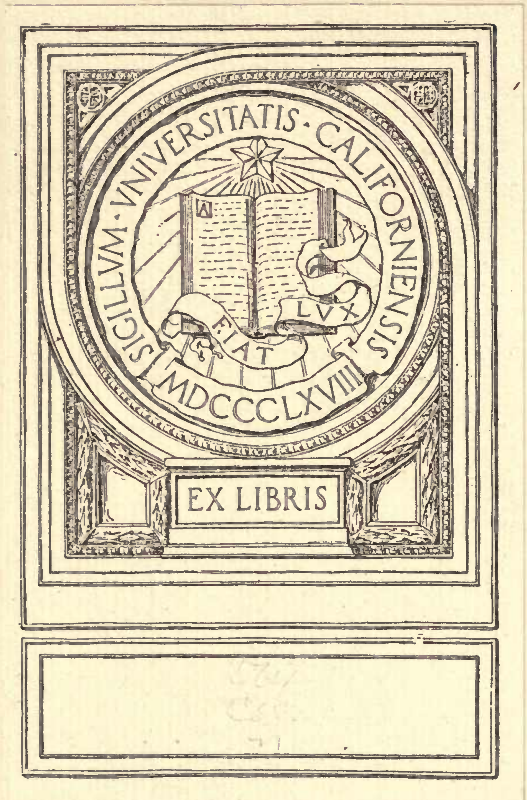
New Ideas In Coal Mining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New Ideas in Coal Mining

Shortcuts and Simple Devices for Getting Improved and Economical Results in Coal-Mining Work. Compiled from the Regular Issues of Coal Age.

COAL AGE
Tenth Avenue at Thirty-Sixth Street
New York
1917

PREFACE

The kink is king—in coal mining work more than in any other industry; in these stirring times more than at any other period in recent years.

The more kinks you know, the more you are worth; the better, quicker, safer, work you can do.

A kink is something you can't learn in the schools; until the book "Coal Mining Kinks" appeared, a year ago, something that you couldn't get in books.

It is a simple, unusual, inexpensive way of doing things that can be hammered out only on the anvil of stern necessity. When you are "up against it, good and hard," and you are at your wits' end to know how you are going to get out of the tight corner into which an unexpected emergency has driven you, how often has an ingenious idea come to you like a flash and saved the day for you!

Equally good ideas have come to other men, in other emergencies. To have those ideas at your fingers' ends is an opportunity of unmeasurable worth to you.

The editors of Coal Age have a knack of encouraging their readers to send in for publication, so that others may profit by them, the kinks they have tried out in their workaday practice.

To the department in Coal Age called "Ideas and Suggestions" hosts of mining engineers, superintendents and foremen have long been contributing crisp, interesting, usable accounts of the worthwhile things they have been doing in their mines—the shortcuts they have thought of for increasing output, saving time, cutting costs and reducing labor—the simple, home-made devices they have hit upon and rigged up, likely as not from the scrap pile, for doing the work of elaborate machinery when new equipment was not available.

About a year ago the best of these new ideas which had appeared in the preceding twelve months were collected into a book, called "Coal Mining Kinks."

Its success was instantaneous. Thousands of copies were circulated. Thousands of men have not hesitated to say that the book has saved them hundreds of dollars—let daylight in on many a problem that at first seemed hopeless of solution.

Since then coal-mining practice has undergone many changes and advances. The greatest war in human history has extended to the United States. With it have come industrial problems of unprecedented magnitude.

Coal being a prime wartime necessity, naturally every phase of coal-mining work has been affected by the new conditions.

The unparalleled demands for production—the shortage of labor—the mounting costs of everything—unsatisfactory transportation conditions—slow deliveries of supplies needed in the mine—the growing disposition to cut profits to the bone—have all added to the burdens of every responsible coal-mining man in the country.

It is a matter for congratulation that coal-mining men have risen so splendidly to the occasion—that they have heroically accepted the challenge of the times by evolving so many new ideas for securing improved, quicker and more economical results.

Never have the columns of Coal Age been so crowded with practical suggestions for meeting the demands of the hour as they have in the past few months, the time covered in the original publication of the Kinks contained in this volume.

At a time when there is such urgent need for greater efficiency—when every minute saved, every dollar pared from costs, every ounce of energy conserved, is a contribution of definite value to the industrial resources of the nation—the appearance of these "New Ideas in Coal Mining" is most opportune.

The editors send it forth in confidence that it will help you with your daily problems—that it will make it easier for you to do your "bit" in these critical days.

They also hope that when the third Kink Book appears, it will contain some of YOUR good ideas which you have been good enough in the meantime to let them buy from you for publication in Coal Age.

For the most part, Coal Age's contributors themselves have written this book. We have let them tell their own story, in their own words. While no editorial responsibility has been assumed, beyond the elimination of personal or purely local references as they originally appeared in the journal, the mere fact that these Kinks were admitted to the columns of Coal Age is sufficient guarantee of their good faith and of their value as contributions to current practice.

Contents

Preface - - - - - - -	i
Acknowledgement - - - - -	vi
Track and Car Kinks - - - - -	1
Kinks in Getting Out the Coal - - -	17
Kinks in Haulage and Hoisting - - - -	26
Kinks in Drainage and Pumps - - -	38
Kinks in Ventilation - - - - -	50
First Aid, Safety and Welfare Kinks - -	55
Surveying Kinks - - - - -	72
Kinks for the Mine Draftsman - - -	87
Kinks in Mine Mechanics - - - -	93
Kinks in Mine Management - - - -	99
Kinks in Handling Electrical Appliances - -	104
Kinks in Handling Pipes About the Mine - -	114
Kinks for the Mine Power Plant - - -	122
Kinks in Lubrication - - - -	134
Miscellaneous Kinks - - - - -	140
Index - - - - - -	147

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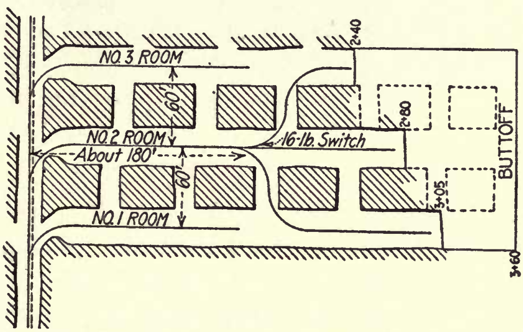
New Ideas in Coal Mining

Track and Car Kinks

Room Tracks

The following is a suggestion for room tracks where electric gathering motors are used. The advantages are: 30 to 50 per cent. of time saved (according to length of room) or a corresponding increase in the tonnage; 30 to 50 per cent. saved in the wear on the motor; 30 to 50 per cent. saved in the wear on the cable; 83⅓ per cent.



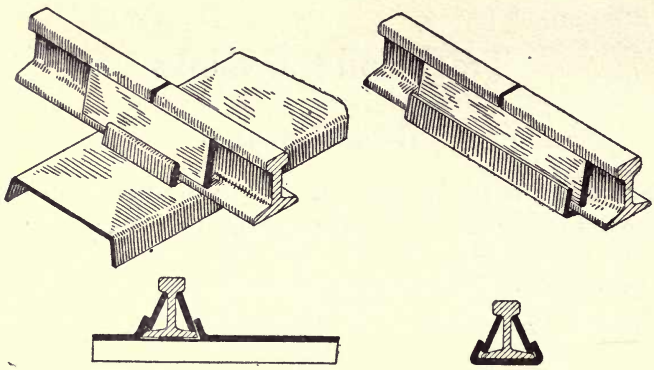
Arrangement of Tracks in Rooms To Save Rails

saved in running under the trolley wire at the room neck, which in itself is quite an item in low coal, especially where safety is considered as being of prime importance.

In the rooms to the right and left of the center room the track (laid on steel ties) up to the third crosscut would not be required for a period of six months or more, or until the pillars were brought back to that point, and could be used in the face of the room, thus effecting a saving in steel. But the main advantage is in the reduction of the time otherwise wasted, for the locomotive does not have to travel the full length of three long rooms every time it gathers a trip.

New Track and Rail Joint

A jointing device, consisting of a baseplate, 6 in. long, of $\frac{1}{8}$-in. steel plate, with longitudinal flanges formed to make an easy fit with the flanges of the rail, and two wedges of $\frac{3}{16}$-in. plate having a taper of $\frac{1}{4}$ in. per ft., which are wedged between the under part of the rail



A South African Form of the Steel Tie

head and the flange of the baseplate, the wedges being placed on each side of the rail, is described by L. W. Macer in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa.

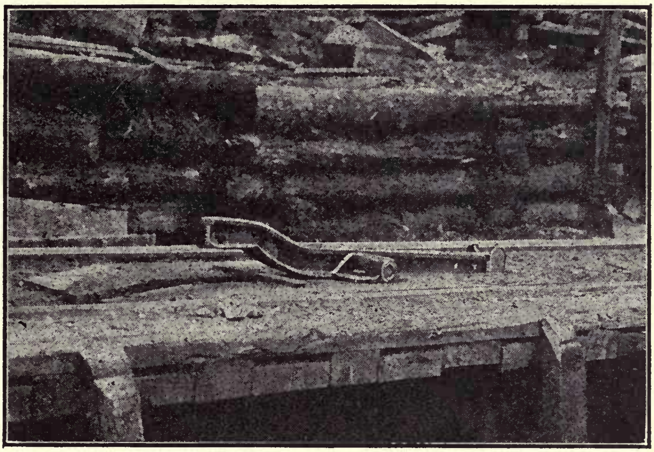
If attached to steel ties, the base is formed by punching up lugs in the ties to form flanges to receive the wedges, and an advantage is gained by making joints on the ties, giving greater permanency of alignment of track. The rails can be supported between joints by wooden ties to which they are dog-spiked or by lighter steel ties, using only one wedge.

Wedge joints, stamped from sheet steel, weigh less than fishplates and bolts, the wedge joint for 16-lb. rails weighing 3 lb. 2 oz. against 4 lb. 3 oz. for fishplates and bolts. The steel tie is also simpler, as it avoids the necessity of clutch bolts. The triangular section formed by the wedges and baseplate is of great strength.

The speed of track laying is greater than with plates and bolts, and where scrap material is available for their manufacture, wedge joints are easily made at the mine with a die and steam hammer.

Safety Dogs

The safety dog is almost as old as the mine rail, but here is one which is used at the Bessie coal mine of the Sloss-Sheffield Steel and Iron Co., at Maben, Ala., a simple contrivance but one which satisfies every need and will pay for itself many times over by preventing



Safety Dogs Will Reach the Runaway Cars Long Before You Can

expensive wrecks. F. R. Bell, the superintendent of the mine, designed this safety dog. One is placed every 100 ft. for the full length of the incline.

Efficient Sand Dryer

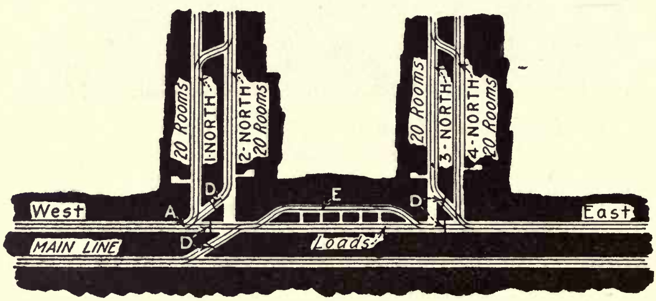
An efficient sand dryer can be made in the following manner: Secure a small Burnside heating stove to serve as a furnace, and set this on a good concrete or sheet-iron floor; make a hoop from a piece of $\frac{3}{8}$ x 1-in. iron bent to rest on the four corners of the first section, or ash pit, of the stove; take a large metal washtub, cut out the center of the bottom so that the tub will fit neatly around the second section of the stove and rest on the hoop previously fitted to the first section; in the remaining bottom surface of the tub punch 1-in. holes about $\frac{1}{2}$-in. apart, to allow the sand to run out when dry; cut a small notch in the top of the tub directly in front of the fire door to allow this door to swing open.

This method of drying sand for two or three locomotives will be found far superior to drying it on a piece of sheet iron over an open fire.

At one of the Superior Thacker Coal Co.'s plants (Williamson, W. Va.), a dryer of this type was installed in the blacksmith shop. In this instance the blacksmith easily dried sand for two locomotives in addition to his regular duties. This dispensed with the services of one man, who had been employed to dry sand on a piece of sheet iron over an open fire.

Gathering-Locomotive Parting

The accompanying illustration shows a gathering-motor parting that is being used successfully in a southern Illinois mine. Its operation allows the motors to be free to gather an extra trip after the parting is full of loads, or during a wait for the big motor. The gathering motor takes 10 or 20 empties from the empty track on parting *E* and



Gathering Parting in Southwestern Illinois

hauls them west until the last car clears the switch *A*, which is then thrown for 1st North. The motor pushes the cars up the entry, the trip rider throws the room switches, and the cars are pushed into the rooms. After the empties are delivered, the motor crosses to 2nd North and gathers loads from the last room first, continuing down the entry.

The motor then pulls the loads into the west entry until they clear the switch *A*. It then proceeds to push the loaded cars onto the parting. After delivering its loads, the motor is ready to deliver empties to 2nd North and, crossing over, gathers loads from the 1st North.

It requires two gathering motors for this plan in order to keep the parting full of coal for the haulage motor. This parting is in successful operation in one of the steadiest-working 3000-ton mines in southern Illinois. Each motor gathers 175 to 200 loads daily of 2¼ tons capacity net.

Turnout Tables for Use in Mine Work

Considerable trouble has been experienced in the past by mine foremen and track layers in installing track and turnouts in mines. In many cases frogs have been set haphazard, without regard to the length of the lead. This makes the approach to the frog irregular and often means a derailment of motor or cars.

The following table and sketches furnished by O. H. Hampsch will be of aid to the foreman or tracklayer who has this kind of work

TABLE OF SWITCH VALUES

Frog No.	Frog Angle	Gage	Lead	Length of Switch Point	Spread of Switch
2½	22°–37′	3′–6″	19′– 7″	7′–6″	5½″
3	18°–54′	3′–6″	21′– 9″	7′–6″	5½″
3½	16°–16′	3′–6″	23′–10½″	7′–6″	5½″
4	14°–15′	3′–6″	25′– 8½″	7′–6″	5½″
2½	22°–37′	3′–0″	15′– 7″	5′–0″	4″
3	18°–54′	3′–0″	17′– 6″	5′–0″	4″
3½	16°–16′	3′–0″	19′– 4½″	5′–0″	4″
4	14°–15′	3′–0″	21′– 0½″	5′–0″	4″

to do. The frog numbers and gages are those most commonly used in mine work. The lead in each case has been figured from the point of switch to the half-inch or actual point of frog. The switches and frogs are computed straight.

