply the boiler. "Consequently, when we used pumps it was almost always necessary to put on both pumps when the engine was working slow on a hill. With an injector, the engine working slow on a hill, the water level can be easily maintained." Mr. West said that this was a matter of valve lift. Pump valves could be so regulated as to flood any boiler at either high or low speeds.

Mr. Colvin: As to pumping an engine by floods or uniformly, I question whether there is anywhere near such a difference as people think. Theoretically, you ought to put in the water just as you are taking the steam out. An automatic regulator would seem to be a good thing; in the sixties such arrangements were put on engines; I had one once, but my experience is that the difference is imaginary. I have never seen a man running south of Mason and Dixon's line that would ever pump an engine what you would call respectably. You take an engine on the New York division of the Pennsylvania Railroad: I believe that there is no place in the world where engines are worked as near their critical point, and I do not believe there is a man running one of those engines to-day who cannot tell in less than a quarter of a minute when his injector breaks, whether he has heard it or not. I know there are many men running there who prefer the closed overflow injector, and they say they would rather have one old "76 Sellers," as they term it, than any of the open overflow instruments they have on that division.

Mr. Mendenhall: What Mr. Colvin says about the service on the New York division I do not consider quite within the scope of this discussion as referring to the breaking of injectors, because that is not a noisy division. I can conceive of a heavy train, running double header at high speed through heavy cuts and along the side of a mountain, where I defy anybody to tell whether the injector is working all right or not, and as a matter of fact the engineers pretty generally, that I have ever had anything to do with, run their injectors by the feel of the feed pipe. It is true if you are running very nicely on a division with no noise you may hear the injector break, but running through a mountainous country, if you do not feel your feed pipe you may get into trouble.

Mr. Hill: I believe that the safest injector on a road is an open overflow injector, and my preference from experience would be for a non-lifting injector where the overflow is carried above the level of the tank. Every man who has had anything to do with injectors, especially in a country where there is bad water, knows that nine-tenths of the repairs and nine-tenths of the failures are due to the priming apparatus. With a non-lifting injector the trouble is that in a dark night, with double headers and snowsheds, they are liable to lose water through the overflow by low steam or some other cause, and a man does not know it, but with the overflow above the running board where he could see it, it is not liable to occur. Another thing, the injector invariably stands full of cold water when shut off and will prime at once when you turn steam on to it. I never knew one of them to lime up.

Mr. Mendenhall: There was a remark made in the paper about the practice of putting two injectors of the same capacity on locomotives. I do not remember just the words used, but that practice was criticised on account of the want of range. Assuming that the range of the injector is fifty per cent., and we have a size of injector that will maintain the water when the engine is working to its maximum, we can get pretty fair feed for fineness, but to put a smaller injector on the other side, or on either side, to reduce that feed so as to get it down where you want to have a continuous feed with the engine running light or working very little, you then rob yourself of one chance of getting over the railroad. If your larger injector fails, you are not going to take your train over the road without losing time, and, therefore, I think that the practice of putting two injectors, either of a size to keep the water up in the boiler, has probably greater advantages than to attempt to put a smaller one on to regulate the feed to a very fine point.

Mr. Sinclair: Mr. Hill expressed my sentiments very clearly in regard to the value of different kinds of injectors for the man who is working the engine. I never saw any injector that suited me so well as a non-lifter, not only as an instrument that was always reliable for feeding, but as an instrument that was very easily repaired and was very rarely out of order. I think, if the men who handled the injectors were to be consulted that, as a rule, the non-lifting injector would be taken in preference to any other. When I stopped running a locomotive, up to the time that I gave up the work I had a great belief in having a pump on one side and an injector on the other. That was a theory that was very dearly hugged by the majority of engineers in the West when I was running. They would say an injector was all right, but you needed to have a pump also. It came to pass that I left locomotive running and was responsible for the repairs of locomotives, which was altogether a different matter. The winter after I took charge was exceedingly severe on the road where I was. It was an extremely hard winter, and very rarely a day passed but that we had engines come in with burst pumps. They would stand about stations and let the water stand in the pump without the heater on, and the result was a bursted pump. It cost the company a great deal of money, and there was no end of annoyance and delay caused by it. We decided that it would be a good plan to put an injector on in the place of the bursted pump, and we adopted the practice. We did not have a single bursted injector all the winter. We had fifty or sixty bursted pumps, and it was decided that no more pumps should be finished or put on engines—nothing but injectors; and it soon developed that the men who thought they could never get along without a pump, got along just as well, and better, with two injectors. The idea of a pump being a necessity was just a fallacy that came of long prejudice in favor of that instrument.

Secretary Hill: I want to differ from Mr. Sinclair in respect to what he says in regard to engineers not liking lifters. I believe, if you took a vote of the 40,000 engineers of the country, that 39,000 would vote for lifters. But I believe that comes from the way of putting on non lifting injectors. The general practice is to put the non-lifter on the left side of the engine. There is not a convenient thing about it. The overflow handle comes up through a hole in the deck where the fireman has to stand on it, and he will open the overflow in spite of himself. The steam pipe has a large, common angle-valve that is too large to use as a heater; the merest crack will put more steam through the hose than you want, and the steam forcing itself past the seat will soon cut it out, and the men dislike to disturb that injector; the thing won't go to work when you want it, and the boys hate them generally. But where a non-lifting injector is properly piped, the lazy cock and the steam valve are handy and in good shape, and are located where the head brakeman cannot get his hand on it when he is sleeping; I think they are generally a success. Every time a man starts the average left-hand non-lifting injector, he has got to help the fireman get it started; he works the rods while the fireman pounds the check with the coal pick. It is a mighty disgusting thing.

Mr. Colvin: In regard to the old Giffard, I will say that I ran one that was put on in 1864. The engine had only one injector, and speaking about the graduation of the old Giffard, it was about as big as a young cannon, and had a regulator wheel, an indicator and all those things. I never had an injector that I could graduate better than that and it never failed. That injector ran seven years that way. In regard to engineers and non-lifting injectors, the secretary says he thinks that 39,000 out of 40,000 would vote for lifters. That vote could easily be changed if the expense of keeping injectors in repair was charged to the engineers and not to the company. I think the vote would be changed exactly the opposite.

Mr. Joughins: I would like to say that I agree entirely with Mr. Hill in respect to the use of the non-lifting injector. Whenever any injector man comes down our way I ask him whether he has a good non-lifting injector or not. I must say that it is quite true that those which we have on our road are not liked by the men who are unaccustomed to using them. The man who is accustomed to using a lifting injector does not like to handle a non-lifter. But I think the non-lifter is the best injector. It is used in the coldest parts of this country with very great success. It does not freeze up, and I know that they make a good solid non-lifting injector for a price which these injector men would open their eyes at if you asked them to sell one at that price, and that is $11. When you consider the first price of $11 of the non-lifting injector, compared with what we pay for lifting injectors, and then remember that the non-lifter has very much less repairs, it is natural to come to the conclusion that the non-lifter is the best injector.

Secretary Hill: I think that the engineer's partiality for the lifting injector is a reasonable one. The majority of them are made to operate with one move of one handle or two, and they require only the closing of one valve to stop them, and the opening of one valve or two valves to start them. With an ordinary non-lifter the engineer has got to shut his lazy cock off or close down the overflow. If it is cold weather he cannot shut off the water, but closes the overflow. If you have a screwed-down overflow it is a good deal of a nuisance, and may jar loose. A non-lifting injector with an overflow pipe up above the tank level, must have an overflow valve that is closed by one movement of the handle, and it must be so arranged, if located next the injector, that when it is closed it will drain the overflow pipe, or it will freeze up in cold weather. They must not have a screw valve with a handle wobbling in a hole in the deck where it will jar itself loose.

Mr. Joughins: I think it is a very important point to have the overflow high, and I have noticed why engineers prefer the lifting injector, and that is because they can work it and they can see the overflow without moving their body. They just move an arm to start the instrument, and they have the overflow within their view. But when we give those engineers a non-lifting injector, they have to crane their necks outside the cab and try to catch a look at the overflow some place else, and they do not like that.

"I can't help my dislike for it," said Meandering Mike; "I oncet seen a sign in the suburbs that said, 'Water works,' an' I never could have no respect for it sence."

Beginning Nov. 1 the Southern Pacific Company put in service an elegant once-a-week train between San Francisco and New Orleans, to be known as the "Sunset Limited." It will run from New Orleans to Los Angeles, 2,007 miles, in 60 hours, and from New Orleans to San Francisco, 2,489 miles, in 77 hours. The equipment for the service both ways will consist of two composite cars, with bathrooms, barber shop, café, library and smoking parlors, four double drawing-rooms, 10 section sleepers, and two dining cars.

The report of the Director-General of Indian Railways for the financial year 1893-94 is given. It states that the additions made to the open lines were 247 miles of standard, 182 miles of meter, and 22 miles of special gauges, giving a total of 451 miles, against 489 miles in the previous year. The total open mileage in India was thus raised to 18,500 miles. During the year sanction was accorded to the construction of 154 miles.

Communications.

Some Economical Characteristics of Locomotive Injectors.

Editor National Car and Locomotive Builder:

Although the Giffard injector has been before the public for many years, and much has been written regarding its action, the subject is still full of interest to the reading public, and critical reviews of carefully conducted experiments always command the attention of the engineering profession. I would therefore ask the privilege of adding some comments to your interesting address on "Locomotive Injectors" presented before the New York Railroad Club, and reprinted in the November issue of your journal—your paper contains much practical information and an account of some valuable experiments which might be difficult for the layman to obtain elsewhere. Comparative tests of locomotive injectors at high steam pressures are always instructive, and the tables you have given are well arranged, and the graphical diagrams of the results are very interesting.

Accepting without criticism the figures of the experiments, I desire to call attention to what I consider an incorrect deduction on the part of the experimenter under the heading of "Averages," and upon which you have based one of your conclusions, premising my remarks with the statement that I will use the more generally accepted term "Range" instead of "Rate" for the percentage which the difference between the maximum and minimum capacities is of the maximum, or (max.— min.) ÷ max. × 100.

An injector delivering water into a boiler against the contained fluid pressure must always give to the moving jet a slight excess of energy to overcome the resistance of the pipes and of the check valves, and must therefore force a little more water and condensed steam into the boiler than would flow out through the delivery tube if all the intercepting valves were removed. The higher the pressure, the greater the quantity of water that would flow out, and it follows that if the injector is equally efficient at all pressures, the capacity must increase in the same ratio as the velocity of the outflowing jet. This is the case with several of the instruments experimented with, and is clearly shown in your Fig. 2, by the lines marked B and G. It is, of course, impossible in practice to carry this upward curvature indefinitely on account of inherent difficulties in obtaining perfect condensation of the steam jet at very high pressure, so that there is always a limiting point at which the capacity commences to reduce, while the rapidly increasing minimum capacity approaches more nearly that of the maximum, and the two lines finally intersect at a pressure beyond which the injector refuses to operate. This is demonstrated by Table II., where injector "G" gives at 120 pounds steam a range of 41 per cent.; but at 140 pounds this has fallen to eight per cent., indicating that the limiting pressure for this feed temperature has been nearly reached.

Examining your diagram, Fig. 2, more in detail: The steam pressure at which the capacity of injectors A, C, E, F, commence to fall off can be easily seen, showing that the difficult problem of designing an injector to work at all pressures has been met by sacrificing the performance at the higher pressures in order to allow them to work at 45 pounds. If, also, the lines be prolonged beyond the limits of the diagram toward the high pressures that are now so extensively used on modern locomotive boilers, the results will substantiate the statements made above. The line of maximum capacity of "A" would meet the minimum at about 175 pounds; "E," at 190; "F," at 180; "H," at 180; "I," at 160; while "B" shows an unusual upward tendency toward further increase of capacity. "C," although falling slightly, would run well up, while "D" and "G" would probably reach 200 pounds, although with a very limited range at that pressure. Now this increase of capacity with the pressure, as has already been shown, is a characteristic of a well designed injector, and the pressure at which the falling off commences should not be below that at which the safety-valve is set. For this reason a comparison of the average capacity and range between 80 and 140 pounds, with an arbitrary figure of 2,200 gallons per hour, does not seem to be correct in principle.

If an injector specification requires the delivery of 2,200 gallons of water at 140 pounds when lifting its feed six feet, at a temperature of 80 degrees, it is a very simple matter to proportion the parts so as to obtain this resultt but at lower pressures the delivery would necessarily be less than 2,200 gallons, or else the maximum at the higher pressure would be increased. The average "rate," or "range," should therefore be stated as the mean of the ranges at each individual pressure, and not upon the arbitrary assumption made, if any conclusions are to be drawn in regard to relative efficiency. This would materially change the figures, and as in your text you have based your deductions upon this column of average ranges in Table II., I desire to present a recalculation of—

AVERAGE RANGES OF INJECTORS A, B, C, D, F, G, E, H.

A.	B.	C.	D.	F.	G.	E	H.	
47	43	34	31	40	33	44	24	Correct.
42	33	29	23	34	30	40	20	Incorrect.

And further, if compared with the pressures carried upon the locomotive under working conditions and at which the range is really required, viz., 140 to 120 pounds, the results would be as given in the following table, to which has been added the maximum delivery temperature, to prove that if the efficiency depends upon these two elements, the relative order of merit in which you arranged the injectors would be considerably altered:

A.	B.	C.	D.	F.	G.	E.	H.	
40	39½	32	30	39	24½	40	18½	Average range 140-120 lbs.
189	234	205	275	208	198	202	190	Highest delivery temperature.

For my own part, I consider that it is important, in designing an injector, to render it efficient from a mechanical standpoint—to obtain a delivery of the greatest quantity of water per pound of steam passing through the steam nozzle. This requires a low delivery temperature at the maximum capacity, but gives a large range, even if the minimum is no better than that of the ordinary injector. There is no objection whatever to putting the water into the boiler at a temperature of 170 degrees at 140 pounds steam when the engine is running, for the circulation is then so rapid that the colder water is quickly distributed without chilling the sheets, while the boiler may be fed at stations with the injector well cut down, and giving a high delivery temperature, using both instruments if the quantity is inadequate.

An efficient injector uses a comparatively small amount of steam and does not drain the boiler of its supply at the very time that the full capacity may be needed to supply the cylinders. The difference is more marked than is generally supposed; take the case of injector "D" in Table III., at 140 pounds, feed 80 degrees, delivery 232 degrees, capacity 1,614 gallons per hour. The ratio of weight of water to steam may be calculated thus:

Total heat 1 pound steam 140 pounds (gage) above 0 degree = moisture about 0.5%	...	1,220.0
Temperature of delivery	...	232 0
		988.0
Energy required to force water into boiler, in T. U. =		3.1
Thermal units used in raising temperature of feed	....	984.9
Raise in temperature 232 degrees — 80 degrees) = 152 degrees.		152 = 6.48

which shows that 6.48 pounds of water are delivered to the boiler per pound of steam; so that of the total delivery, 249 gallons, or 2,074 pounds, of water have to be evaporated to supply the injector itself, and which, at a water rate of 35 pounds, is an expenditure of 59 horse power. Compare this with injectors "B" or "C"; taking a delivery temperature of 175° under the same conditions, the ratio of water to steam would be 10.99 to 1; steam consumption, 1,387 pounds, and an expenditure of only 39.6 horse power, which is nearly 33% less. This does not represent the economy of fuel, because, as you have clearly stated, all the heat of the steam is returned to the boiler; but when the locomotive is running, what is wanted is *steam*, and even a small saving in this direction is of great importance in the actual operation of the motive power of our fast trains, where the excess of steaming power of the boiler is so very small that an injudicious use of an uneconomical boiler feeder may cause the loss of a considerable amount of time between terminals.

In conclusion, I would suggest that there should be included, in your concise summary of the necessary characteristics of the best locomotive injector, the additional condition of efficient action of the steam jet when running on the maximum capacity.

Strickland L. Kneass,
Philadelphia, Pa.

Remarkable Snow Clearing.

Editor National Car and Locomotive Builder:

Perhaps a description of a very successful trial trip of one of the latest improved Jull snowplows during the past winter would be of interest to your readers. The great cost of these plows and the skepticism regarding the efficiency of so great an improvement over the old push plows, have combined to keep most railroads from investing in them until it was proved, beyond a doubt, that they would do all that was claimed for them. One of these plows has been on the Wyoming Division of the Burlington for the past two years, but not until the last winter was there a chance to thoroughly test its efficiency. The storm which gave the opportunity for the test blocked about 600 miles of the Wyoming Division.

The worst blockade occurred between Gillette and Sheridan, Wyo., where snow up to 25 feet in depth was encountered.

This stretch of track, being farthest west, was reached last, and the snow being wet when it fell, and having settled for three days, made, indeed, a severe test. The snow was weighed in several cases, and was found to average about 25 pounds per cubic foot. In one case where sand had drifted in with the snow the weight was as high as 35 pounds per cubic foot. In cuts where the snow was not over 8 feet deep the plow went steadily through at a speed of from 6 to 10 miles per hour; and in one instance went through a cut with 5 feet of snow at a speed of 15 miles per hour.

Where deeper snow was encountered a slower rate of speed was necessary, in order not to block the snow wheel. The speed must be regulated according to the density and volume of the snow. Where the snow was over 10 feet, or above the hood, it was found necessary to run the plow in slowly for a short distance and then back out, and break down the top of the tunnel thus made; the next time it would throw out the snow thus knocked down, and the operation repeated as before; and so on through. Snow was thrown either to the right or left, or in both directions at the same time, according to conditions. The snow wheel was run from 150 to 200 revolutions per minute, according to the volume of snow to be thrown out.

The track is flanged and left free, none of the snow rolling back, as with the old plows, while the sides of the snow cuts are left as smooth as if cut down by a knife. These plows are a great improvement over the old method of taking a run at it, and have certainly bridged a chasm of danger, and overcome a maximum of time, labor and uncertainty.

Master Mechanic.

The M. C. B. Coupler in 1894.*

A. M. Waitt.

The past year has been one of very considerable improvement and development in the M. C. B. coupler. The results of shop and service tests, and experience, have shown many weaknesses in the various designs, which have been taken up by the manufacturers, with a view to putting the couplers in shape to stand all the reasonable requirements of service, and to show at the same time satisfactory results in the pulling and drop tests. Some of the companies, whose former designs contained an excessive number of parts, have simplified their devices, without detriment to the strength or efficiency of the couplers, and without in any way interfering with the interchangeability of the working parts. Unfortunately, some of the manufacturers have, with a view to improvement, altered their design and dimensions to such an extent as to prevent the interchangeability of either knuckles, coupler castings or locking parts. This, it seems to me, is a fatal mistake that proves the unreliability of such devices and causes no end of loss of time, money and patience, when it is considered that to provide for such unexpected, and I may say unwarranted, changes it necessitates carrying an additional stock of duplicate parts in large inspection yards and repair shops all over the country.