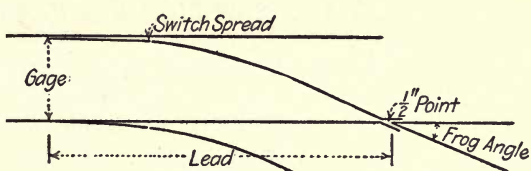


FIG. 1

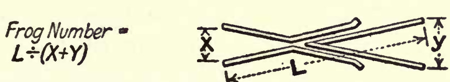


FIG. 2

Figure Showing Names of Switch Parts

The method of obtaining the frog number, as shown, is self-explanatory. Care should be taken, however, to make the measurements to the gage or running side of the rail.

Repairing Steel Mine Ties

Steel ties are a heavy item of expense, and some companies have found it justifiable to spend considerable time and money in order to repair broken ties rather than buy new ones. The particular form of tie which is in most extensive use and gets out of commission the easiest is that with the lugs punched from the body of the tie.

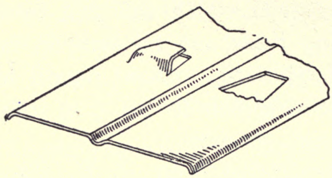


FIG. 1

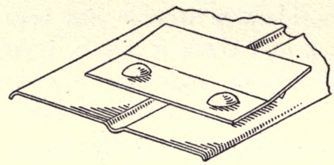


FIG. 2

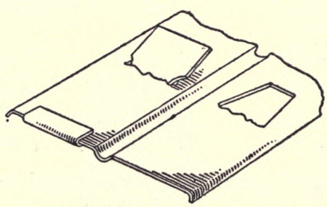
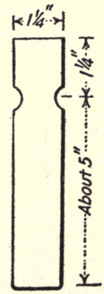


FIG. 3



Repair Lug

Figs. 1 to 3. Showing Steel Tie and Its Repair

When a car is wrecked and dragged along the track, the flange of the wheel mashes these lugs down flat. When the trackman attempts to straighten them again, they usually break off and render an otherwise good tie useless. These broken ties are gathered up and taken to the blacksmith shop to be repaired.

The usual method of repairing the ties is to rivet a piece of $\frac{1}{4}$-in. iron on the end of the tie to take the place of the lugs, as shown in Figs. 1 and 2. To do this, the blacksmith must punch two holes in the end of the tie outside of the old lug holes. He must then cut a piece of iron about 3 x 3 x $\frac{1}{4}$ in. and bend it so that it will admit the rail when in place. He must then mark and punch two holes in this piece to correspond to the holes in the tie and give the proper gage. The piece is then riveted on, and the tie is again ready for use.

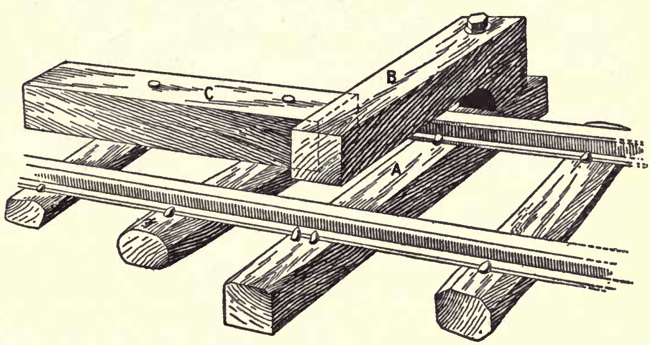
A mine blacksmith has devised another way to repair the broken ties, which seems to be much better. He takes a piece of iron about 1¼ x ¼ x 6 in., necks it slightly, sticks the head of this piece up through the old lug hole in the tie, turns it flat so that the head cannot slip out, and bends the end round and over the end of the tie, with the result shown in Fig. 3.

The amount of metal used in the new way is about one-third that required for the old, and the saving in time is even greater. It is only necessary to replace one of the old lugs in this manner, and the tie thus repaired is as good as new.

Safety Car Stop

The accompanying illustration shows a safety device, or block, to be used at the end of the tipple so as to prevent empty cars from running down the slope.

A is a large railroad tie under both rails, spiked securely and tamped solid. *B* is a piece of 6 x 8 with a ¾-in. bolt through it and the tie *A*. This bolt acts as a pivot, or hinge, upon which the block *B* swings. *C* is another block spiked firmly to the ties between the rails and of such height that the boxes of the cars will not catch



Car Stop in Operating Position

upon it. The block *B* rests against this stationary block when the device is in the closed position.

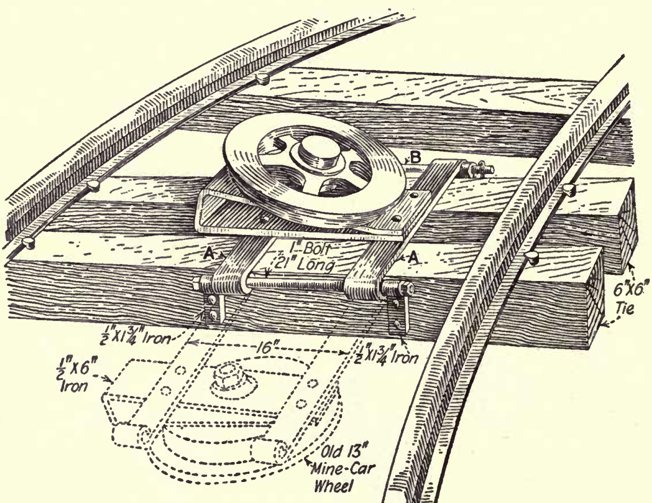
The block is opened for the trip to pass through, and as the triprider rides the last car he uses his foot, giving the block *B* a push, which swings it across the rail and against *C*.

The contributor to whom we are indebted for this suggestion, states that he has seen a trip of seven cars shot over the first knuckle so fast that enough brakes could not be applied to stop the trip, strike this safety block with such force that the first car was sent over the block and the second brought up hard against it. Of course, the first car was derailed, but the only damage done to the block was the impression of the flange of the wheel where it struck the timber. This has happened about a dozen times—and the block can withstand a dozen more.

Useful Angle Sheave

The accompanying illustration shows a rather useful angle sheave devised by the operating department of the Castle Gate mine of the Utah Fuel Co.

This device is made of odds and ends and is for temporary use along slopes where entries are being turned off and where it is neces-



The Sheave in Position

sary to move undercutting mining machines from one entry to another across the slope.

In order to prevent the hoisting rope from swinging over to the sides of the slope and wearing against the ribs when the trip of cars is lowered into or hauled out of a level entry, some kind of sheave must be provided. Usually these are permanently installed, but they must be high enough to catch the rope when it is nearly at the height of the drawbar of the car and, consequently, they are too high for an undercutting mining machine truck to pass over.

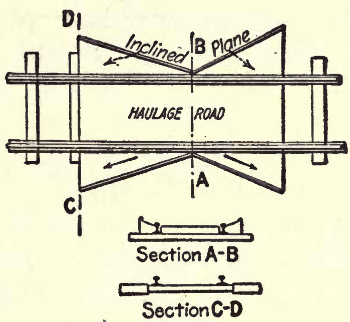
This difficulty was overcome by hinging the carriage of the sheave so that when the cutting machine had to pass over it it could be turned upside down between two ties, as shown in broken lines in the foreground.

The hinge is shown at *A A* in the plan. The bolt *B* is simply for holding the carriage rigid when the rope is in the sheave and the side and lifting stress is upon it. When it is desired to reverse the sheave this bolt is taken out, which frees the carriage. The drawing is sufficiently in detail to show the working plan.

Mine-Car Rerailer

Anyone familiar with underground haulage knows that derailments occur frequently and cause much delay and annoyance, as it is a difficult matter oftentimes to rerail a loaded mine car.

A type of rerailer that may prove of interest is shown in the accompanying sketch. The device possesses the advantage over others,

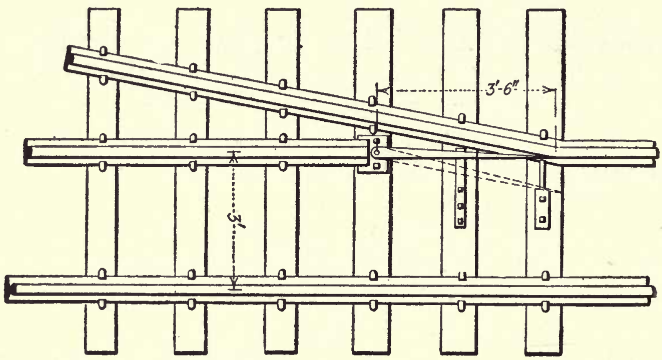


in that it presents an incline plane for the wheels to travel and by which they are elevated to the level of the top of the rails. This is the case both outside of the track and between the rails, so that both wheels of the car climb the rails steadily.

Simple Derailing Device

It frequently happens that a parting must be put in on more or less of a grade. This is a constant source of danger from runaway cars. The simple derailing device shown in the accompanying illustration, which has been in successful operation for some time at the plant of the Chicago & Big Muddy Coal and Coke Co., obviates this danger.

This appliance may be placed just outside the parting switch so that neither loads nor empties can run far enough to gain dangerous headway before being thrown from the track.



Plan of the Derailer

When the latch is closed, it rests against, and is held in place by, a twisted fishplate spiked to a tie near the latch point. It is necessary to lift this latch point in order to open it. This operation must be performed by hand.

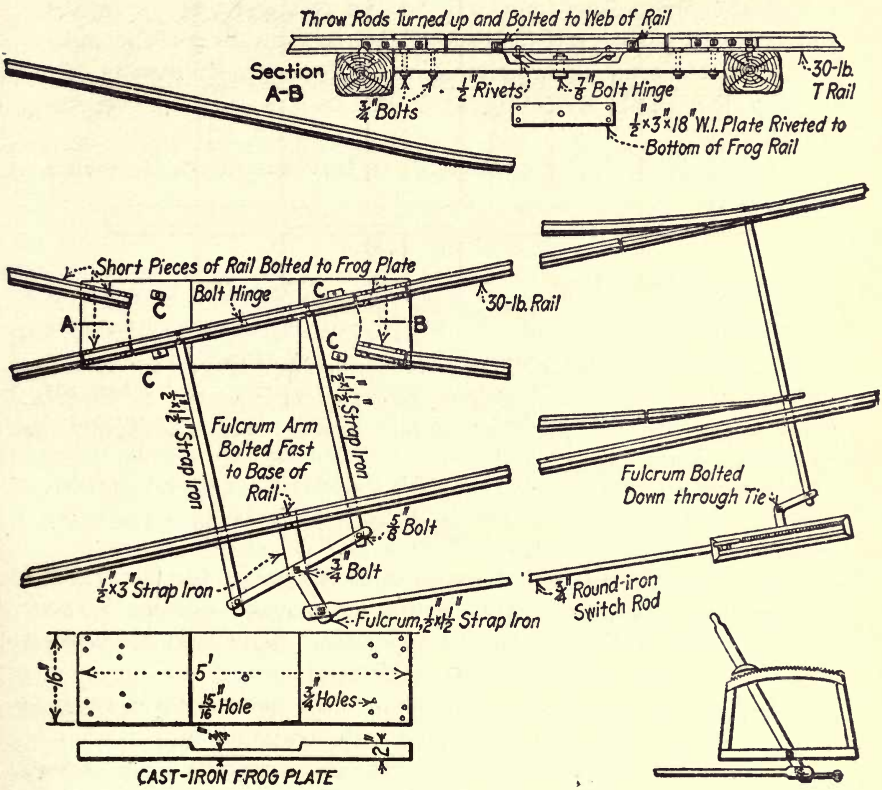
A Frogless Switch

A frogless switch which has been in service in the No. 1 shaft of the Morrisdale Coal Co. since October, 1914, is adapted particularly for use on main electric haulage roads, at partings which must be frequently traversed by mine locomotives.

It is a well-known fact that much trouble is experienced at these points in the maintenance and upkeep of switches, using ordinary frogs, owing to the locomotive wheels becoming grooved at certain times to a depth, which while not justifying a change of wheels, often causes a broken frog or a derailment, entailing delay and expense.

In the accompanying drawing it will be seen that the frog is replaced by a pivotal rail, arranged at the juncture of the convergent rails of the main and branch tracks. This pivoted rail is connected by two bridle bars and a throw rod to the same switch lever which operates the latches. When the switch lever is thrown to one side, setting the latches for the branch track, the pivotal rail forms a part of the branch track, and when the switch is reversed for the main track, it becomes a part of the main track. The drawing shows it in the latter position.

The pivotal, or swinging, rail section is fastened to an iron baseplate, having a depression in the center which allows room for the



Parting Switch Well Adapted for Use on Electric Haulage Roads

pivot hinge. Four short pieces of rail are bolted to the plate, one at each corner, their angle of convergence forming what would ordinarily be termed the angle of the frog. Each of these rail sections is drilled for fishplates, to connect with the abutting rails. The baseplate is also well spiked to the ties, making the whole solid and rigid. Small plates *C* are bolted to the base, to limit the throw of the swinging rail and insure its proper alignment with the connecting rails.

This switch is located at the main parting near the bottom of the shaft, at the juncture of the loaded and empty tracks. It is always set for the loaded trips coming out, the brakemen on the empty trips opening and closing it as they go in. It has been in continuous operation for two years, with a daily average of 60 to 70 motor trips (about 1300 cars) passing over it, has not cost one cent for repairs and has given perfect satisfaction. The motormen are much in favor of it, there being no jar or jumping of the locomotive in passing over it when the wheels are worn, as is the case in running over the ordinary frog.

The switch is patented by W. R. Ross, trackman at the Morrisdale No. 1 shaft.

Sanding Rails

Sand is used on locomotives to increase the adhesion between the driving wheels and the rails. Its use is really an emergency measure to assist the machine in passing over a slippery stretch of rail, up a steep grade, starting heavy loads, stopping suddenly, and when the locomotive is too light for the work it is doing. Whenever increased adhesion is required sand is useful, for it increases the effective friction between locomotive and rail. The increase in resultant drawbar pull for cast-iron wheels is usually considered as being 5 to 10 per cent., and for steel-tired wheels from 5 to 7 per cent.

Many locomotive runners use sand indiscriminately just because it happens to be available. This is a great mistake and one which usually results injuriously for the apparatus. Sand used needlessly and too often sometimes works into the bearings and moving parts, causing havoc by interfering with the oil flow and cutting the bearings and commutators and interfering with commutation.

Another effect that follows the use of sand, especially in excessive quantities, is that doing so materially reduces the capacity of the locomotive by decreasing the effective trolley voltage. To all intents and purposes sand is a nonconductor of electricity, and placing it between wheels and rail in the direct path of the current flow is equivalent to inserting a resistance, if not an actual insulation in the circuit. This is the same as reducing the voltage and current carried by the circuit. Since sand is generally used when starting, when the required pull and also the current upon which torque depends are greatest, the voltage drop is highest and the sand may so seriously reduce the voltage and volume of the current that the locomotive cannot start its load. In cases of this kind it is often claimed that there is insufficient copper in the trolley, whereas the current is cut down by the high resistance interposed by the film of sand on the rails.

Still another effect of the promiscuous and excessive use of sand is that persons touching the locomotive may receive a shock. When a film of sand exists between wheels and rail the frame of the locomotive as well as the wheels become partially insulated from the rails. As the current in passing from the trolley goes through the motors to the wheels and thence to the rails, it is obvious that with the wheels isolated if not actually insulated from the track the frame of the locomotive is raised to almost the same potential as that of the trolley. Any person standing upon damp ground or upon the rail and touching the frame of the machine will then receive a shock which may be dangerous because it may cause the recipient to stagger or fall.

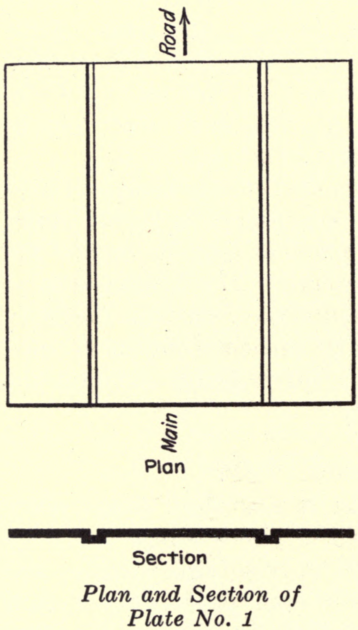
It is a wise plan, therefore, not to use sand merely because it happens to be available. It is available for emergency, for special conditions such as slippery track, excessive grade or load, or because the locomotive is too light for the work imposed. If a locomotive is so far too light that sand must be used all the time, the load should be lessened, a heavier locomotive obtained or steel-tired instead of cast-iron wheels should be employed. This latter change improves the drawbar pull between 5 and 10 per cent.

Useful Underground Plates

A number of places frequently exist in and about mines where plates can be laid down instead of points and crossings and serve the purpose with equal satisfaction and in some circumstances suit the conditions even better. Commonly, such platforms are built of separate sections laid down between the rails and one on either side of each rail. This means a good deal of time and trouble in laying and staying in position, although it has the advantage that the line of rails does not need to be disturbed when the plates are removed elsewhere. The accompanying illustrations show two plates that are in common use in some districts. They are single pieces of plate designed to be lifted complete and to do the work of the turn out in more limited space.

Plate No. 1 is laid with its surface level with the top of the rails, a groove being cast along the plate in the direction of the main traveling road, in which the flanges of the wheels run. There is no flange groove in the direction of the side road, and the side-road rails are slightly above the level of the plate.

In coming off the side road, the car is swung around as it touches the plate, and if this is skillfully done its own momentum carries it over the plate and allows it to slide into the tracks in the plate which act as a stop. This operation can be performed almost without appreciably affecting the forward movement of the car.



Plan and Section of Plate No. 1

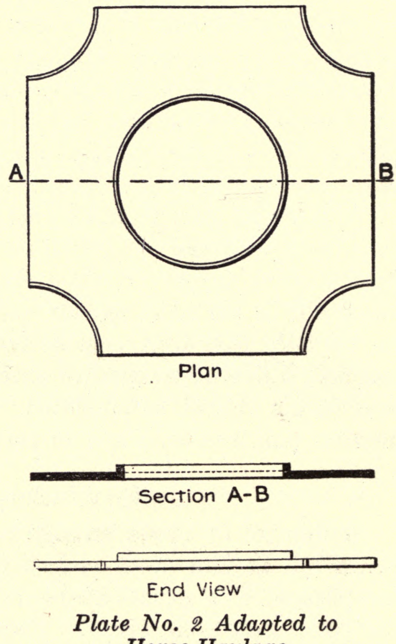
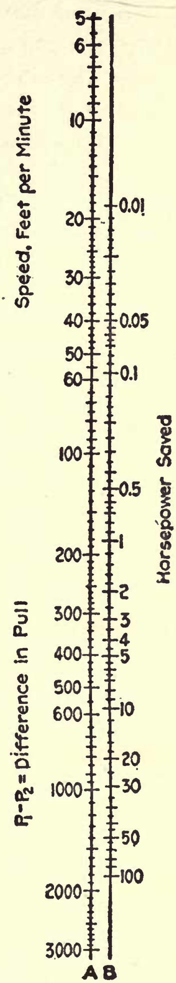


Plate No. 2 Adapted to Horse Haulage

Plate No. 2 is a type that is useful where horse haulage is employed, as it provides a space into which a horse can step instead of depending for footing upon the surface of a slippery plate. The raised edges in the center and outside corners form practically a turntable and provide the means whereby swinging the car upon the plate is easy of accomplishment.

Determining Mine-Car Friction

Coal producers seem slow to adopt the antifriction type of bearing in preference to the old plain type, and it is difficult to understand why this is so. Perhaps the average engineer or mine operator does not know how much power is going to waste daily because of the use of plain bearings. Perhaps he hasn't thought of the fact that lost power means lost money. To assist the operator, therefore, N. G. Near, of New York, has developed the chart herewith shown. This gives the horsepower saved under various conditions, in column *B*. For example, let us suppose that a given car was so poorly fitted with bearings that it required 2000 lb. to pull it, which is an exaggerated case. Let us further suppose that the speed of the car is 200 ft. per min., which is slow. Now let us suppose that roller bearings were substituted for the plain bearings and that the pull became 1000 lb. instead of 2000 lb. The saving would be 1000 lb. In other words $P_1 - P_2 = 1000$ lb. Find the 1000 in column *A*. Find the 200 also in column *A*. Then find the point midway between these two. Opposite this mid-point is the answer—the power saved by using roller bearings instead of plain—about 6.1 horsepower. It wouldn't be a bad plan to provide one of your cars with roller bearings and do a little testing "on your own hook." It is not a difficult matter to determine the pull required to move a car by the use of a dynamometer or tractometer. By exercising a little judgment and ingenuity, a home-made dynamometer employing springs can be developed by means of which the actual pull in pounds can be closely approximated. Then, by applying results to the chart the horsepower saving of roller or ball bearings over plain bearings is soon found. There is no question but that the "frictionless" type of bearing is a great money saver. Friction is a needless waste that should be overcome wherever possible. The range of this chart

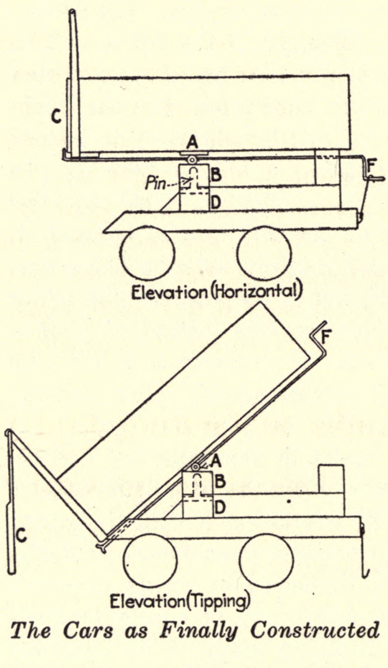


Car Friction Chart

is great enough to easily cover any mine car, varying from 0.01 to 100 hp. and from a speed of 5 ft. per min. to 3000 ft. per min. or from a difference in pull of 5 to 3000 pounds.

All-Around Tilting Dump Car

A Coal Age contributor once needed a lot of equipment, and among other things on order were two cars for the dump. In his requisition he had specified small self-tipping cars. The purchasing agent sent out two brand new coal cars capable of holding about a ton of coal each and provided with fixed ends and no doors. When used for rock work on the dump it took the combined effort of the entire surface force to move them along the track; and as for dumping them, that was an impossibility without a crane or lifting tackle. What was



The Cars as Finally Constructed

wanted was a small car that could be handled and dumped by one man, even though it would be necessary to make many trips to and from the ore chute.

It was finally decided that a new car must be built. Since there was neither iron nor a set of wheels upon the ground, both had to be secured from the cars sent out and accordingly they were set on fire and completely burned. From what was left after the holocaust the car shown in the accompanying illustration was made, which served the purpose well. It proved handy to move, was easily dumped either forward or sidewise, and did not carry enough material to make its handling, in the event that it went off the track, an impossibility.

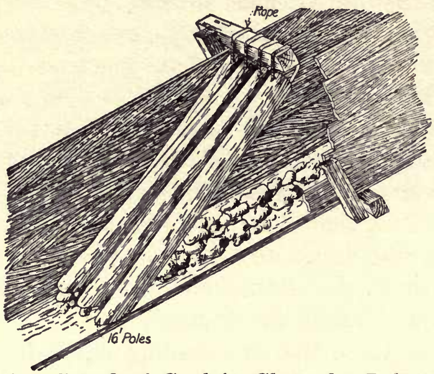
The car was built high and was hinged at *A* to the block *B*. *B* in turn swivels upon an iron or hard-wood pin fastened to *D*, allowing the body to rotate through a complete circle. The door at the front *C* is kept closed by an iron rod that runs through to the back end, terminating in a handle *F*. A short iron hook fastening over this handle and attached to the bottom frame served to counteract any tendency of the car to overbalance at the front end during loading. The surface between the blocks *A* and *B* was greased.

In handling, provided that the loading was fairly equal, the car proved quite adaptable. Knocking off the iron hook at the back enabled the car man to swing the body of the car to any side he pleased. He then turned the handle *F* and up-ended the back of the car, allowing the rock to rush through the door. Bringing the car body down to the horizontal position also brought back the door at the end to the vertical, when a turn of the handle again fastened the catch at the foot of the door, making the car ready for another load. The car stood quite a deal of hard usage, but as it was made without much fancy trimmings or metal work it was easily repaired in a country where every man could handle an axe to some effect.

Kinks in Getting Out the Coal

Pole Buffer in Coal Chute

In the accompanying illustration is shown a device for retarding coal or rock rolling down a steeply inclined chute. A number of poles, 8 to 10 in. in diameter, are suspended in parallel groups from the tie-pieces of the chute, as shown, the lower ends resting on the bottom of the chute. The number of poles and the distance between the groups vary according to the steepness of the chute and the size of the coal. Ordinarily, one pole to each foot in width of chute will suffice. If the coal is coarse and dry, the groups of poles will have to be so spaced that the lower ends of one group will be about vertically under the upper ends of the next lower group. For finer coal, or material that is wet or sticky, a wider spacing will be sufficient. If the coal changes from a free-rolling to a slower-moving



Reducing Speed of Coal in Chute by Pole Buffer

material, it is a simple matter to elevate the lower ends of one or two poles of each group by tying them to the next lower chute-tie, thus permitting a less interrupted passage.

Extraction of Coal in Breakthroughs

This article should be of particular value to firebosses and assistant foremen, or those whose duty it is to look after the extraction of coal in bituminous mines. No doubt every mine official has had, or will have, his troubles with this problem. The solution here offered will be of value to those whose duty it is to see that the proper breakthroughs required by law are cut through the ribs.

Many of the rooms in the bituminous region are turned on 39-ft. centers and driven 24 ft. wide, leaving a 15-ft. rib between rooms. Now when it comes to cutting on the ribs for breakthroughs, it is found that two cuts with the ordinary breast machine, which cuts about 6 ft. 4 in., will often fail to cut through the rib. It is then necessary for the assistant or fireboss to see that the remaining coal is got out of this passage. There may be from 1 to 4 ft. or more of coal remaining in the breakthrough, and to get this cut and loaded out necessitates paying the machine men something extra for the third cut, as the small amount of coal will not repay them for their labor. This also means additional expense for yardage, and the men do not want to be bothered with this third cut.

All this can be avoided by the man in charge having the machine men widen the room out to eight runs at the point where the breakthrough is to be made, which will mean two cuts of eight runs each, making the room about 28 ft. wide at this point. This will not seriously injure the uniformity of the rib and will prove to be a decided advantage to the miner, the cutter and the man in charge. It will also result in a saving to the company, as in the vast majority of cases the breakthrough will only have to be cut twice to put it through.

Another suggestion is this: When a room is finishing on the face and the rib is to be drawn immediately, or soon, instead of waiting until the room is driven up its full distance before cutting the rib four runs could be cut on it when the room is within 12 ft. of being finished. After the room is up to the line, the other four runs may be cut. This will save the miner the extra work of keeping his slate back in order to give clearance for the machine and also avoid the necessity of changing the posts. This is particularly advantageous where the roof conditions are bad.

The foregoing suggestions save in labor, trouble and expense.

Roof Troubles Overcome

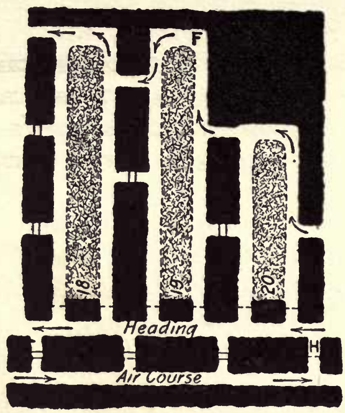
In reply to an inquiry as to the best method of working a seam of coal from 4 to 5 ft. in thickness when overlaid with a roof that flakes off and falls under the action of the air current, a Coal Age contributor gives his own experience in working a somewhat thinner seam, under similar conditions.

The coal in that mine was but 3 ft. thick, which required the taking down of from 2½ to 3 ft. of roof on the roads, to make height for the mules. The roof started to cut in the entries. The first evidence of this was the appearance of a white line on the roof in two of the entries, as though it had been drawn by a chalkline.