During the past year, not only have the coupler manufacturers sought to improve the design of their devices, by simplifying and by adding strength to weaker parts by means of a better distribution of metal, but there has also been an honest effort to decidedly improve the quality and uniformity of the metal used. There will doubtless for a long time exist a marked difference of opinion among railroad men and manufacturers as to the relative merits of malleable iron and steel for the construction of coupler fastenings. I have always been a believer in malleable iron as the safest all-round metal for such use. I am to-day resting again more firmly in my faith in the malleable iron coupler as the safest, surest and best. I would not say that in a pulling test the best malleable iron would outlast the same section of best steel; but I believe that to-day more reliability can be placed on getting a uniform result in quality and strength with malleable iron than can, with the most approved methods, be placed on getting reliability and uniformity in cast steel. There seems, in spite of the latest improved methods, to be a peculiarity in steel castings by which certain elements separate themselves and concentrate at some one point in the metal, leaving other parts lacking in those elements, and thereby rendering such parts weaker than others and leaving the steel not uniform in density, and varying considerably in percentage of carbon. It is due to such peculiarities in cast steel that some roads, who have made extensive use of steel couplers, have, during the past year, abandoned the steel for malleable iron. Undoubtedly the time will come, before many years, when cast steel will be made with absolute uniformity and free from the blow-holes which are so often a prominent feature of the metal used in castings. Until this time arrives, let the manufacturers use every effort to raise the standard in malleable iron to its highest point, feeling, as they can safely do, that with attention to proper mixture and plenty of time in annealing, malleable iron may be depended on to produce a uniform result, almost without exception.

I cannot refrain from calling attention to the reprehensible practice on the part of a few coupler manufacturers, during the past year, to take advantage of the results of the M. C. B. coupler tests in 1893, by carefully figuring out some unimportant class of results in connection with those tests where their coupler made a good showing, and then sending broadcast to railway officials circulars with the name and record of their coupler in large full-face type, claiming that they showed the best record, when in fact, by reference to the complete official records, they showed only the most ordinary results. The use of such methods to hoodwink railroad managers, who may not have time to verify the printed statements, cannot be too strongly condemned.

It is quite noticeable that the past year has seen very few prominent additions to the list of coupler companies, and it is a fact worthy of rejoicing over, when it is considered that every new design of coupler put on cars means that, in order to prevent delaying freight and avoid necessity for changing couplers, hundreds of points must be supplied with special knuckles and locking parts for making quick repairs. May we not hope for and advocate a movement among coupler companies or railroads that will in some way reduce the number of different styles of couplers, or at least will modify some of them enough so that the principal makers will be able to use the same knuckle pin, and similar uncoupling levers and brackets for same? With such a result possible of realization we might for a short period be willing to approve of the coupler manufacturers making modifications which would,

* Abstract of paper read to the Western Railway Club. A large number of tables accompany Mr. Waitt's paper, as reported in the proceedings of the October meeting of the Western Railway Club. They show the number of failures of different parts of different couplers on several different railroads.

for the time being, interfere with interchangeability of some parts of the couplers in cars now equipped, but which would lead to a more general interchangeability of the wearing parts of several or all makes of couplers after a few years.

A pleasing feature in the past year is the change wrought in the opinions of some formerly strong opponents of the M. C. B. style of coupler. The best recommendation of the M. C. B. type of coupler is that it wins friends wherever it is extensively used. More of the troubles experienced in its use by trainmen and switchmen come from the necessity of its coming in contact with the old link and pin type, than from any inherent faults of the M. C. B. type itself.

For two years or more considerable thought and inventive genius have been spent upon so adding to or modifying the parts of the couplers that the knuckles will be self-opening. It is an open question whether the result accomplished is particularly desirable if it is accomplished at the expense of adding more parts or by modifying parts already existing so as to in any way weaken them.

Among the articles written the past year on the coupler question, there appeared one which suggested that, as the principal coupler patents had expired, each railroad company could design its own couplers and have them made by malleable or steel makers, subject to certain tests. I believe the railroads of this country will rue the day that a move in this direction is made. We are at present suffering great expense in the way of large amounts of money tied up in dead coupler stock at shop and inspection points, and if each road is to design couplers to suit its officers' ideas, with the present tendency of railroad mechanical men to vary from and improve on their neighbors' methods and designs, there would soon be as many varying designs of M. C. B. couplers, each differing from the others enough to prevent principal repair parts from being interchangeable, as there are now of varying styles and shapes of link and pin couplers, whose name is legion. In these days of advancement in science and art, the best results and highest achievements come from the work of specialists, who, instead of covering the whole ground in a profession, take up one small portion and devote all their study and energies to bringing that portion to its highest development. May not the same principle be applied to railroad mechanics, and is it not true that better results can be depended on from specialists in that line than from a railroad mechanical department attempting to carry on the manufacture of all or many of the specialties used by it?

From what seem to be the most reliable data from a reasonably long record, it would appear that the coupler casting breakage, where a road has 100 or more cars in continuous service, runs from 75-100 per cent. to as high as 17 per cent. per year, and the knuckle breakage from ½ per cent. to as high as 20 per cent. The general average thus having been far above what economical service would permit. It is encouraging, nevertheless, to note that the result of this great breakage and consequently great replacement by the manufacturers, together with the very valuable information derived from the careful work of the M. C. B. Committee on Automatic Couplers, has begun to produce results that augur well for the permanence and stability of the M. C. B. type of coupler in the future.

A gratifying fact that I have recently noticed is, that some of the more recent developments in couplers, brought out during the present year, are showing a record for freedom from breakage that is truly remarkable. One of the best records shown in the statements I have been able to obtain, and one where all the facts are known and have been verified by me, is shown in an 1894 development of coupler, which has been in miscellaneous service on 403 cars for an average of six months, with an actual breakage of only four coupler castings and not even one knuckle, or an average of only 1.2 per cent. per year of couplers broken; and this result was obtained with a malleable iron coupler.

A reason may be given for the best results now being obtained with the M. C. B. coupler, from the fact that the strongest couplers are in each case being manufactured by the coupler companies themselves, and are not made for them by manufacturers of malleable iron or steel, who must produce the goods so as to make a fair profit in order to do business, and who have but little interest aside from that in the durability of the material. It may be set down as a self-evident fact that an individual or a company will use greater care and more skill in doing work for itself than it can ordinarily expect from an outside party; and it may reasonably be expected that better couplers will be obtained where the coupler companies manufacture their own goods. This, I believe, is also a further strong argument against the policy of railroad companies ever attempting to make their own coupler patterns and then get metal manufacturers to cast the couplers for them. This is an age of specialists, and the coupler specialist can and will produce the best results.

An altogether too prominent class of coupler breakage is in the shank. It is an unfortunate fact that the early designers of the M. C. B. couplers chose 5 by 5 inches as the outside dimensions of the shank, but as not nearly one-half of the freight equipment of the country has yet been fitted with the M. C. B. coupler, and as the larger part of cars already equipped can readily be adapted to the change, it is to be earnestly hoped that at the next M. C. B. convention some positive action will be taken to at once remedy the present weakness in our standard coupler, by increasing the shank section by ½ inch each way, thereby enabling the adding of considerable strength in supporting the weak guard arm, as well as giving great additional strength to the shank.

Too great praise cannot be given to the very efficient and valuable work of the members of the M. C. B. Association Coupler Committee during the past two years, for their patient work and valuable information deduced by them, and it is safe to say that their good work, together with the careful analysis, by the coupler manufacturers, of the breakages they have met with in their devices, is going, in the immediate future, to give to the railroads of the country M. C. B. couplers which will be a source of greater economy and safety than railroad mechanical men ever imagined when the M. C. B. standard coupler was adopted.

Prevention of Railway Strikes.*

BY JAMES PEABODY.

The inherent difference between transportation and ordinary industrial pursuits is not commonly understood, or if understood is ignored. An individual or a number of individuals may construct and operate works for the manufacture and sale of various commodities without let or hindrance, but there is no natural right in the individual to engage in railway transportation, for that involves the exercise of the right of eminent domain, a prerogative that in the nature of the case belongs alone to the government. The providing and maintenance of the highways of travel is a function of government which indeed may be delegated, but which cannot of right be wholly surrendered. The delegation of this authority carries with it the obligation to perform the necessary duties connected with transportation, and it would not seem unreasonable to insist that with the obligation should also go the protection necessary to make its performance possible.

The act to regulate commerce passed in 1887 is an expression of this right of regulation. That Congress believes it not only has the right of direction as to the methods employed in the conduct of transportation, but also the authority to provide all necessary means for the uninterrupted maintenance of railway service, is still further attested by the following resolution which was reported by the full meeting of the House Committee on Interstate Commerce, and adopted by the House, at the time the railway strike of last summer was in progress:

Whereas, The Constitution of the United State gives to the Congress of the United States alone the power to regulate commerce among the several States, and

Whereas, Said commerce has been and is now interfered with and interrupted without the authority of Congress; therefore be it

Resolved, That the Committee on Interstate and Foreign Commerce be and is hereby directed to investigate said interference and interruption and the causes thereof, *and to inquire what additional legislation, if any, is necessary to prevent a recurrence thereof.*

The noticeable thing in this resolution is the inquiry as to what additional legislation, if any, is necessary to prevent interference with the regular movement of commerce, and the assumption that the function of transportation and everybody engaged in the performance of it is answerable to the United States authority. No argument is needed to establish the fact that the unimpeded and uninterrupted flow of commerce is necessary to the welfare of the entire public. The affairs of the several railways comprised in the American railway system are so interwoven and interdependent that the interference with the business of a single road of any magnitude inevitably throws the entire system into disorder. The stopping of a single train by a party of bandits and the robbery of the passengers or express is deemed a crime worthy of being visited with the swiftest and severest justice; but the stopping of thousands of trains and the consequent loss to the public of many times the amount that could by any possibility be realized in a train robbery is commonly but slightly condemned, often passed by with seeming indifference, and sometimes even attempted to be excused. That some additional legislation is needed to render the regulation of the general government effective and to promote the welfare of the public is also evident from the recent decisions in connection with railway affairs.

It may not be amiss to refer in passing to the confidence possessed by many in the value of a license system under governmental direction as an aid in overcoming the tendency of railway employees to strike. While without doubt the inauguration of such a system would in some degree improve the personnel of the men employed, and thus in a measure minimize the danger, it would appear to be open to two principal objections: first, in that instead of being universal in its scope, embracing every employee from the highest to the lowest, it would be limited in its application; and second, that it would fail to prevent, so far as law can prevent, the engagement of men in a strike if they were so disposed. Such a plan is somewhat relevant to an attempt to cure a fever by the application of cooling lotions; they may be agreeable, and not without merit in the way of amelioration, but as means of cure they are without value.