A little later the roof cut back 4 in. over the coal, and it seemed as though there was great pressure exerted by the overhead weight, which caused much trouble in supporting the roof on the roads. The same trouble was not observed, however, in the rooms, which were driven from 30 to 40 ft. wide with perfect safety. The accompanying figure shows a good plan of driving wide rooms. The rooms here shown are driven 42 ft. wide with 30 ft. pillars between them. Each room has two necks, a track being laid up along the rib on each side of the room, and the space between utilized for the storage of waste.

A like case occurred in the Thomas mine at Whiteville, Tenn., where the coal was overlaid with a very hard slate roof. It could not be said that this slate disintegrated, although it fell in great flakes both on the roads and in the rooms.

At one time it was thought that the mine would have to be abandoned. But the plan being adopted of widening the rooms so as to



Double-Neck Rooms

give more space for storing the slate and reduce the expense of handling this waste, much to our surprise the roof trouble in the rooms ended at once. It then became possible to drive the rooms to their full distance without further trouble.

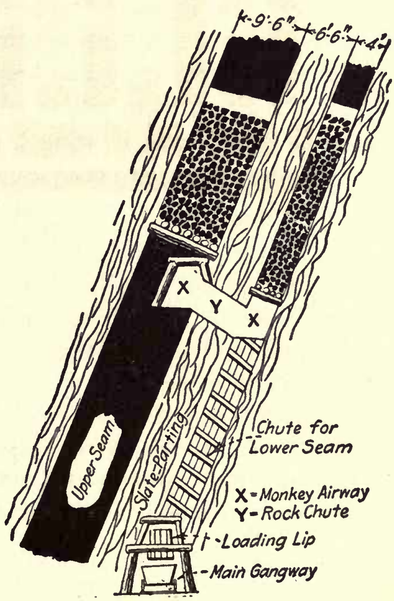
The explanation given was that this roof was of a nature that required more room for expansion, which was afforded by widening the rooms. No difficulty was experienced in drawing back the pillars between the rooms and from 90 to 95 per cent. of the coal was taken out.

Working Contiguous Pitching Seams

A well known mining engineer submits a plan for working 9½- and 4-ft. coal seams separated by 6½ ft. of slate and pitching from 60 to 75 deg. This plan has been tried out and proved to be a success, but care is required in doing the work right.

The first question to be decided is whether it is possible or feasible to work these two seams together by taking out the slate with the coal. There are 13 ft. 6 in. of coal to 6 ft. 6 in. of slate, which makes over 32 per cent. of refuse to be handled in the excavation. Since this is too much for economical operation, it will be necessary to work the two seams separately.

In order to secure a maximum extraction of the coal in these two seams they must be worked by the retreating system. For this purpose, the main gangway is driven to the boundary line in the lower seam, taking some of the top and bottom rock to give the required width of road. The position of this gangway and the "monkey airway" 30 ft. above it in the same seam is shown in the accompanying figure. From the monkey airway, a rockhole is now driven to the upper seam, on a suitable inclination to form a chute, and a second monkey airway is driven in the upper seam, on this level. All of



Working Two Seams on a Steep Pitch

these airways and the main gangway are driven to boundary line. They are connected by chutes and rockholes, at regular intervals, for the purpose of ventilation.

The work of opening the breasts is started at the boundary line, by driving five chutes and manways up from the gangway in the lower seam. The breasts are driven on 50-ft. centers and opened to a width of 24 ft. They are driven up a distance of, say 240 ft., with four cross-headings in each of the pillars separating the breasts.

The breasts must be kept full, only sufficient coal being drawn to give the miners headroom at the face. When these five breasts are fininshed five more are driven in the upper seam, directly above the first five in the lower seam. These breasts are also kept full of coal. Next start five more breasts in the lower seam, and when they are finished drive the five breasts above them in the upper seam.

There are now ten breasts standing full of coal, in each seam, and the work of drawing the pillars is started in the lower seam by driving a hole up the center of the pillar between the two breasts next to the boundary line. The hole is driven from the gangway to the monkey airway above, where a rockhole is made to the upper seam. Now, pull the coal in these two breasts, in the upper seam, and drive pillar holes and shoot the pillar between these two breasts, working from the top downward. The work on these pillars must not be delayed.

While the coal in the upper seam is being loaded out, the work of driving pillar holes is started in the lower seam; but these pillars should not be fired until all the coal is out of the upper seam. The breast runs can then be started and the pillars fired in the lower seam, working from the top downward, as before.

The work must all be done on the retreating system and the first mining carried on rapidly enough to keep the new work not less than five or more than ten breasts ahead of the robbing. Every precaution must be used to disturb the middle slate as little as possible.

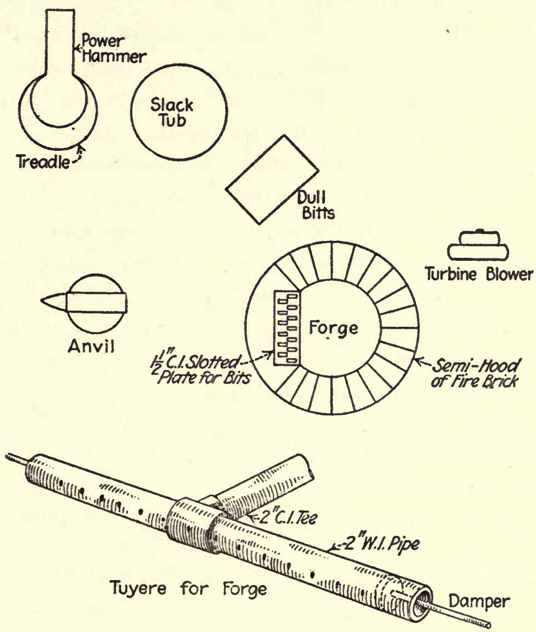
Referring now to the methods employed in driving the gangways and opening the manways and chutes, one manway may be made to serve two chutes; but it will generally be better to drive a separate manway for each chute, and this can be used later as a pillar chute.

The loading chutes are built in the ordinary manner, with a check-battery to control the movement of the coal in loading. The loading lip is arranged over the center of the gangway, and it will be necessary to lag the gangway timbers heavily at this point. In this arrangement the loading lip is constructed at right angles to the line of the chute and in line with the center line of the gangway. This lip should have a pitch of 35 deg. and be long enough to reach within 18 in. of the top of the car.

The question of ventilation is not a difficult one, since the monkey airways furnish the means of deflecting the air into the breasts, in both the upper and lower seams. The main gangway is the intake, while one or both of the monkey airways form the return.

Sharpening Bits for Coal-Cutting Machines

The sharpening of bits for coal-cutting machines often assumes large proportions. When done by hand it is arduous work. One ingenious superintendent decided to improve on the old hand method and purchased a Little Giant power hammer, to do the heavy work. This improved conditions, but still the blacksmith thought he must resort to handwork for finishing. His movements in heating, han-



Arrangement of Tools and Details of Tuyere

dling and tempering bits were many and awkward. Accordingly, after some study and experiment, the following system was devised.

Around the forge a semicircle of firebrick about 2 ft. in diameter and 9 in. high was built. The distance across the opening of the semicircle was about 18 in. Across this was placed (when bits were being heated) a piece of 1½-in. cast-iron plate 20 in. long by 10 in. wide in which were cut about 30 slots ⅝ x 1½ in., for receiving the dull bits. The iron was inclined toward the fire and the points of the bits were on the fire side. The tuyere of the forge was made of 2-in. pipe perforated as shown in the accompanying drawing.

The equipment was arranged as shown in the sketch with such spacing that the blacksmith operates the treadle of the power hammer with his left foot and easily reaches the forge, dull bits, slack tub and hammer without taking unnecessary steps and with single movements, all finishing being done by the power hammer. He can now sharpen 55 per cent. more bits with at least that much less labor on his part.

Sharpening Coal Augers

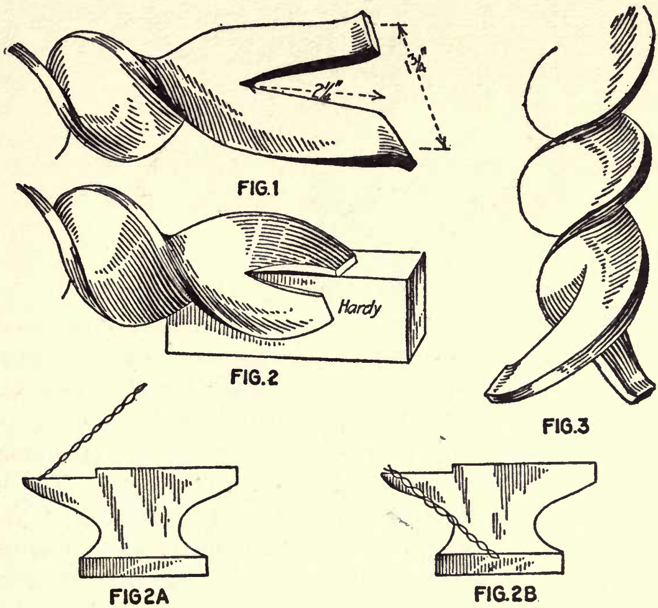
The bit or cutting end of the auger is first flattened out on the anvil and the cutting edge squared and drawn down thin. As shown in the accompanying sketch (Fig. 1), the points are then split back to a distance of 2¼ in., using a hot set for that purpose, after which, holding the auger on the anvil, strike the inside edge of each prong so as to give each a sort of curl or twist.

Now, lay the auger over the hardy set crosswise in the anvil, and strike the outer edge of one prong near the point so as to draw the cutting edges closer together. Turning the auger over, treat the other prong in the same manner. The inner edge of each of these prongs must now be beveled so as to form a cutting edge for the core when drilling, as shown in Fig. 2.

In Figs. 2A and 2B, the auger is shown as held at an angle of about 45 deg. while striking the prongs, one at a time, with a ballpeen hammer, so as to expand the opening between the prongs and give the drill the proper clearance. When one of the prongs has been treated in this way, as shown at 2A, the drill is turned over and the other prong treated in a like manner, as shown at 2B in the figure.

Different coals call for somewhat different treatment to give the bit the twist and turn that will enable it to cut to the best advantage. The operation calls for much skill on the part of the blacksmith, whose experience will enable him to judge what is required in coals of different hardness.

In this coal field, the bit is given the proper temper by allowing it to cool in the air. Miners generally want the bit soft enough so that a file will cut the steel. This enables the miner to sharpen the cutting edge of his drill, frequently, to improve its condition and enable it to cut the coal better. Our augers are all split back $2\frac{1}{4}$ in. The bits are sharpened in sets of three, as follows: The 2-ft. bit



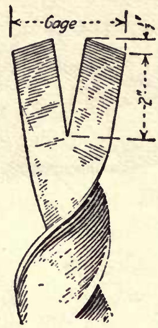
How To Sharpen Coal Augers

is brought to a gage of $2\frac{1}{2}$ in.; a 4-ft. bit, $2\frac{1}{4}$ in.; and a 6-ft. bit, $2\frac{1}{8}$ in. Fourteen augers and bits have been sharpened, in the manner described, in 40 minutes.

Sharpening Coal Augers

In answer to the request for information in regard to the sharpening of a twist drill to obtain the best results in drilling the coal, a contributor submits the following method, which he has found to give the best satisfaction, after a number of years of experience in using and sharpening this kind of drill.

The first step is to take the twist out of the drill, for about 3 in. from the end. Then, make a cut in the center and spread the two parts to form a V-shaped opening at the center and so that the two cutting edges of the bit will be separated about $\frac{1}{2}$ in. Cut the two edges of the bit straight and on such an angle that the points at the center will be about ½ in. in advance of the outer edge, which must be forged to the proper gage. The arrangement is indicated in the



accompanying sketch. The gage must be wide enough to give a sufficient clearance to the drill. After the cutting edge has been forged to a thin straight line, it should be dressed with a file.

When a drill is sharpened in this manner by a good blacksmith, little difficulty will be experienced in drilling the coal. The temper required can only be determined by knowing the quality of the steel and the hardness of the coal. This information must be gained by experience in every case. With the usual grade of steel furnished for drills, a drawn temper slightly harder than that used in tempering a cold chisel gives good satisfaction.

Kinks in Haulage and Hoisting

Mine Haulage

A Coal Age correspondent describes a method of locomotive haulage adopted in a mine where he was employed, by which was avoided the necessity of a sidetrack or parting for making up the trips for the haulage motor to pull out of the mine.

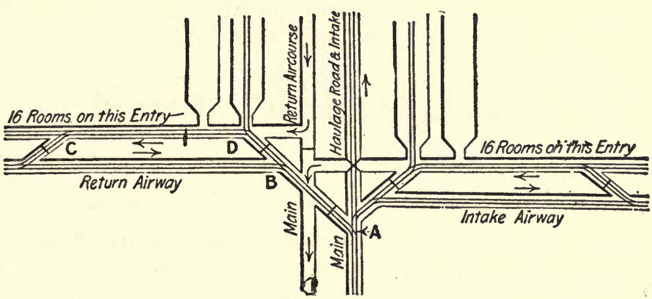
At the present high price for steel and copper, every foot of track and of trolley wire that can be saved is an important matter. This was particularly true in the instance cited. It was necessary to arrange for an inside parting or provide in some other way sufficient trackroom for handling the empty and loaded trips coming in and going out of the mine. Below is a rough sketch that illustrates the plan adopted.

The figure shows a portion of the main haulage road and intake and return aircourse, together with two pairs of cross-entries driven to the right and left of the main road; there were 16 rooms on each entry. The rooms were driven on 34-ft. centers and were 24 ft. wide, the track being laid up the center of each room.

A feature of this plan was that the first room on each pair of entries was utilized for trackroom, for setting in the loads ready to be hauled out of the mine by the haulage motor. There was a gathering-motor working on the cross-entries. In order that the two motors should not be in each other's way, the following plan was adopted:

The haulage motor would come in with a trip of 30 cars and cut off 15 of these at the switch marked *A*. The motor would then pull the remaining 15 empties through the crossover onto the return airway on the left, so that they cleared the switch marked *B*. The haulage motor then left this trip and returned through the crossover marked *C* to the mouth of room No. 1 on the other entry. Here it picked up the loaded trip standing in No. 1 room and pulled it out through the crosscut marked *D*.

Leaving these loads in the crosscut, the motorman proceeded to do the same thing with the remaining 15 cars standing on the main



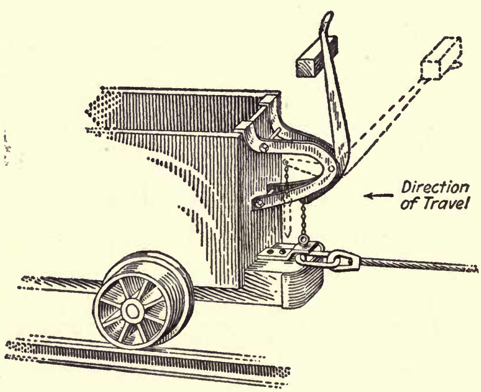
Proposed Method To Avoid Inside Parting

haulage road. The cars were taken into the airway on the right, and the loaded trip standing in No. 1 room on the right was then hauled out through the crossover onto the main road just over the switch *A*, after which it was backed up and coupled to the loaded trip standing in the crossover on the left, and the entire trip of 30 cars was then hauled out of the mine. In the meantime, the gathering motor continued its work of gathering cars on the rooms inby of the crossover marked *C*.

This plan proved very satisfactory in the mine in which it was adopted. It saved the construction of a parting 350 ft. in length and eliminated the same amount of single track and trolley wire. Moreover, it avoided the frequent accidents that occur from flying switches, as in the old system it was the custom to fly the empties onto the parting when bringing them into the mine. In like manner, the gathering motor was accustomed to make a flying switch with the loads at the other end of the parting.

A Handy Rope-Detaching Device

At one mine a man was dispensed with and a dangerous job eliminated by having a tool made to uncouple the rope at the foot of an incline. The device is fastened to the rear end of the trip. It pulls the pin, detaches the rope, and the trip runs onto the siding.



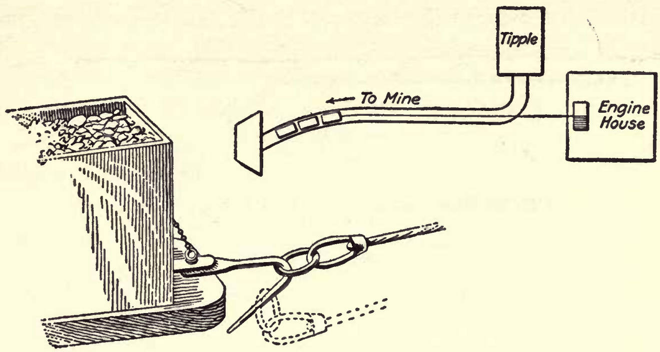
Device Automatically Releases Rope at Foot of Plane

The overhead knocker is placed at the point where the rope is to be attached to the loaded trips to make the return journey up the incline.

Cable-Detaching Hook

Sometimes a hook can be employed to cut off the haulage rope, especially where the hoisting engine is set at right angles to the tipple track, and where the rope passes under the track to the engine drum.

Such a hook is shown in the accompanying illustration. It is attached to the car by means of the ordinary coupling pin. When the rope slackens after the cars pass the slope knuckle, the link on



Detaching Hook for Slopes

the end of the cable readily slips off the hook, releasing the rope from the trip and allowing it to pass on into the tipple.

This idea, though not original, has been used profitably, eliminating some dangerous work.

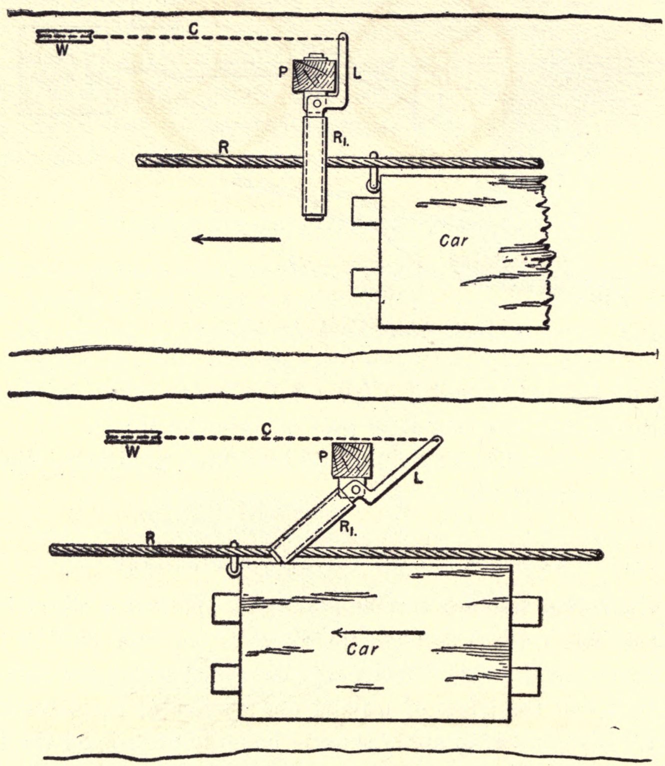
Trouble Saver on Rope Haulage

On a side-rope haulage trouble developed wherever a slight hollow in the road was reached through the stress of the rope pulling it out of the jiggers on the cars. When this happened where the cars were far apart it had the effect of leaving one particular car standing on the track. The following one was quite liable to push it off the track, causing a wreck. Sometimes five or six cars would get piled up together before the haulagemen could find out where the trouble was.

As a means of obviating this difficulty the small appliance shown in the accompanying illustration was erected. The upper drawing shows a car approaching the appliance and the lower one the car passing and deflecting the arm.

Post *P*, a strong one, has bolted to it a lever *L*, one arm of which projects behind the post, and the other in front of it and at least 6 in. beyond the line of the rope and 3 to 4 in. higher than its normal position. The front arm has a piece of pipe R_1 fastened to it, which serves as a roller when the rope is running up against the arm. Attached to the arm at the rear of the post is a chain *C* which passes over the wheel *W* and is attached to a counterbalancing weight.

In operation the arm R_1 projects over the running rope and prevents it from rising above the limit fixed. It does this without putting

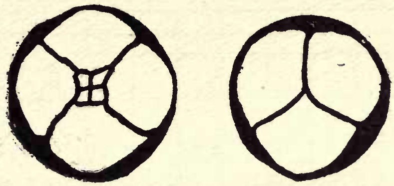


Device To Prevent the Rope from Rising

any perceptible stress on the working of the haulage. An approaching car pushes the arm aside, but the counterbalance exerting itself tends to draw the lever back, keeping the arm tight against the side of the car and above the rope. As soon as the car has passed the arm springs out into its original position.

Three Strands Best in Cotton Rope

Cotton rope is made in three, four, or even in seven strands, but the real contest between ropes lies between those of three and four strands. The four-strand rope cannot be constructed without a supporting core, and since that core is an indispensable part of the rope, its collapse will cause the dislocation of the whole structure. As the core occupies only about one-fortieth of the whole cross-sectional



Figs. 1 and 2. Showing Cross-Section of Four- and Three-Strand Rope

area, it may reasonably be assumed that the force exerted by the alternate contraction and extension of the spiral as the rope passes over the sheaves must tend toward the breaking of this core, the period of endurance being limited by its elasticity and the tension at which it is laid. It is this core which usually collapses first and spoils the rope.

Fig. 3 shows a four- and a three-strand rope of the same thickness, the lengths occupied by a single strand being indicated by the figured lines. It will be seen that the turns of the three-strand rope are more frequent than are those of the four-strand. The strand spiral of a seven-strand rope is almost double the length of that of a three-strand rope and is therefore still nearer a straight line. As the medium with the greatest number of turns is the most resilient and the

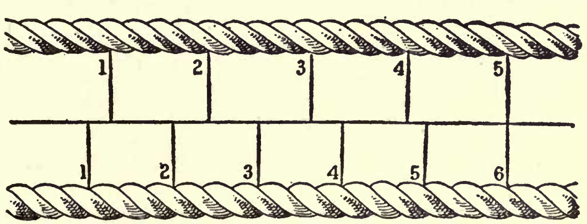


Fig. 3. Comparing Turn Frequency in Four- and Three-Strand Rope

most capable of disposing of the shocks and stresses set up in the rope, the three-strand rope is to be preferred to the rope with more strands.—J. Melville Anderson, before the Engineers' Society of Western Pennsylvania, June, 1917.

Finding the Size of Rope Required

A great number of the new coal-mine operations are so situated that an inclined-plane machine is required to lower the loaded cars

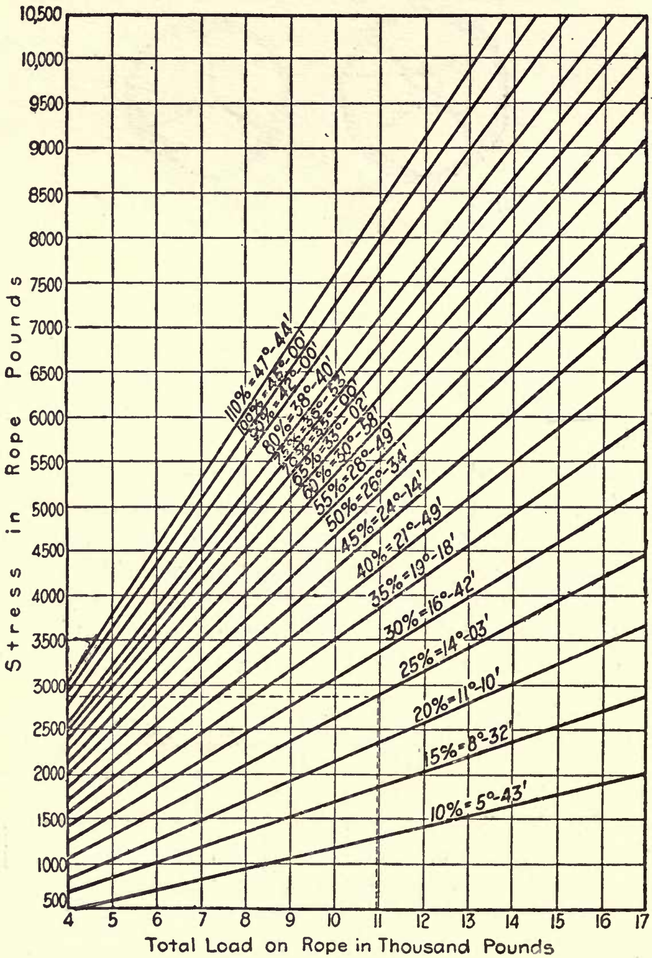


Chart 1. Showing Stresses Produced in Rope by Various Loads and Grades

to the tipple. With such an installation one of the problems that confront the manager is the size of and the material to be employed in the haulage rope, in order to make the lowering operation safe without using an excessively large rope and thus incurring unnecessary expense. By using the accompanying charts this problem can be readily solved.

Example—To find the size of rope necessary to use on an inclined plane 400 ft. long, 25 per cent. slope, with two loaded cars in the

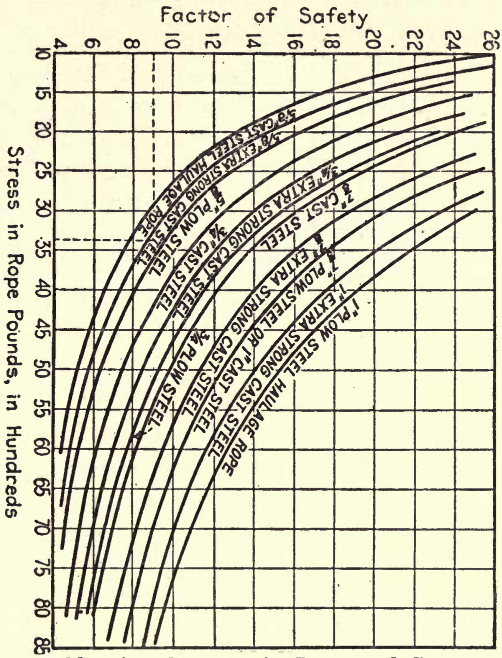


Chart 2. Showing Stresses in Rope and Corresponding Safety Factors

trip; capacity of cars $1\frac{1}{2}$ tons each; weight of empty car, 2000 lb.; weight of coal, $1\frac{1}{2}$ tons ($1\frac{1}{2} \times 2240 = 3360$ lb.), making total weight of loaded car 5360 lb. The weight of two loaded cars will thus be $2 \times 5360 = 10{,}720$ pounds.

Assume that it will take a $\frac{3}{4}$-in. rope weighing 0.89 lb. per ft.; 400×0.89 lb. $= 356$ lb. $=$ weight of rope. The total load on the rope will then be $10{,}720 + 356 = 11{,}076$ pounds.

From chart No. 1, starting with a total load of 11,076 lb. and following the vertical load line to the 25 per cent. grade curve, the stress in the rope is found to be 2875 pounds.

Using this stress in the rope with chart No. 2 as shown by the dotted line, a $\frac{5}{8}$-in. extra-strong cast-steel haulage rope will be found to give a factor of safety of 9, which is sufficient. A rope having a factor of safety between 7 and 10 will give satisfactory service, but any larger factor will make it stronger than is necessary.

This chart was furnished by W. B. Crowl, of Fairmont, W. Va.

How to Cut Wire Rope

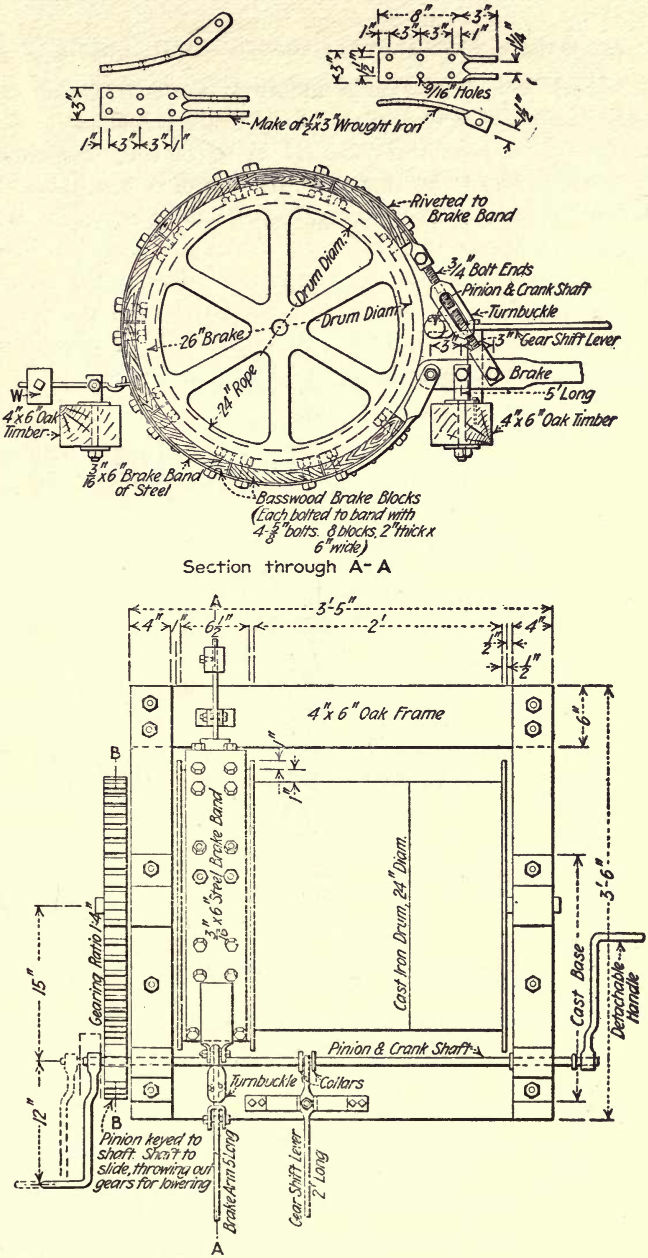
When a rope is to be cut, care should be taken to securely and properly serve or bind the rope on each side of the place to be cut, so as to prevent one strand from working back and, therefore, not receiving its share of the stress. This condition causes what is known as "high strand." After the rope has been served as mentioned, place the cable over a length of old railroad rail or a piece of steel—then cut by means of a cold chisel with handle, and a sledge hammer. If it is necessary to cut rope frequently, it is advisable to secure a special cutter for the purpose. The same care in binding the rope should also be taken when attaching a socket.