To my mind it is perfectly evident from the history of the past, that if our railways are to be depended upon to maintain uninterrupted the movement of commerce, some way must be provided that will prevent employes from abandoning the service without warning. In other words, the only way in which the commerce of the country can be exempt from obstruction is to provide that those engaged in the conduct of transportation shall be required under penalty to give a reasonable notice of their intention to quit, such notice being sufficiently long to permit of their places being filled with competent men. Concurrent with this regulation should go the correlative provision securing employes against discharge except on similar notice. The violation of the law should be declared a misdemeanor and punishable by fine in such amount as, while not proving unnecessarily burdensome, would, through the medium of a wide discretion given the court, enable it to make the punishment fit not only the crime but the individual. The particular lines in which this principle of regulation shall be expressed are not essential so that the law is impartial and effective. That it must be done by national legislation and enforced in the United States courts follow in the nature of the case. No other instrumentality is competent to handle it.

It is, of course, understood that in opposition to such a regulation the cry of "involuntary servitude" will be heard throughout the land, but it is a little difficult to see wherein such a term applies to the case. The United States maritime laws provide that a sailor may not either quit his vessel or refuse to perform his required duty under penalty, not because of the danger of loss of life (for the rule applies in, as well as out of, port), but for the reason that commerce may not be impeded. But there is no element of involuntary servitude in such employment, the condition precedent to the employment being fully understood in advance of entering upon it. No man is obliged to ship as a sailor, nor under such regulation as is suggested would any man be compelled to engage in the service of transportation. But having taken such service with full knowledge of the requirements as to duties, compensation and required notice, there can be no ground for the assertion that the employment would partake in any degree of the nature of involuntary servitude.

The public recognize the fact that in the railway service, as in the army or on shipboard, discipline is essential. They care very little by what means discipline is promoted, but they do insist it shall be of such character as will permit of the regular and safe movement of trains. It is probable that, because of the danger of impairing this discipline, those most familiar with railway affairs consider arbitration as wholly inapplicable to railway troubles. With the exception that the railway official may not take the law in his own hands, railway management as between those engaged therein must be as arbitrary as is that of the army or marine service. The exigencies of railway service demand instant, unquestioning and exact obedience. The performance of the service is of a nature that cannot be arbitrated. Trains must run. Freight and passengers must be transported. A vessel may refuse cargo, but a railway cannot. So that if unquestioning obedience is a necessary factor in the one case, it is a thousand times more essential in the other. Admit arbitration as a condition of train service or any other service pertaining to the movement of freight and passengers, and argument would take the place of orders.

At present railroad men with few exceptions are better paid than almost any other class of artisans possessing and exercising the same degree of intelligence and skill. Not that their compensation is excessive. They earn all they get, but as compared with other classes of manual labor they have no cause of complaint. While, therefore, it may not be practicable to formulate any universal panacea for the cure of the strike disease, it is altogether possible to prescribe such regulations in connection with those matters affecting the general public as will prevent the recurrence of such scenes as have lately been witnessed in this country. The right of a man to work or to quit working is not questioned, but no man engaged in a service created by and devoted to the public has any right to terminate his connection with the service in such a way as to interfere with its continued performance.

*Abstract of paper read to the Congress on Arbitration and Conciliation, held in Chicago, Nov. 13 and 14.

A Garbage Crematory.

The question of the disposal of garbage in towns and cities is one of the practical questions affecting the health of communities that is receiving increased attention each year. The process of cremation of such refuse is growing in popularity as its advantages become better understood by the people, and as furnaces for this purpose become improved to better suit the requirements of the work.

This matter is receiving a good deal of attention in New York City at present, and a commission has been appointed to visit and inspect the different garbage crematory processes in use in different places. The Dixon process, in use at Atlanta, Ga., inspected by this commission recently, seems to be one of the best, if not the best, yet seen. It consists of two reverberatory furnaces, one on top of the other. The flame comes from coal burned in the firebox. The garbage is dumped into the upper furnace, and as soon as it dries it falls through grate-bars to the lower one. The fumes, gases and odors evolved are carried to another furnace under the stack, where an auxiliary fire of coke consumes them utterly. There is not a particle of odor, although in the forty tons of stuff burned during twelve hours there are 120 barrels of night soil, and this carries at least 60 per cent. of water. A dead horse put into the upper chamber had vanished, bones and all, in one hour and ten minutes. The furnaces consume four tons of coal a day. The process is rapid, complete and perfectly odor less, and the smoke from the stack is slight and has no smell, except that of burning coal.

The Youngstown Car Company has contracted to build 200 cars for the Pittsburgh & Lake Erie Railroad, for which the Simons improved drop door has been specified.

Mr. Charles Parsons has been appointed General Western Agent for the Mica Roofing Company and the Childs Manufacturing Company, whose specialties are roofing material for railway buildings and cars, and insulating papers and paints. His headquarters will be at room 500, 112 Dearborn street, Chicago.

Compressed air has been applied to the operation of typewriting machines in England. The usual complex mechanism of such machines is dispensed with and the type is actuated by a much lighter touch than is necessary with the old machines. Keys of the ordinary machine are superseded by small hemispherical chambers made of special indiarubber. These chambers are collapsible, and each one communicates by means of a rubber tube of small diameter with a small metallic tube, in which is a sliding rod, having a type on its outer extremity. In working the machine the collapsible chamber is lightly pressed with the finger, and this drives out the type rod connected with that chamber, imprinting the letter on the paper by a smart blow. The pressure on the chamber creates a partial vacuum within it, which operates in sucking back the type rod into its tube the moment the letter has been printed.

Probably the most remarkable feature of the origin of the Bessemer process of steelmaking is the fact that, at the time he took up the subject of the steel manufacture, Sir Henry knew little or nothing of the metallurgy of iron. This he has described as being rather in his favor than otherwise, for he says: "I find that persons wholly unconnected with any particular business are the men who make all the great inventions of the age." This is so far true that if we look over the history of the greatest inventions we shall trace comparatively few of a really revolutionary character that were due to the men employed in the industries affected.

Krupp, the great iron founder, of Essen, Germany, is to supply Italy with 10,000,000 nickel coins. He will probably get the contracts for slot machines later.

Annual Meeting of Superintendents of Bridges and Buildings.

The fourth annual meeting of the American International Association of Railway Superintendents of Bridges and Buildings was held in Kansas City, Mo., on Oct. 16 to 19. The meeting was called to order by President J. E. Wallace (Wabash), of Springfield, Ill. The rollcall showed 60 members in attendance, in addition to a large number of visitors, chiefly prominent railroad officials.

The committee on "Depressed Cinderpits," consisting of Messrs. Walter G. Berg (Lehigh Valley), Geo. W. Andrews (Baltimore & Ohio), R. M. Peck (Missouri Pacific) and Abel S. Markley (Pittsburg & Western), presented a very exhaustive report on the subject, classifying and reviewing the existing practice and submitting recommendations. This report was accompanied by a large number of drawings and an appendix, in which the valuable detail data collected had been compiled for easy reference. We give herewith a synopsis of this report.

Among the subjects for consideration and discussion at next year's convention are the following:

Mechanical action and resultant effects of motive power at high speed on bridges. Sand dryers, elevators and methods of supplying sand to engines; including buildings. Interlocking signals. Pumps and boilers.

The following officers were elected for the coming year: President, Geo. W. Andrews, Baltimore & Ohio, Philadelphia; First Vice-President, W. A. McGonagle, Duluth & Iron Range, Two Harbors, Minn.; Second Vice-President, L. K. Spafford, Kansas City, Fort Scott & Memphis, Kansas City, Mo.; Third Vice-President, James Stannard, Wabash, Moberly, Mo.; Fourth Vice-President, Walter G. Berg, Lehigh Valley, Jersey City, N. J.; Secretary, S. F. Patterson, Concord & Montreal, Concord, N. H.; Treasurer, George M. Reid, Lake Shore & Michigan Southern, Cleveland, O.

The following is a synopsis of the report on

Locomotive Cinder-Pits.

Investigation of this subject showed that it would be impracticable to recommend standards for general practice throughout the country, as the choice of a cinder-pit system depends to such a large extent on local conditions. There are, however, a number of distinctive systems with individual characteristics in prominent use, so that the existing practice can be classed and described under the following nine groups.

A. Dumping on ground or in shallow iron trough between track rails; ashes shoveled out.

For dumping a limited amount of ashes at stations, water tanks or coaling platforms, where trains make a short stop on the main track. The main objections are the limited amount of ashes that can be dumped, the necessity for prompt removal of same and especially the damage done to the crossties. The ties are sometimes protected by old sheet iron. An improved form in use is to place the rails on plank stringers, spiked on top of ties, and bend the old sheet iron so as to form a trough between the plank stringers, thus giving a greater capacity and less liability for ashes to run against rails.

B. Depressed closed pit: ashes shoveled out. Ash car track depressed, where possible.

This group practically represents the general style of cinder-pits adopted almost universally throughout the country till within the last few years, and the present standard on a very large number of roads.

The best practice for this group consists of having special cinder-pits, conveniently located in connection with an engine house or a coaling or water station, properly built so as to resist the heat, provided with a suitable water supply and efficient drainage, and the ash car track located alongside of pit as conveniently as possible, so as to reduce cost of handling. The general objections to this class of pits are that the handling of ashes is expensive, rehandling being usually required, and the work is interrupted when engines are on the pit. Unless the pits are well built and efficiently protected against heat, the combined deterioration caused by heat, water, frost and shoveling, the vibratory action of passing engines, and the stopping up of drains will destroy the pits or at least call for frequent extensive repairs, while the cost, if built very substantially, is practically equivalent to improved modern methods offering better economical results in operation.

C. Depressed closed pit; ashes dumped into movable iron buckets, baskets or hopper cars in pit, hoisted out by cranes.

This group is similar to the one just discussed, excepting that iron buckets, baskets or hopper cars in connection with cranes are employed for removing the ashes from the pit to ash cars, in place of shoveling by hand. It would seem that there is a very considerable saving in using the crane and bucket system in place of shoveling, and, in addition, it is more expeditious. The committee was of the opinion that the increased first cost of this arrangement was offset largely by the reduced necessary cost of pit construction, as the deteriorating influence of heat, water and shoveling will not be serious. If ash cars with suitable protection against heat are provided, then water need not be used in the pit at all and drainage can be dispensed with. The feature of not being able to remove ashes, when engines are using the pit, is offset by the fact that the ashes are handled more expeditiously than by hand. The question of power for operating the cranes is serious, however, and special arrangements for this would not pay except for a large plant.

D. Raised track above general ground level, rails carried on low iron pedestals or columns, pit open on both sides; ashes shoveled or drawn out sideways under rails.

In this group the distinguishing feature is the raising of the cinder pit track above the general level of the ground or neighboring tracks, suitable inclines or run-offs being provided at each end of the raised section. The location of these pits should be preferably on a special track, connected, however, at both ends with a running or important yard track. The introduction of an ash-car track depressed below the floor of the pit will decrease the cost of handling ashes, and should be done wherever feasible. These pits need no drainage and hence are admirably fitted for level country.

E. Elevated iron trestle, open on both sides; ashes dumped on ground and shoveled up on cars.

This group of cinder-pits is represented by an elevated iron trestle of the Central Railroad of New Jersey. Its chief merits are stated to be that the removal of ashes is entirely independent of the dumping and does not have to be arranged for until sufficient ashes have accumulated to warrant the work train making a special job of it.

F. Depressed pit, open on one side, and both track rails carried on iron pedestals or columns.

The characteristic feature of this group is that the running track does not have to be raised above the general track or ground level, and yet the objectionable features of depressed closed pits are practically eliminated by making the pit open on one side and introducing a depressed ash-car track located at or preferably considerably below the floor of the pit. This allows the work of removing ashes to be done, even when engines are on the pit and with one handling. Double pits with one depressed ash-car track between them are used for larger plants.

G. Depressed pit, open on one side, one track rail carried on wall and the other supported on iron or masonary columns.

This group can be considered as containing some of the best standards for depressed cinder-pits, and the prominent list of railroads represented lends emphasis to this statement. It has all the advantages of the preceding group "F," with the additional feature that, owing to the fact that one rail is supported on the side wall of the pit, the track is very rigid, allowing the pit to be placed, if necessary, on fast running tracks and on curved tracks. It can be located with good advantage close to a main track without spreading the tracks; and if on the outside of an embankment, then the introduction of a deep depressed ash-car track and the disposal of the drainage are easily settled. The columns under the rail, on the open side of pit, are of various designs, and, as a rule, of cast iron. One road uses old rails for columns, and the details of the connections to the girder on top and to the bedplate at the foot are exceedingly neat and simple; the sloping floor of the pit adopted by the Pennsylvania lines west of Pittsburgh offer considerable advantage in shoveling.

H. Pitts with chutes underneath for delivery of ashes by gravity to ash cars.

This group is, in a general sense, simply an extension or improvement on the preceding one, excepting that iron chutes are introduced under the track pit, running out between the columns on the open side of pit and reaching over the top of an ash car on the deep depressed ash-car track. Water is used to cool the ashes and wash them down the chute. One of this type has been in use on the Southern Pacific a short time.

I. Mechanical conveyor system requiring power; ashes dumped into hoppers under track and thence conveyed by bucket elevator or through conveyor to overhead iron chutes for delivery to ash cars.

This group is clearly defined by the above heading. Mechanical ash and coal conveyors of different kinds are successfully in use in connection with stationary boilers, so that the application of this system on a large scale to locomotive cinder-pits seems to be a most natural conclusion and prophecy for the future. Unfortunately the plants actually built for locomotive ashes, as far as known, are limited to two different systems in use on the Philadelphia & Reading at Philadelphia, one of which has been apparently abandoned, while the other is reported to be working successfully.

A conveyor system with independent power supply is naturally only feasible at a very large cinder plant. Generally the aim seems to be to combine an ash conveyor system with a coaling station, placing pits under the coaling track; but if the engine is to be thoroughly cleaned, the time consumed is so much longer than the time required to take coal from overhead chutes that this combination will not prove as practical in actual operation, where there is a big rush of engines, as would appear at first thought. Unless plenty of time can be spared to each engine it will therefore prove preferable to make the ash-conveyor system and track independent of the coaling track. The extra first cost of a conveyor plant, the possible rapid wear and tear of the machinery and iron parts, owing to the presence of destructive chemical agents in the ashes, combined with a fine sharp grit, and perhaps the inconvenience of the yard operations connected with the plant, may go far to outweigh the advantage gained by the reduced cost of handling.

Impressions of European Railway Practice.

Mr. E. M. Herr, formerly Superintendent of the Grant Locomotive Works at Chicago, read a paper to the Western Railway Club, on his recent return from a European trip, giving his impressions of the railroad practice he came in contact with during his travels. In the following we republish most of his remarks relative to the rolling stock of the roads he traveled on:

In Italy.

The locomotives are designed after English and German models and are usually outside connected. The machinery is usually dirty and not well maintained. The exhaust is soft and engines seem to steam well. Both German soft coal and a manufactured fuel made by compressing a mixture of coal dust and coal tar into blocks measuring about 6 by 6 by 10 inches are used, the latter more extensively in southern Italy. The cars are nearly all four wheeled, equipped with vacuum brakes, and have three or four compartments, entered at the side, and with seats for eight in each compartment; they are hard riding, untidy and uncomfortable and very poorly warmed in cold weather. They are only heated in winter by means of metal tanks, or flattened cylinders, filled with hot water and laid on the floor of each compartment. All cars are absolutely without toilet accommodations.

In Switzerland.

The St. Gothard Railway of Switzerland, the only Swiss line that I visited, is constructed in the most thorough and substantial manner.

The locomotives are generally outside connected and not compound. Over the mountains six-wheel connected locomotives are used; they have no trucks, and have driving wheels of about 48 inches in diameter. The piston rod on nearly all St. Gothard locomotives projects through the front cylinder head. The machinery is in good condition and the engines work very freely with soft exhaust even when pulling on grades. German bituminous coal is used almost exclusively. The entire line over the mountains is double track. It passes on the south side of the Alps, through 28 tunnels, several of them helical loops over a mile in length cut out of solid granite, finally gaining elevation enough to pierce the main range by the great St. Gothard tunnel, 9¼ miles long. It then descends through another series of loops and straight tunnels, 27 in number. The entire road is splendidly built and a marvel of engineering and constructive skill. Over the mountains a brakeman, or guard as he is called, is required to stand on the rear platform with a lighted lamp at all times. The movements of trains and station hands are always deliberate, and station stops are long on this account. The engine was invariably detached from the train when water was taken, notwithstanding water cranes were frequently on the main track and convenient to the station. The cars are quite superior to any other European cars. They nearly all have end platforms with through center aisles, and toilet-room, and are equipped with Westinghouse airbrakes and steam heat. The windows of these cars were especially well fitted with good glass, and, although lowering down instead of raising as in American practice, were counter-weighted, and the sash all concealed within the post so the pane of glass was the full size of the opening between the side posts.

In Germany and Austria.

Austrian railway practice is so similar to that of Germany that a single description will suffice for both. The subway of the German lines is good and the roads are nearly all well ballasted, mostly with gravel. Many metal ties are used. All wagon road crossings are provided with watchmen and usually with gates. A signal by means of electricity setting in motion a gong operated by weights and clockwork is given at each watchman's station, announcing the approach of a train and its direction. The use of block signals is quite general, there being 1,200 block signal stations, and upward of 2,500 interlocking towers on the 26,200 miles of German lines. Some of the large stations are models of magnificent and commodious trainsheds and waiting and refreshment rooms and offices; notable examples are found at Frankfort, Cologne and Munich. The small stations are similar in arrangement to those with which we are familiar, being built, however, of stone or brick with no wooden platforms. They almost always have a cafe at which beer is sold. The ordinary train service is slow on account of the great number and length of stops, and trains seldom average much above 20 miles per hour between terminals. Express train service is, with a few exceptions, also slow.

The motive power and rolling stock are well maintained. The locomotives are of the English type, but many of the recent improvements in construction and design have been taken from American practice. This is especially noticeable on the Prussian lines, where the very careful and extensive study of American railway practice made several years ago by Mr. Von Borries, mechanical engineer of the Prussian lines, is seen to have been utilized in many of the latest locomotive designs. There are still, however, many points of design very different from American practice, notably copper fireboxes with tube sheets 1 inch thick, plate frames, steel or wrought iron driving-wheel centers, a variety of valve motions, including Allen, Walschaert and Heusinger von Waldegg, but rarely Stevenson; short valves and ports, but large nozzles and light reciprocating parts. Compound locomotives are quite extensively used and are giving general satisfaction. They are nearly all of the Von Borries or Lindner type, principally the former, which are doing good work wherever used, and are well liked by the crews running them. They only claim a saving by compounding of about 10 to 12 per cent. over simple engines, except in the very heaviest service and where simple engines are overloaded. Engines are well maintained and are generally single crewed. The older passenger cars are similar to those in Italy and other European countries, but are better built. The new cars have usually end platforms and aisles similar to the Swiss cars. All European cars, Italian, German, Swiss, French and English, are lighted only by a dim gas jet in the center of the ceiling. Reading after dark is impossible. In Prussia there are four classes of passenger accommodations on trains; elsewhere in Germany and throughout Europe there are only three. The passenger traffic on the German roads is divided among the different classes as follows: first-class half of one per cent., second class 10 per cent., third class 61 per cent., fourth class 26 per cent., while the remaining 2½ per cent. are soldiers. There are five times as many soldiers and twenty times as many second-class passengers as first class. The German railways are operated with much greater freedom from accident than those in America.