Small Gravity Drums

On the Mesabi Range, timber, lagging, mine cars, powder and other supplies are commonly sent into the mine through "timber shafts," instead of through the main hoisting shaft, there sometimes being five or six timber shafts to serve a single mine.

The material lowered through this timber shaft is ordinarily handled by means of a common windlass with brake attachment. With the common windlass a number of accidents at a mine were due to handling too heavy loads, it being impossible for the lander to hold the load, after raising it clear of the shaft collar, with one hand, while applying the brake with the other. It was therefore decided to install a winch for raising the load above the shaft collar. A winch was not to be had designed primarily for lowering, with means provided for readily disengaging the gears, and the winch shown in the accompanying sketch was therefore designed. Three winches of this type were built and installed.

In operation, the lander throws in the gear by means of the shift lever and hoists the load clear of the shaft collar. The brake is then applied, the pinion thrown out of gear, and the load lowered on the brake. Two ropes, wound on the drum in opposite directions, are used, so that the loaded end brings up the empty chain and there is always a chain ready to which to attach a load at the surface.

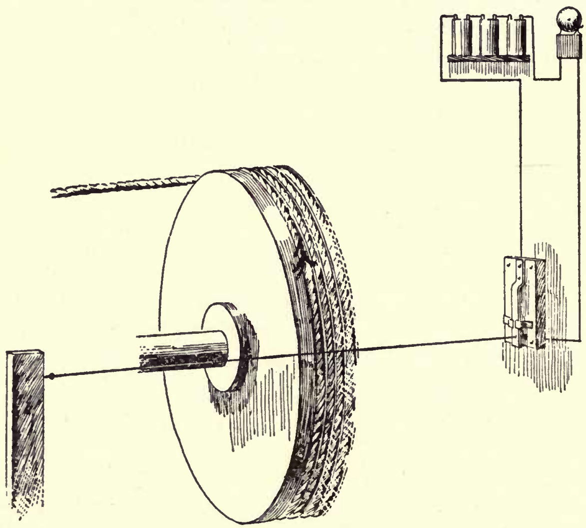


Details of Shaft Timber-Winch

Alarm Signal for Transmission Ropes

The signal here illustrated is in use at the coal washeries of the Tennessee Coal, Iron and Railroad Co., Pratt Division.

The device has been instrumental in preventing breakdowns and has many times saved the company the cost of a new rope. It does not prevent the rope from breaking, but it sounds an alarm as soon as the first strand begins to ravel out. When the alarm is heard, the machine is stopped and the rope repaired, which takes about 15 or 20 min. If the repair is not made immediately and the rope is permitted to run 5 or 10 min. longer, the rope would be in such a condition that it would have to be replaced by a new one.



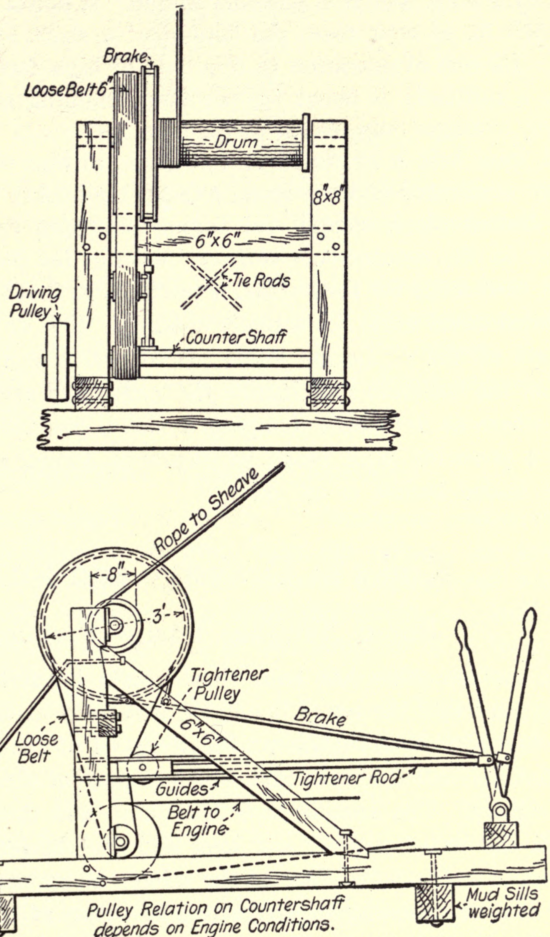
Telltale for Stranded Rope

The signal bell that is part of this alarm is placed in the engine room, the trouble catcher being placed near the sheave wheel, tacked up on the side wall or on posts. The trouble catcher is first put in position on one side of the sheave. A piece of wrapping twine runs from the copper spring of the trouble catcher, passing just behind and parallel with the face of the sheave and fastening to a nail on the opposite side. As soon as one of the cable strands begins to ravel out, it strikes the spring and breaks it. The copper spring immediately makes an electrical contact and the bell rings until it is cut out.

When the broken rope is repaired, the spring is again placed in position and the current again turned on.

An Economical Prospect Hoist

One of the simplest, cheapest and yet most satisfactory and economical hoists one could wish for use in preliminary mine exploration



A Home-Made Belt-Driven Prospect Hoist Operated by Gasoline Engine

can be rigged up from an ordinary 3- or 5-hp. gasoline engine. It was formerly the custom to employ a horse whim for that period in shaft sinking that occurs before the windlasser really dreams of a mechanical hoist. That was in the days of yore, before precedent and example showed the miner that a gallon or two of gasoline or distillate is cheaper than horse feed.

The equipment shown in the illustration is installed at a small mine at Westpoint, Calif., in what is known as the East Belt of the Mother Lode. The whole contrivance, which is home-made, is operated by a 3-hp. Sampson gasoline engine. It hoists a bucket containing 500 lb. of rock from the bottom of a shaft 110 ft. deep in 1¼ min. Its cost of operation in this land of high freight rates (30 mi. from a railroad) is about 8c. per hour, running at capacity, but it usually averages only 30c. a day.

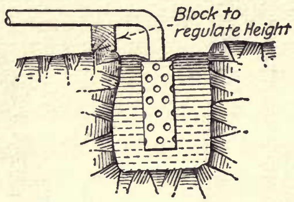
A loose belt is employed on the drum, so that when the tightener pulley is released and the brake put on, the bucket can be stopped at any desired place, though the engine continues running, the small pulley on the countershaft turning inside of the loose belt. A third lever, or throttle for the engine, is provided so that the engine may be throttled down while not actually hoisting. It is of great convenience to have all the regulating levers placed near the collar of the shaft, so that the hoistman may handle the bucket and attend to its unloading, where no automatic dumping device is provided. It is essential that a powerful band brake be employed, strong enough to hold a fully loaded bucket at all times.

Kinks in Drainage and Pumps

Pump Trouble Easily Prevented

A certain mine has been thrown idle by failure of the main pump; not that the pump is of poor construction, but because of the way in which it is installed. Small pieces of coal, wood and other rubbish get into the valve chambers and prevent the valves from closing tightly. The trouble with the pump was that the strainer by which the water entered was long and laid horizontally, above the bottom or even on the floor of the mine. There was nothing to prevent it from drawing in dirt, chips or pieces of bark, for all these were kept swirling around, having gathered from points where the miners were digging coal or from the "swags" or "dips" along the haulageway.

Straîners should be set at such levels that the holes by which the water enters are below the free surface and above the bottom of the sump. The surface of the water is full of chips. The bottom is covered by fine material that is large enough to give trouble at the



Center the Strainer in the Water

valves and yet small enough to enter the holes in the strainer. If the strainer can be arranged to miss both, any good pump will give satisfactory service.

It should always be arranged that the water does not have to be drawn down so low that the suction made by the uppermost holes will draw floating rubbish into the pipe. For this reason, the end of the pipe should turn over into an adequate sump hole and the strainer be set vertical.

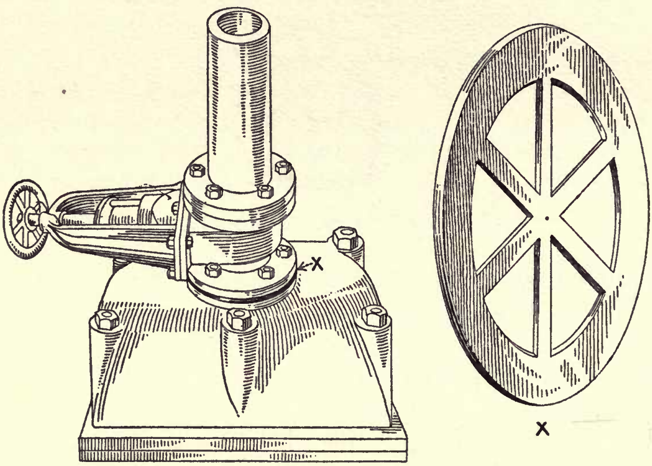
Roughening Gasket Surfaces

A pump had given considerable trouble by blowing out gaskets on the water end. It was desired to use graphite on one side of these gaskets, so that the heads and caps could be removed and replaced without spoiling the gaskets; therefore the water-end heads, cap and valve plates were roughened by bolting to the faceplate of a lathe and taking a light cut on the gasket face with a diamond-point tool.

No graphite is used on this rough surface, but the other side of the gasket is well covered so that the gaskets stick to the rough surface and the slight corrugations keep them from blowing out, while the other face parts from the smooth pump body and will go back perfectly tight and may be used a good many times before it needs renewing.

To Catch Loose Pump Valves

Some such a strainer as that shown in the accompanying illustration should be used in the discharge line of a boiler-feed pump, as it will save a lot of trouble. If any of the pump valves work loose, they are apt to get lodged in the pipe line or some of the valves. The best location for a strainer is next to the pump, but the one shown can be placed between flanges anywhere. It is made out of a sheet of brass or bronze cut to the diameter of the inside of the bolt circle



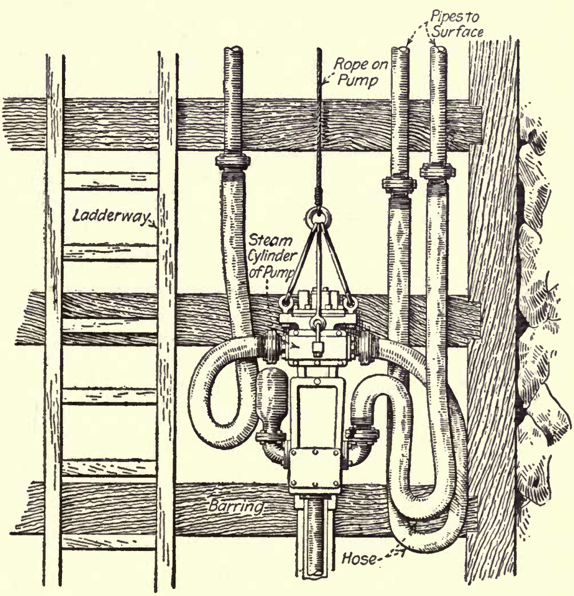
Strainer in Flange Joint Next to Pump

and the web openings or perforations made of sufficient size not to obstruct the flow of water by decreasing the area of the pipe. I consider such strainers entirely satisfactory after several years of use on different pumps.

Hose Connections on Sinking Pumps

The flexibility attained through using hose connections in handling sinking pumps in shaft work may not be an original idea, but it certainly deserves to be more widely known and applied.

As the sinking of a shaft proceeds and the depth increases, the sinking pump has to be frequently lowered. Usually this is done by fitting in short lengths of pipe, until a sufficient distance for a full pipe length has been sunk. This may be a comparatively simple matter where there is little water in the shaft and there is consequently plenty of time in which to make the change. Remember, however, that a shaft pump must have attached to it two and sometimes three pipes (depending on whether the power is steam or air)—the intake steam, the exhaust steam and the water discharge. These pipes extend to the surface, and in a long distance it is a hard task to juggle the pump up and down so that they may be changed and brought into position to be properly connected to the pump. Three full lengths have to be changed at one time, since the alternative of working with a number of short lengths of varying measurement implies too much "dodging" for position. It is nearly impossible to get three pipe lengths projecting down a shaft to remain in the same straight line, so that they can be readily attached to the pump. Nearly always the pump piece, probably a short nipple, and the pipe to which it is to be attached meet at an angle sufficiently large to make the threading of the one piece to the other a matter of great difficulty. This is greater in inclined shafts, where the pipes lie along one wall and where a projecting piece of timber may throw them out of line. In large sinking operations these difficulties are



Arrangement of Flexible Hose Connections for Sinking Pumps

provided against, but in small prospecting work there is much thoughtless procedure. In cases where there is excessive water and the pump is working to its utmost capacity, the time spent doing this pipe changing is often so great that no progress can be made.