In France.

In France one is at once struck with the elaborate railway organization, and also with both the scientific way in which investigations are made and the unscientific way in which results of investigations of limited scope are generalized. Their track and subway are generally good, the surfacing being better than in Germany. Their signals and interlocking are not as extensive or as well worked out as on the German lines. The locomotives are well built, but often too much complicated to meet American ideas of good practice. France is the only European country in which 4-cylinder compounds are used to any extent. Here they

seem to be much more in favor than the 2-cylinder types They usually have a large receiver between the high and low pressure cylinders with a capacity of about 1¾ volume of high pressure cylinder. The economy is about the same as on the German lines with 2-cylinder compounds, viz., from 10 to 12 per cent. in heavy passenger and ordinary freight service.

The French passenger cars are usually poorly designed and uncomfortable. They almost all have side entrances and are cramped and decidedly behind the newer equipment in Switzerland and Germany. The speed of trains is higher than in Germany and the train service quite good. Some of the larger depots are well arranged, fine structures, but the smaller stations are no better than, if as good as, those of other countries.

A Ride on a Piano.

We do not publish the following as news, because it is too old for that. It has been floating around in different papers a long time that we know of. It bobs up every once in a while, and, like Hamlet's ghost, won't down. Every time we see it our liking and respect for it are increased. Whether the latter sentiment is due to its age or not we will not venture to say. The fact exists, and our regard has grown so warm that we are impelled to give it a home, and we therefore publish it herewith for the delectation of those of our readers who have not seen it, as well as those who have :

"I was loafing around the streets last night," said Jim Nelson, the veteran locomotive engineer, "and, as I had nothing to do, I dropped into a concert hall, and heard a slick-looking Frenchman play a piano in a way that made me feel all over in spots. As soon as he sat down on the stool I knew by the way he handled himself he understood the machine he was running. He tapped the keys away up one end, just as if they were gauges, and he wanted to see if he had water enough. Then he looked up as if he wanted to know how much steam he was carrying, and the next moment he pulled open the throttle, and sailed out on the main line as if he were half an hour late.

"You could hear her thunder over culverts and bridges, getting faster and faster, until the fellow rocked about in his seat like a cradle. Somehow I thought it was old '36' pulling a passenger train and getting out of the way of a 'special.' The fellow worked the keys on the middle division like lightning, and then he flew along the north end of the line until the drivers went around like a buzz saw, and I got excited. About the time I was fixing to tell him to cut her off a little, he kicked the dampers under the machine wide open, pulled the throttle away back in the tender, and—Jerusalem jumpers! how he did run! I couldn't stand it any longer, and yelled to him that she was pounding on the left side, and if he wasn't careful he'd drop his ash-pan.

"But he didn't hear. No one heard me. Everything was flying and whizzing. Telegraph poles on the side of the track looked like a row of cornstalks, and trees appeared to be a mud bank, and all the time the exhaust of the old machine sounded like the hum of a bumble-bee. I tried to yell out, but my tongue would not move. He went around curves like a bullet, slipped an eccentric, blew out his soft plug, went down grade fifty feet to the mile and not a confounded brake set. She went by the meeting point at a mile and a half a minute, and calling for more steam. My hair stood up like a cat's tail, because I knew the game was up.

"Sure enough, dead ahead of us was the headlight of the 'special.' In a daze I heard the crash as they struck, and I saw cars shivered into atoms, peopled mashed and mangled and bleeding and gasping for water. I heard another crash as the French professor struck the deep keys away down on the lower end of the southern division, and then I came to my senses. There he was at a dead standstill, with the door of the firebox of the machine open, wiping the perspiration off his face and bowing at the people before him. If I live to be a thousand years old I'll never forget the ride that Frenchman gave me on a piano."

The Consolidated Car Heating Company of Albany, N. Y. has sold 1,103 car equipments of electric heaters for street cars from August 1 to December 1, including the West End road of Boston, and the People's Traction Company of Philadelphia ; other roads have recently ordered over 700 car equipments.

The Henry C. Hart Manufacturing Company, of Detroit, Mich., has assigned all of its railroad business, including its stock, patterns, tools, patents and "goodwill," to the Dayton Manufacturing Company, of Dayton, O. The latter company announces that with the increased facilities afforded by the addition to its own of the plant of The Henry C. Hart Manufacturing Company, it will be able, more promptly than ever before, to supply its patrons with everything in its line, to which has been added the manufacture of the well-established Hart's Deck Sash Ratchets and Water and Dry Closets.

Metals for Rolling Stock Use.

A large variety of metals specially designed for use on railroad rolling stock is made by the Brady Metal Company, whose New York office is at 115 Broadway, and whose foundry is at 202-8 Tenth street, Jersey City, N. J. The foundry is fitted with all modern tools and appliances, including a well-appointed pattern shop and more than 6,000 patterns. It has a capacity of 1,000 bearings and 10,000 pounds of engine metal per day. Among the specialties manufactured by this company are the following :

Self-fitting, lead-lined journal bearings for passenger equipment, freight equipment, locomotives and all classes of engines.
Magnus metal for locomotive engine castings, driving box and rod bearings, or any bearings for high speed shafting.
Magnus tin for use as a substitute for block tin by railroad or other companies having their own brass foundry.
Magnus anti-friction lining metal.
Solder, in different grades or as per formula furnished.
Phosphor-bronze in ingots, bearings or castings.
Babbitt metal, nine different grades.

The self-fitting, lead-lined bearings are making a splendid record for themselves, and are in use on six of the principal railways in the East running high-speed limited trains, and up to date not one recorded complaint has been made against them. An important feature of the method by which these bearings are molded is that every bearing is cast face down, regardless of the inconvenience in molding or the extra cost. This insures a solid bearing surface.

The metals known as "Magnus," which are sold in either ingot or casting form, are now in use on many prominent railroads, and the demand for them is constantly increasing. The latest extraordinary record made by Magnus metal bearings in a competitive test on a well-known trunk line showed an average of 3,194 miles' service to one ounce of wear.

The President, Mr. Daniel M. Brady, who is also general sales agent of the company, served for more than 11 years as Chief Clerk of the late Leander Garey, when the latter was in charge of the Car Department of the New York Central & Hudson River Railroad. This long connection with such an able and prominent car department official as Mr. Garey, and with such a large railroad as the New York Central, was a valuable school of experience for Mr. Brady, and one abundantly competent to instruct him in the needs of car equipments. While serving in this capacity the fact was impressed on Mr. Brady that the most prolific cause of train delays was hot boxes on cars and engines. Even at the present time fully 40 per cent. of train delays on the best managed and equipped railroads is due to this cause, and formerly the proportion was greater. Mr. Brady's study of this subject made him a specialist in the matter of the proper treatment of journals and bearings to reduce friction to a minimum, and avoid the annoying and expensive delays caused by hot boxes. In commercial life he has continued to study the various phases of his important specialty, and has labored zealously to produce and introduce bearing metal alloys that his experience has taught him are excellently adapted for their specific purposes. In another year Mr. Brady will have finished a quarter of a century in active railway and manufacturing service.

The General Superintendent and metallurgist of the works of the company is Mr. Adolph Onslow, a mechanical engineer of 35 years experience. Mr. Onslow put up the first plant in America to manufacture self-fitting, lead-lined journal bearings, and in the past 26 years has made upward of 10,000,000 of them.

The long practical experience of these gentlemen in the field of railroad service and of manufacturing railroad supplies has rendered them thoroughly conversant with the requirements of metals used in cars and locomotives; and this largely accounts for the success that the company has met in the introduction of its goods, the output of its works having increased fivefold in the past six years.

The New York, New Haven & Hartford is about to place an order for 25 new locomotives.

New Riehle Testing Machine.