To overcome a series of difficulties of this character in one particular instance, the scheme was tried of inserting in the pipe line, between the bottom lengths of pipe and the pump, a pipe length of hose. Twenty-two feet of steam hose for the steam pipe, the same for the exhaust pipe, and also for the discharge pipe, were cut and fitted with a short nipple connection and a union. The connections between the hose, pump and pipe were made by means of unions, one at each end of each hose. As there was pressure on steam- and water-discharge connections, care had to be taken to have them fitted extra tight. The kinking of the hose had to be watched, and when the pump was close to the pipe ends, the coils of hose were looped by leather holders and marlin tying strings to nails driven in the timbers so placed that the hose would be clear of the working space in the shaft.

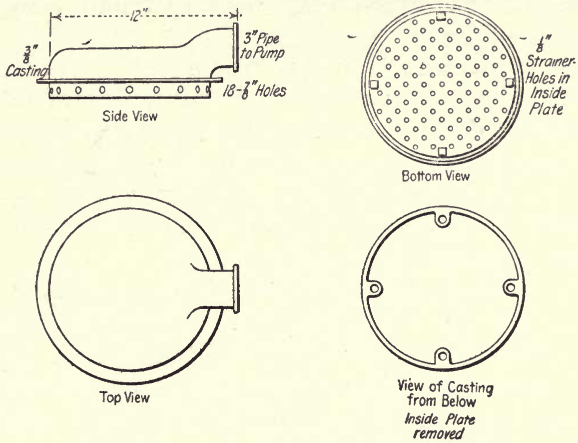
The advantages gained by this scheme were flexibility of the pumping arrangements and speed in changing pipe connections. The disadvantages of any twists in the pipe from the surface to the pump were readily obviated by the use of the hose; the pump could be lowered 20 ft. at a time without changing the pipes and could be kept working if required during the lowering process. This prevented the loss of time during which the men working in the shaft bottom were driven out by water and the time while that water was being pumped out. The hose and the unions facilitated the changing of the pipes to a great extent. The three pipes to be changed were lowered by rope to the pump and hung in position along the side of the shaft, while the pump remained where it was without any change.

Strainer for Sinking Pumps

During the process of shaft sinking many of the troubles encountered arise from the sinking pumps and these troubles in turn are due to the strainers at the end of the suction pipe. The strainer may be too light and get crushed by falling material, or the holes may be too large, admitting much foreign matter and choking the pump.

The strainer illustrated herewith, the construction of which will be clearly understood from the drawing, possesses a number of features that may recommend it to those looking for such an article.

The design of the strainer allows the suction face to be always downward and in the water, even though that may be only a few inches in depth, while the weight and thickness of the metal will keep the strainer in position without the necessity of tying it in place. This also allows of rough usage and of a reasonable amount of material being placed on top of it without damage.



Details of a Simple and Practical Strainer

The outer suction plate is of a large area and serves to keep the larger pieces of material from coming against the inner plate. This inner plate in turn keeps out the smaller stuff. Chips of wood and floating material are always above the strainer of this suction, and there is no half-air-half-water draw. The bottom plate can be easily removed for cleaning without having to go to the trouble of removing the whole hosepiece.

Unwatering a Dip

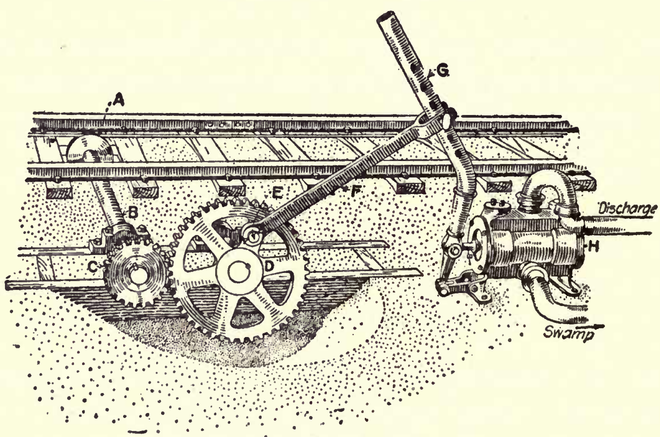
Some time ago a correspondent had charge of a mine where a rope haulage 1¼ miles long was installed. Some distance from its outer end the main haulageway passed through a dip, or swamp. For several years this depression had been a source of considerable annoyance, as the water sometimes rose to such a height as to enter the wheel bearings, as well as in other ways interfering with operation. It was the practice to bail the water out of this swamp into water cars twice a week.

To drain the swamp and at the same time obviate the expense of bailing the device here described was constructed.

A horizontal hand-operated force pump and 1200 ft. of pipe were purchased and installed. To drive the force pump the device shown in the accompanying illustration was built, practically all the material entering into its construction being reclaimed from a scrap pile that was located nearby.

Briefly, the construction of this "pump jack" is as follows: An ordinary rope pulley *A* was keyed to the shaft *B*. On the opposite end of this shaft the pinon *C* meshes with and drives the gear *D*. At the proper distance from the center, one of the spokes of this gearwheel *D* carries the crankpin *E*, which transmits motion through the connecting-rod *F* to the pump hand lever *G*. The haulage rope thus operates the pump and drains the swamp.

In order to secure adequate friction of the rope upon the driving sheave *A* the trip rider, when the pump is to be started, stops at the pump and places the rope under the adjacent pulleys upon either side of the pump jack. When the swamp has been pumped dry, or nearly so, the trip rider again stops at the pump and puts the rope back in its normal position.

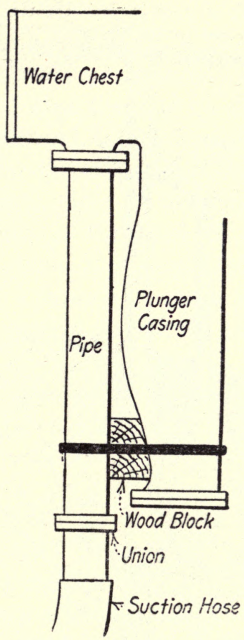


The Pump Jack in Operation

This device has worked successfully for several years. Once, however, when the mine was shut down on account of a strike, one of the mine bosses kept the swamp drained by operating the pump three or four hours per day by hand.

Steadying the Suction Pipe

The device illustrated herewith is for use on sinking pumps, and though it may be quite contrary to common practice, it has been found useful on a number of troublesome occasions. In sinking it has always been the writer's custom to use a length of pipe at the suction which will reach just below the bottom of the pump, and to attach the hose at this point with a union. This has been done because there is little room between the body of the pump and the pipe in which



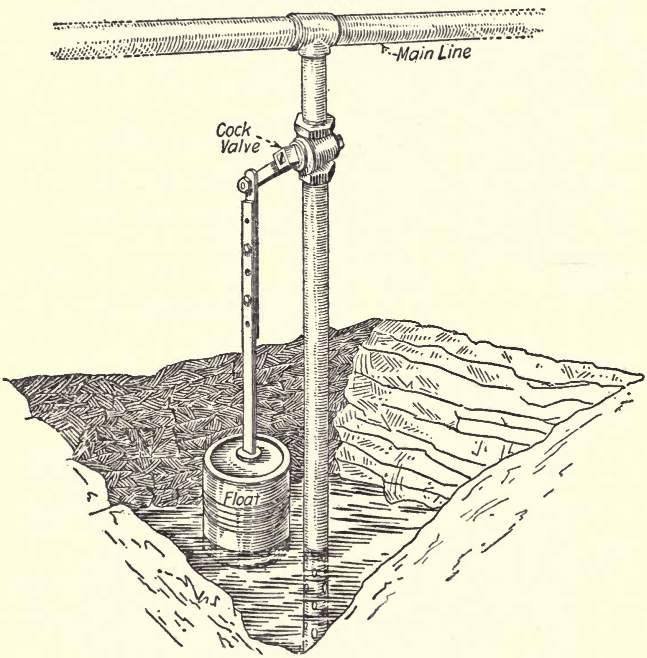
The Steady Block in Place

to place a union and to take off and put on the hose. It is easier to do it just below the pump. When this pipe was first used it caused trouble by frequently breaking off where it entered the pump, because of being knocked against the sides of the shaft in raising or lowering. To obviate this a piece of wood is now inserted as shown in the drawing. This has the effect of making this piece of pipe solid with the pump throughout its entire length. Breakage of this pipe is now rendered infrequent as the pipe is thoroughly steadied by the block and cannot vibrate.

An Automatic Suction Control

At some mines where several pumps are required, each drawing water from several sumps, unless some kind of automatic suction-control device is employed more than one pumpman will be necessary to keep all the pumps in efficient operation.

The accompanying illustration shows a device which has been found useful for governing the flow of water from the various sumps to a single pump. It consists essentially of a cock in the sump suction



The Suction Control in a Sump

line, a float in the sump and a suitable rod and lever connecting the two. When the water in the sump rises, the float opens the cock; when it falls, it closes it.

For a float an old powder keg is used. The hole, of course, is first effectually sealed, after which the can is given a good coat of paint. This answers the purpose fairly satisfactorily. By means of the above-described apparatus several sumps may be kept pumped out without the continuous care of the pumpman.

Use of the Siphon in Mines

The following incident may be of interest, as showing the use that can be made of a simple siphon for draining rooms in pitching seams where the seam is faulted and a dip occurs at the head of the pitch. Such was the case in a mine where the writer was employed.

There were seven places driven to the rise of the gangway, and I was working No. 4, which unfortunately was somewhat lower than the other places and took all the drainage from them. These places had a pitch of 12 deg. for about 125 ft., where a fault made it necessary to drive 70 or 80 ft. on a dip of about 6 or 8 deg. to catch the seam again, which pitched then almost as steeply as before.

In driving my place I kept the road on the high side. In order to drain the water that collected at the foot of the short dip, I laid a pipe from that point over the rise and extended it down the pitch to the gangway. There was a valve on the discharge end of the pipe at the gangway and another at the head of the pitch, the last valve being provided with a nipple that permitted the pipe to be filled at this point by the use of a funnel. I made a sump at the foot of the dip and submerged the suction end of the pipe in the water that collected there.

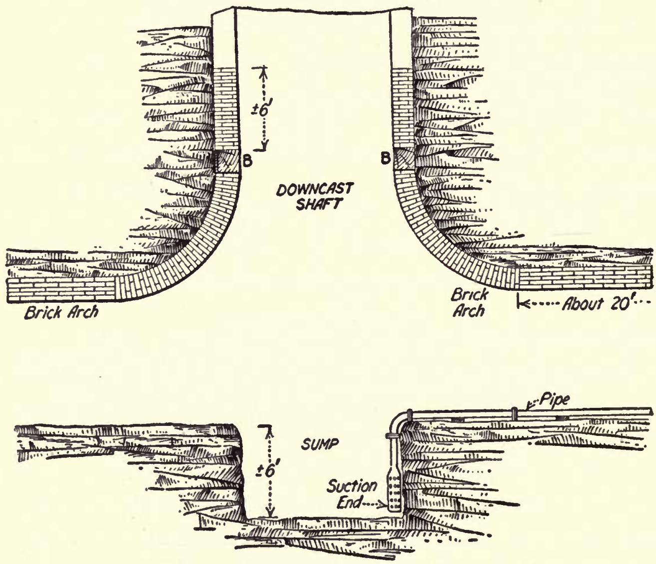
When starting the siphon, after filling the pipe with water at the crown and closing that valve, I sent my laborer to open the discharge valve on the gangway the moment I signaled to him that I was ready. Then I pulled the plug in the suction end of the pipe and the water started to flow, draining the place. When filling the pipe I carried the water from the sump in a powder keg that I kept for the purpose, and when the water was running I would examine carefully for any holes, by passing my lamp along close to the pipe. If there were any holes that were sucking air, I would close them with mining soap, so as to prevent the siphon from emptying itself, which it would do if there were any leaks. Where gas is present a safety lamp must be used to examine the pipe, and soapsuds put on the pipe will show any leaks.

Never siphon all the water from the sump, but shut the discharge valve on the gangway, as soon as the level of the water has been sufficiently lowered. The discharge valve should be shut first, and a few seconds later the plug should be driven in the suction end. By doing this, it will not be necessary to refill the pipe each time that the sump must be drained.

Keeping Ice Out of Shaft Bottoms

In winter the bottoms of airshafts become choked with ice, thus blocking the airway so that it is necessary to send men in to dig it out. Owing to the cold the men cannot stay long on the job. It is also risky, because of the falling ice.

Instead of putting in the usual wood curbing, bricks should be used just above the vein of coal, as shown in the sketch. The lining should extend about 6 ft. up the shaft. A brick arch extending for about 20 ft. along the entries should be built below the timbers *BB*.

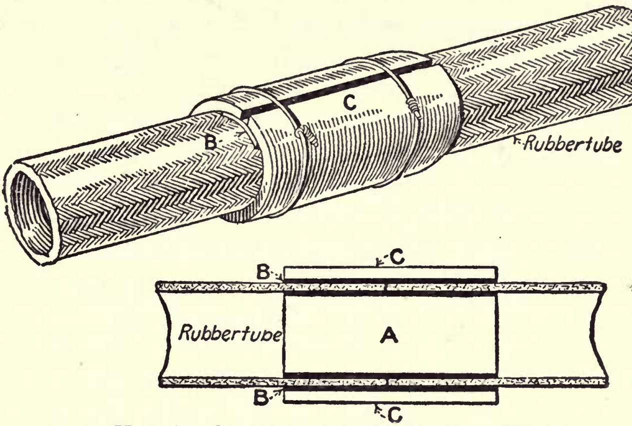


To Relieve the Necessity of Digging Ice

The sump should extend about 6 ft. below the level of the coal bed. The pump suction should be connected to the steam pipe by a bypass controlled by valves near the pump. These valves should be so arranged that steam may be turned into the sump to thaw any ice that may form there.

To Mend a Broken Rubber Hose

The accompanying illustration shows a simple method of repairing a rubber hose that has been broken. This repair is effected as follows: A short piece of pipe *A* is inserted in the broken ends of the hose. A second piece of pipe *C*, slightly larger than the outside diameter of the hose, is split longitudinally into two halves. A curved piece of thin sheet metal, bent to the diameter of the hose, is then placed beneath the open space between the two halves of the larger pipe, as



How To Repair a Broken Rubber Hose

may be clearly seen in the illustration. Two wire bands or other fastenings are then placed upon either end of the split pipe and drawn up snug.

This emergency repair, which is quite effective if properly made, may be easily and quickly executed, the material therefor being almost always at hand around the mine or coke plant.