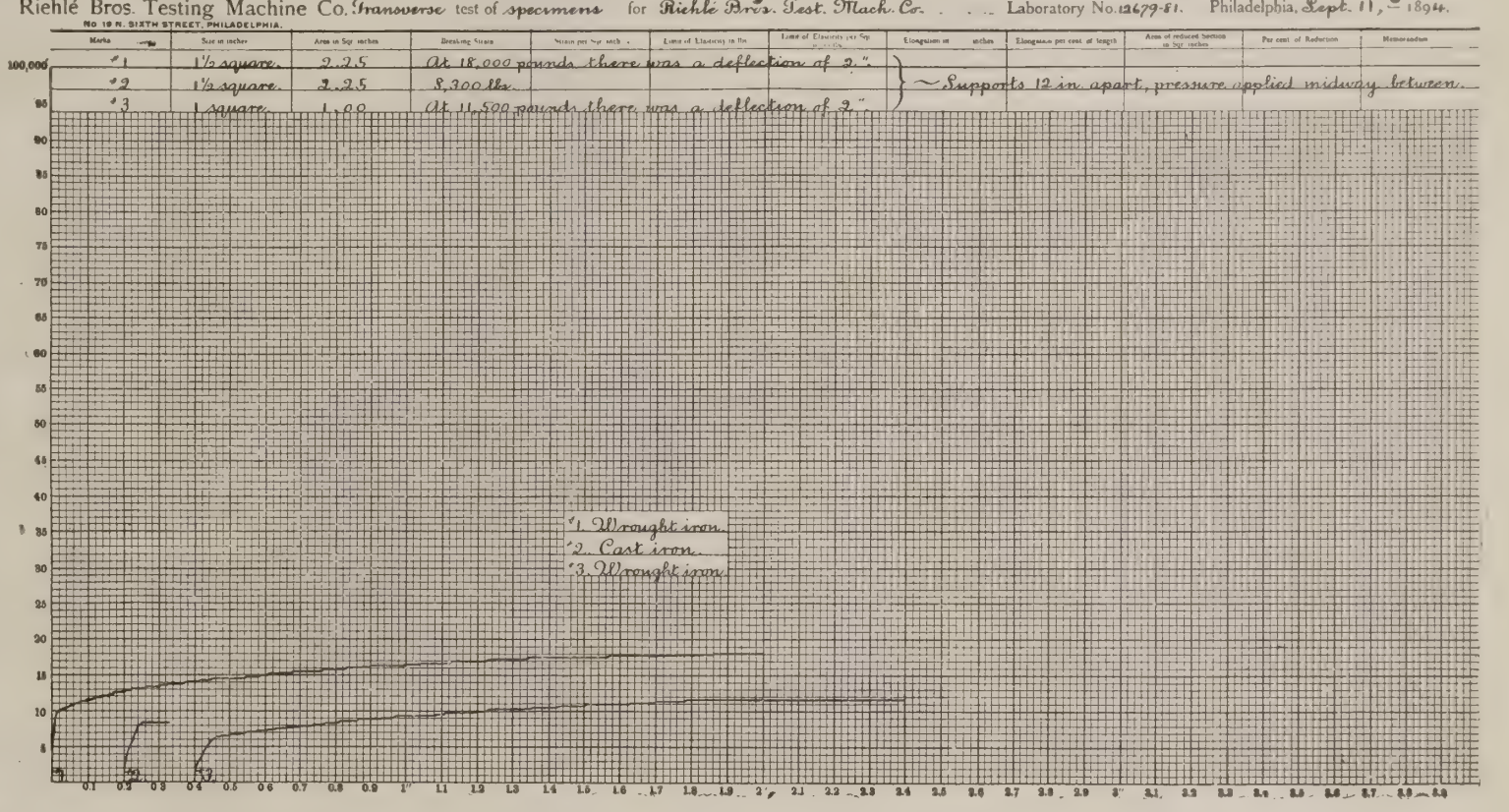
The accompanying diagram shows a record of some tests of wrought and cast iron recently made on a new improved testing machine manufactured by the Riehle Bros. Testing Machine Company, of Philadelphia, Pa. The makers have sent us another diagram showing tests of Munz metal on this machine, which, however, we do not reproduce herewith. The specimens tested were taken from the ordinary stock of cast iron, brass, machinery steel, Munz metal and wrought iron, and the lines of the diagrams are just as recorded by the machine, without any doctoring, and the slight waviness is due to the automatic action of the rise and fall of the beam in combination with the stretch of the specimen. In these tests the actual stretch of the specimen was magnified five times, so that each division of one-tenth inch represents an elongation of two one-hundredths actual; the vertical divisions represent 1,000 pounds to each division of one-tenth inch.

The method of making the tests may be described as follows :

One machine having been adjusted to suit the specimen in question, a strain card is placed on the drum cylinder at head of the beam, and the telescopic extensometer attached firmly to the specimen by means of the adjusting screw, but so that it will follow the elongation by its telescopic slides. A fine piano wire is then used to revolve the drum and is carried across over suitable guide pulleys to the extensometer, the points of which are say 8 inches apart; now in order to multiply the actual elongation, a series of small guide pulleys is mounted on pins, corresponding in distance with the points of the extensometer screws, so that the wire can be rove over the pulleys as many times as it is desirable to increase the stretch.

With everything adjusted at zero, the machine is started up; and as the load is applied and the beam rises an electric circuit is made, which, by means of a magnet and friction clutch, causes a grooved wheel to communicate its motion to the handwheel controlling the weighing mechanism. A very simple (patented) arrangement of two disks at right angles to each other gives the operator the power to control both the speed and direction of the weighing poise, as may be most suitable to material in hand.

These improvements in the Riehle machines are quite recent, some of the patents having been but just allowed, and the mechanism is notable for its simplicity and handiness. A feature of value in connection with the machine being that it is either automatic or not, at will of the operator, by simply disconnecting the poise belt.



Diagrams of Tests on the New Riehle Testing Machine.

The Lunkenheimer Company, of Cincinnati, O., has issued a new and very handsomely printed and illustrated catalogue and price list of the many articles of its manufacture. As is generally well known, these are mostly in the line of gate and globe valves, angle valves, hose, indicator and quick opening valves, regrinding and ball check valves, and steam valves of various other kinds including safety valves, cylinder cocks, water gages, steam gages, lubricators, etc. This company makes a specialty of steam whistles—the common, the mocking-bird and chime whistles. Among its lubricating devices are many forms of oil and grease cups, sight-feed lubricators, graphite lubricators and boiler oil-injectors. The goods of this company are well and favorably known, and are of a high standard of excellence. Those interested in such articles should address the company for one of these catalogues.

A train parted in the middle, and the bell cord snapped off like a thread, the end of it striking an old lady on the bonnet. "What is the matter?" she exclaimed "Oh, the train is broke in two," replied a gentleman, who sat in the next seat. "I should say so," the old lady said, looking at the broken cord. "Did they s'pose a little bit of string like that would hold the cars together?"

Combination Drilling, Boring and Turning Machine.

We illustrate herewith a 40-inch boring and turning mill, in combination with a 40-inch upright drill of the latest design of the Bickford Drill and Tool Company, of Cincinnati, O. The machine in all its parts is constructed for durability and convenience of handling, and has a number of new features, which are due to the long experience of the designers in modern machine manufacturing.

The table, or rather its strong spindle, revolves in two long bearings of the swinging arm, and in addition is supported by a foot bearing, which is fastened rigidly to the base. A hardened steel toe is inserted in the end of the spindle, and finds its support on a hardened steel plate that is always submerged in oil. This plate can be raised or lowered by means of a screw, according to the desired speed of the revolving table.

The table with its supporting arm can easily be swung around the column on anti-friction rollers, which run in an annular groove at the bottom of the arm, and by fastening the foot bearing to the base plate it brings the center line of the table spindle exactly central with the drill spindle and no setting or adjusting is required. The table is indirectly driven from the top shaft of the machine by means of a steel miter wheel which matches into a miter wheel on the vertical shaft between the column and the back brace. On the end of this shaft, which can be raised or lowered to bring the miters out or into match, is a spur pinion that drives, by means of the column surrounding intermediate wheel, the spur ring of the table. By the peculiar appliance and combination of the gearing on the top shaft, the spindle and table can revolve together, thus giving the machine the qualification of a double-head boring and turning mill.

The strong and heavy front arm slides on the V-shaped face of the column very easily. It has long gibbed bearings and can be raised or lowered either direct by crank handles or by the worm and wormwheel, and the same handwheel that serves for feeding the drill spindle by hand. It can also be fed up or down by power, the same as the spindle, without much change in the feed mechanism, by throwing in an intermediate gear on an oscillating lever. The front arm has on the left side a strongly braced extension, which carries the carriage and tool holder. The carriage can be fed either automatically or by hand from the right to the left or *vice versa*, the same as on any ordinary turning mill.

There are four different speeds for turning, as well as for drilling or boring, and eight different speeds for the rotation of table and spindle. The front arm or head and spindle are counterbalanced by a chain and weight. All handles for changing feeds or speeds of the machine are in convenient reach. The spindle shafts and studs, likewise the main gearing, are made of steel.

Preservation of Metals Used in Roofs, Etc.

At the Montreal meeting of the American Society of Mechanical Engineers, an interesting paper was read on methods for preserving metal used in pipes, roofs, bridges, poles, construction work, etc. It was said that the whole question of how best to protect iron and steel from corrosion in all the varying conditions that the wants and usages of to-day demand, seems to resolve itself into several "don'ts,' as the best mothod of answering it, to wit:

Don't have any scale on the metal.

Don't paint it with anything but pure linseed oil and oxide of lead or graphite paints.

Don't forget that frequent inspection and care are very necessary.

Don't let the cost and interest accounts be the governing factors in the case of protecting any metal structure on whose continuity and strength human life and safety depend.

In comparing the two paints recommended, it may be well to add that a properly made graphite paint should prove more durable and a better protector than oxide of lead. Graphite has a strong affinity for metal surfaces, and experienced painters claim that even where light colors are desirable, graphite paint should be used as a priming coat. Again, graphite is impervious to the action of heat, cold, sea air, acid or alkali fumes, which are more or less destructive agents to lead paints. The Joseph Dixon Crucible Company, of Jersey City, N. J., has manufactured a pure linseed oil and graphite paint for over 25 years, and has some very convincing testimonials of its value.

The Wrong Fare in the Box.

The absent-minded man has on various occasions dropped his change in the "chopper's" box on the elevated station, carefully clinging to his ticket. Once or twice he has attempted to drop a glove or stuff an umbrella into the box. The other evening he got into trouble with a new trick. He was late to a dinner engagement, and as he started to climb the elevated stairs he saw his train run into the station. Going up the steps two at a time, he bought his ticket hurriedly and rushed for the door. Tossing his ticket, as he supposed, into the box, he ran on to board the train. The "chopper" tried to restrain him, yelling out several excited words, but the absent-minded man was determined to catch that train, so he shook off the man, and, bolting through the crowd, gained a car platform. Then, as the gate slammed behind him and the train moved out of the station, he realized what had happened, for the "chopper" was howling like mad about lighted cigarettes. The absent-minded man had paid his fare with a lighted cigarette, and whether the tickets in the "chopper's" box were burned up or not he doesn't know. He would rather be left in ignorance than go to the "chopper" for information.—*New York Tribune.*

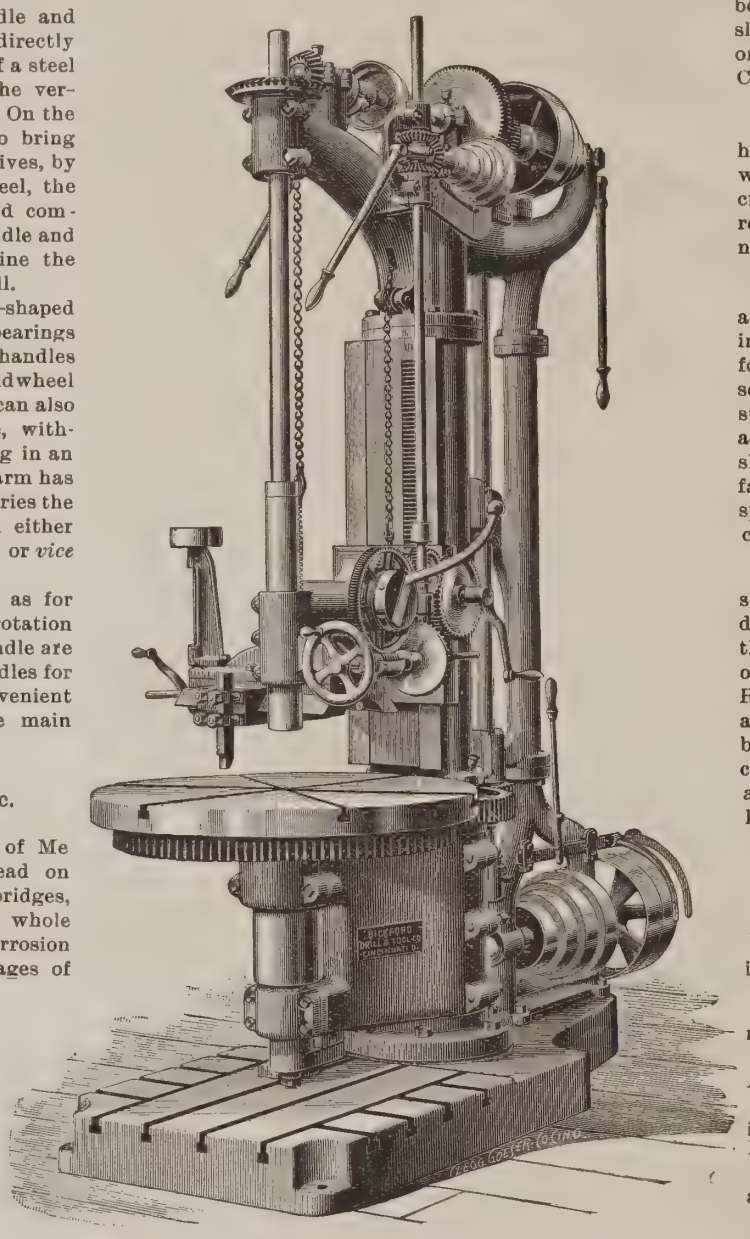
The Berlin Iron Bridge Company, of East Berlin, Conn., has just completed for the Baldwin Locomotive Works the steel roof trusses for the addition to their wheel shop.

Protection of Magnolia Metal by Injunction.

Judge Lacombe, of the United States Circuit Court at New York, has granted the Magnolia Metal Company an immediate injunction agaist the Nassau Smelting Company, of New York city (composed of Benjamin and Moses Lowenstein), restraining them from selling a metal called the *Mongolia* metal, which they have been assiduously offering in the New York market and elsewhere, claiming it to be the same as Magnolia metal and confusing the trade very generally with the similarity of the names used.

The West End Railway of Boston has ordered 149 cars equipped with the electric heater manufactured by the Consolidated Car Heating Company.

Mr. Charles A. Sheldon has resigned as Assistant Division Superintendent of the Michigan Division of the Lake Shore & Michigan Southern Railroad, to accept a position with the Consolidated Car Heating Company. He will have charge of the Compressed Gas Lighting Department of the company.



The Bickford Drilling, Boring and Turning Machine.

The new machine shop for the American Hard Fibre Company, at Newark, Del., is now completed. It is designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and is 50 feet wide by 226 feet long, the roof being made of steel and covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roof covering. This roof covering is also to be used on the new power station this company is to build for the United Electric Light and Power Company on East Twenty-eighth street, New York city. The power-house is 100 feet wide and 200 feet long; the engine-room is 100 feet wide and 80 feet long, and the boiler-room is 56 feet wide and 100 ft. long.

The Sterlingworth Railway Supply Company, of 256 Broadway, New York, has presented its friends with canvasback pocket-books large enough to accommodate bills without folding Of course the liberal minded gentlemen who compose the Sterlingworth Company would not think of giving their friends *empty* pocket-books, so each book contains several "important papers in the northeast pocket," which call attention to the several articles of manufacture handled by the company, all of which are specially adapted to railroad requirements. Among these may be mentioned Magnolia metal, which has made for itself a world-wide reputation as an excellent anti friction bearing metal. Its largest present use is in marine and stationary engineering, but it is as well adapted to railroad rolling stock uses. The Sterlingworth Company has undertaken its introduction in this field in America, and those who know the push of the individuals of the company must admit the probability of their early success. Among the other specialties handled by this company are the Sterlingworth steel body bolster for freight cars, the Sterlingworth brakebeam, and a switch stand bearing the same name.

Leather Belts.

No one using leather belts can afford to be indifferent to their care. There is a certain amount of elasticity in all good leather belting, but time and continued hard work seem to destroy or at least weaken its power. Then comes the question whether it is better to simply tighten the belt or use some form of dressing. Experience of many very practical observers favors the use of a good dressing, as tightening the belt strains it and calls for more engine power. The superintendent of a large printing establishment has an 18-inch main belt now running its eighth year which has never been taken up, and it would be extremely hard to convince him that the dressing used does not preserve the life of the leather and keep it soft and elastic. Of course one should be careful what sort of dressing is used. Soap, rosin, tar and tallow should not be used at all. Even castor oil is objectionable. The dressing used in the case cited was Dixon's belt dressing and leather preservative, which was the only article that would start the big driving belt used at the Paris Exposition in 1878, and keep it from slipping. Circulars about the dressing will be sent to any one interested by the Dixon Crucible Company, of Jersey City, N. J.

The Consolidated Car Heating Company, of Albany, N. Y., has just awarded the contract for an addition to its factory, which will practically double its capacity. Its rapidly increasing business in electric heating appliances and the requirements of its compressed gas lighting business have necessitated increased facilities for manufacturing.

The Clayton Air Compressor Works, the offices of which are at 26 Cortlandt street, New York, have issued a list naming the many various purposes that compressed air is used for in the industrial arts. The list is a long one, and names some applications of this useful agent that will doubtless surprise those who have not kept a close watch on its rapid advancement in favor. Those interested in the subject should send for one of these lists. This company also manufactures air compressors of various kinds, and also furnishes special designs of air compressors for every possible application of compressed air.

The Beamless Brake Company, whose offices are at 41 Dey street, New York, is meeting with good success in the introduction of its beamless form of brake. As an instance of the durability of the beamless brake it is announced that over 50 cars on the New York, Susquehanna & Western Railroad have been equipped with it for nearly three years and not a cent has been required for repairs to the beamless brake. The claims of the makers are that this form of brake costs less to apply than the common type, and that car bodies are less mutilated in its application; also that safety is largely promoted by beamless brakes.

Our Directory

OF OFFICIAL CHANGES IN NOVEMBER.

We note the following changes of officers since our last issue. Information relative to such changes is solicited.

Atlanta & Florida.—General Manager T. W. Garrett has resigned.

Canadian Pacific.—George A. Haggerty, Master Mechanic Atlantic Division, has resigned.

Carrabelle, Tallahassee & Georgia.—S. D. Chittendon is appointed Purchasing Agent, with office at Tallahassee, Fla.

Central R. R. of New Jersey.—Norman E. Sprowl is appointed Division Master Mechanic at Phillipsburg, N. J.

Denver & Rio Grande.—Charles H. Schlacks is appointed Assistant General Manager.

Detroit, Lansing & Northern.—Walter T. Rupert is appointed Master Mechanic.

Duluth & Winnipeg.—President Wm. F. Fitch is appointed Receiver.

Georgia Midland & Gulf.—John F. Flourney is appointed Receiver.

Great Northern.—Superintendent J. R. Van Cleve, of the Cascade Division, is succeeded by F. L. Corwin.

Iowa Central.—C. W. Huntington is appointed General Superintendent.

Kansas City, Osceola & Southern.—Leslie McLachlin is appointed Master Mechanic. Office, Clinton, Mo.

Mexican Central.—R. H. Nickerson is appointed General Manager, vice Edward W. Jackson, resigned. R. M. Thomas is appointed Superintendent of the San Luis Division, vice S. O. Lewis, resigned.

New Orleans & North-Western.—General Manager C. H. Sharman has resigned. Receiver L. K. Hyde assumes the duties of the office.

New York, Chicago & St. Louis.—The office of W. L. Blair, Superintendent Eastern Division, is removed from Cleveland to Conneaut, O.

New York, Lake Erie & Western.—Alfred Walter, General Manager, has resigned, and the office is abolished. L. C. Smith is appointed Superintendent of the Jefferson Division. E. E. Loomis is appointed Superintendent of the Tioga Division. George Donahue is appointed Master Mechanic of the Mahoning Division. Willard Kells is appointed Division Master Mechanic at Cleveland, O.

New York, New Haven & Hartford.—The office of John Henney, Jr., Superintendent Motive Power, remains at New Haven, Conn.

South Carolina & Georgia.—James Meehan is appointed Superintendent of Motive Power and Machinery.

Southern Pacific.—James Agler is appointed Superintendent at Wadsworth, Nev. C. W. Cooley is appointed Superintendent at Dunsmuir, Cal.

Western of Alabama.—Joseph Herrin is appointed Superintendent. Office, Montgomery, Ala.

Wanted.

WANTED—By a large manufacturer, some new specialty to mannfacture for the railroad trade. Address "ADVERTISER," care of the NATIONAL CAR AND LOCOMOTIVE BUILDER.