Attaching Rubber Hose Coupling

Among the jobs that are difficult when not gone at in the easiest way but that are easy when done right, is that of attaching a coupling to a rubber hose. Following is one method:

Heat the coupling in a forge or with a blowtorch to a dull red and, holding it with a pair of tongs or pliers, thrust it into the hose end, held firmly in a vise or by other means. Then promptly plunge the hose end and coupling into water. The heat of the coupling will vulcanize the rubber to it, and after affixing the clamps it will be absolutely impossible to pull it off if the job is well done.

Kinks in Ventilation

Hanging Brattice Cloth in Gaseous Places

My duties, says a contributor to *Coal Age,* require me to remove the gas from a pair of entries that are crossing a steep hill and consequently are liberating a dangerous quantity of gas. As all work had to be suspended on the return airway until the entries were cleared, this proved to be slow work when performed in the usual way—that is, by setting up posts and curtains. Had it been necessary to erect the curtains only once, the trouble might have been endured; but inevitably the rush of air swept them away every evening when the shots were fired. As a result the output was reduced considerably.

It seemed to me that the posting of the entry was wasted energy, so the bratticeman and I contrived a better way. We got an old brace and bit and drilled holes in the roof 5 ft. apart, such as we had seen used by engineers for putting in stations. We put plugs in the holes, drove 20-penny nails in the plugs and turned the heads of these over with a hammer till the free ends of the nails were level. We suspended the curtain from these nails by simply hooking the heads through small holes made in the brattice cloth. The curtain was kept normally on the floor of the mine. When I visited the place on my rounds, I would drag the curtain from the side of the road, and in 10 minutes have it hung on the hooks and the air driving out what gas had accumulated.

Before going to the surface to make a report, I would visit the entries again, and invariably I found them safe. As a result of this plan no time is ever lost in the section by reason of gas.

Upraising an Airshaft

A year ago, it became necessary to put in an airshaft in a little coal mine I have in Alberta, says a contributor. The cover was less than 30 ft., composed of soft sandstone and glacial drift. Circumstances made it necessary for me to do the work myself, so I decided to begin at the bottom and work upward.

I started in a crosscut about 6 ft. from the entry and bored holes upward with a breast auger, shooting the rock down with black powder.

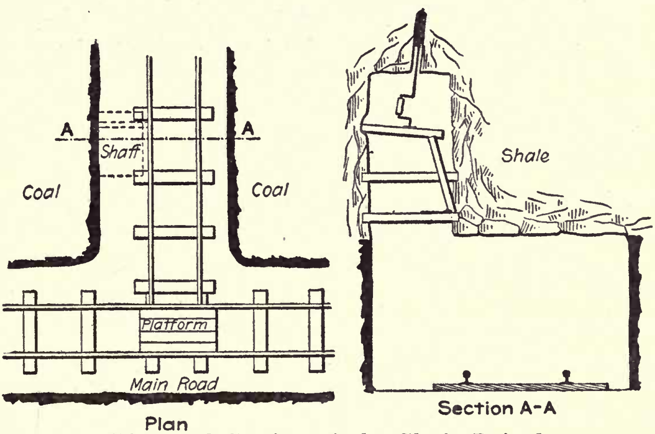
The shaft was small, only 2½ x 4 ft., and with a breast auger nearly 6 ft. long the holes were of necessity nearly vertical. Naturally, I did not get the full benefit of the powder, but by putting in holes a little over 2 ft. deep I could shoot down about 18 in. of rock at a time.

When the strata became so hard that I could not make the breast auger cut by pushing up on it with my arm, I used a pry made from a piece of 2 x 4 about 4 ft. long. I put one end into a hitch cut in the side and spragged it up with a small post from below at the other end. Of course, it required frequent adjustment. The accompanying drawing shows the arrangement.

As the work progressed, I cut hitches in the sides of the shaft and put short lengths of 2 x 6 across to act as a ladder for going up and down and to stand on while boring and charging the holes and while trimming up with a pick.

Owing to the fact that men were working near, and that the ventilation was poor, I could shoot only at night and occasionally at noon. Each shot advanced the hole about 18 in., and the face was carefully trimmed with a pick before shooting again. I used about 1-5 lb. of black powder to the charge and fired it with a squib. I never had a misfire and always had time to get out of the way.

To dispose of the rock I laid a square platform of 2-in. plank in the main roadway and put a track at right angles to the entry and



Plan and Section of the Shaft Raised

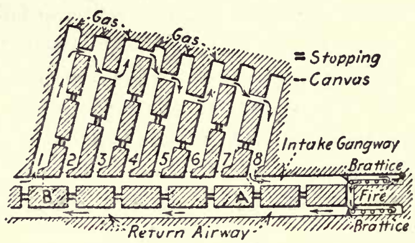
extending to the foot of the shaft. Here I could load the rock blasted out quite easily, push it outside unaided and dump it without trouble.

I do not know how many hours or days it took to complete the job, as I worked only at odd times when there was nothing else to do; but I do know that I never noticed the work or missed the time it took. I worked alone, utilizing spare time which would have been impossible had I been sinking from above. I needed no extra equipment and no extra help, both of which would have been required in sinking. Furthermore, it was never cold inside, while outside the temperature was frequently 20 deg. below and the ground frozen 2 ft. deep and freezing deeper every night.

Extinguishing Fire in a Gassy Mine

In the accompanying figure, let us assume that the face of the heading is 100 ft. inby from the last crosscut. As shown by the arrows, the rooms are ventilated by the air current before it reaches the seat of the fire, which is located at the very face of the heading.

Having removed a part of the brattice, reduce the quantity of air passing around that end, by short-circuiting a portion of the current, allowing it to pass through a hole in the brattice at the crosscut. This will permit suffcient air to flow around the brattice to make it possible to ascertain whether the fire can be extinguished by any direct available method such as fire extinguishers or water. The arrangement will also prevent any accumulation of gas in the heading in proximity to the fire, by keeping the place sufficiently ventilated.



Assuming that the fire is of such magnitude that it cannot be extinguished by any available direct method but will require to be sealed off and smothered, it will be necessary before doing this to increase the quantity of air circulating at the face of the rooms, so as to minimize the danger of an explosive mixture being formed by the gas issuing from the faces of these rooms.

The next step would be to remove a part of the stopping next outby from the one through which the air is traveling. This is done as a safeguard against the danger that would arise in case the fire increased and drove the men back from the last crosscut. The opening made in the second crosscut back from the fire will act as a regulator to short-circuit a portion of the air passing up the heading.

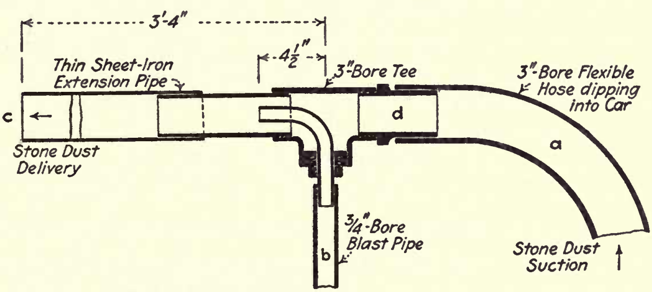
Everything is now in readiness to build the stopping to isolate the fire, provided the necessary material for that purpose is at hand. The work should be done as quickly as possible and should be in charge of a competent person. Good practical miners must be employed to do the work. A wooden stopping is first built, after selecting a good place as near as practicable to the seat of the fire. Immediately outside of the wooden stopping another stopping of slate, or brick laid in mortar, or concrete should be built. It is important to build into the stopping a vent pipe, which can be closed by a plug or valve. The purpose of the vent pipe is to enable the air to be tested from time to time to ascertain its condition and enable one to judge of the progress made in the extinction of the fire.

Rock-Dusting Mine Roadways

In this country we are discussing rock-dusting as one of the mild obsessions of the United States Bureau of Mines, for which we graciously pardon them. Meanwhile in Great Britain rock-dusting is being put actively into force, apparently with excellent results. But there they have less coal dust on the roads, and rock-dusting is therefore not such an almost impossible task. Their cars are tight and do not leak, and the coal they contain not being built up above the sides is not scattered along the roadway.

They clean their roads by hand, and then at least one colliery uses a jet to dislodge the dust remaining. This is shown in the accompanying illustration. It may be used as a dust dislodger or as a rock-dust distributor. When used for the former purpose, the 3-in. flexible hose *a* is removed and compressed air is driven through the blast pipe, which is fed by the ¾-in. compressed-air hose pipe *b*. This blast pipe is curved so as to discharge into the center of the 3-in. thin sheet-iron pipe *c*. The escaping air dislodges all the dust in the crevices of the rock. Reliance is placed on sprays to cause this dust to fall so that it can be collected.

After the 3-in. flexible hose *a* has been attached, its end can be dipped into a car of rock dust. When air under high pressure is al-



Pipe as Equipped for Rock Dusting

lowed to flow through the blast pipe, it causes a vacuum in the flexible hose and draws the ground rock through the latter, ejecting it with violence from the orifice of the rock-dusting pipe.

There are objections to the use of the apparatus as a dust dislodger. It cannot be used when the mine is working, as a cloud of coal dust can be observed 3000 ft. distant from the point where the ejector is at work, in spite of the use of fine sprays through which the dust must pass. G. D. Budge, speaking before the South Wales Institute of Engineers, said:

> Until some arrangement is devised which will catch the dust and prevent it from escaping into the workings and return airways, the excellent work done by the ejector is of little avail. By this method a road can be made practically free of dust, but there is nothing to be gained by this if the immunity of this particular stretch of roadway is obtained at the expense of other parts of the colliery.

It would appear that a vacuum cleaner would do the work to better advantage, as it could be made to collect all the dust and preclude the possibility of dusting the interior workings with an impalpable combustible material.

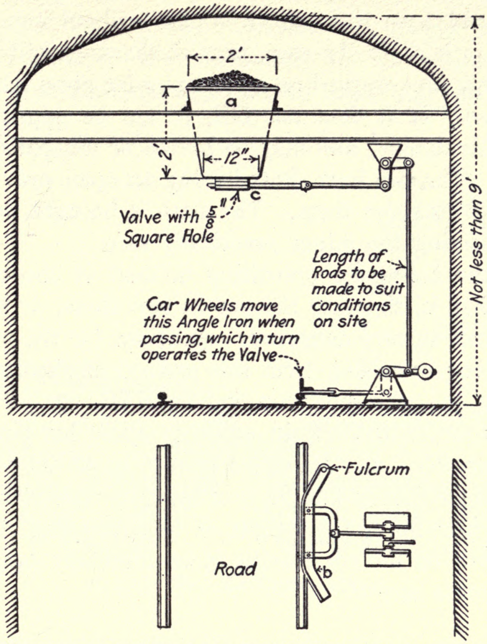
Mr. Budge doubts whether the use of this pipe gives results superior to those obtained in rock-dusting by hand. In that case the dust is put on the ledges of rock with some violence, and it brings down no little coal dust from the crevices. But where there are large and high holes above the timber, the pipe cleans such holes more satisfactorily than can be done without it, and it is more successful in distributing the stone dust.

Rock-Dusting Mine Air

The air of the mine is continually filled with flying coal dust raised by passing cars. George Hann, a Welsh mining man, observed this fact and believed that it would be an excellent idea to make each car that went in or out of the workings distribute an antidote for the dust which it was industriously scattering, so he rigged up the apparatus illustrated herewith and described by G. D. Budge in a paper entitled "Notes on the Stone-Dusting of Steam-Coal Collieries" and read before the South Wales Institute of Engineers.

It will be seen that as the car passes a certain point in the track the wheels on one side push back an angle iron which by means of two bell cranks opens a gate in a hopper containing rock dust. Each car, therefore, liberates an amount of dust dependent somewhat on the speed of its travel. However, as this does not vary much, the amount can be gaged with some accuracy. Mr. Hann provides 0.72 oz. of dust per car for a road on which 800 cars per day are passing.

In a mine so rock-dusted the air is as innocuous as the floor, roof and sides, though these have been immunized by the ordinary rock-



Arrangement for Rock-Dusting Roadways

dusting processes. Where it is not employed the air may contain dust which is as pure as that in a chunk of coal, though the dust on the floor may have a high percentage of ash.

First Aid, Safety and Welfare Kinks

Safety in Shooting Coal

The safest method of shooting machine-mined coal, especially where the slate has a tendency to draw or break away from the roof when the shot is fired, which is the prevailing tendency in a pitching seam, is to fire three shots when the coal being worked is in the ordinary room. Before shooting, all bug dust should be removed from under the cut, so that the coal will not bank itself when the shot is fired. If the bands are loose, they should be removed before attempting to shoot.

The first hole should be placed near the center of the cut and drilled at a slight angle, to enable powder to work on the largest area possible. This first shot generally displaces enough coal to permit the miner to load from three to seven cars without any danger from the slate and, as is often the case, part of the slate will fall with the coal, as the large area worked on by the powder gives it ample opportunity to do so. If it does not fall, it can be approached by the miner with little danger, and may be barred or wedged down without much trouble. The two butt shots having an open end, little powder will be required to shoot them. The slate is brought down with the coal, thereby leaving the miner practically safe.

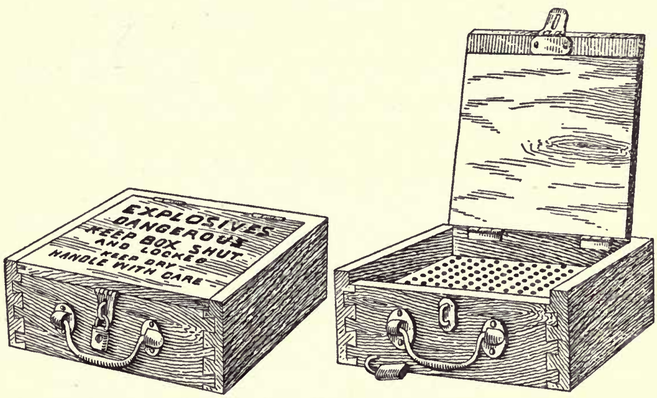
On the other hand, the prevailing method of shooting machine-mined coal—that is, shooting the cut in two shots, or the tight shot on the rib—tends to very dangerous conditions for the miner to work under. The dangers arising from this method of shooting, which are evident to any one who will stop and consider, are as follows: The miner shoots first on the rib, in order to allow his powder to work satisfactorily on the coal. He drills from 6 to 18 in. away from the rib. This in itself leaves the rib in a dangerous condition, for when the room is driven past, the weight of the overlying strata squeezes the coal and slate on the rib, leaving it in imminent danger of falling and catching some one.

A Convenient Safety Cap Box

Although it is a dangerous practice to carry dynamite and caps in the same vehicle on account of the sensitiveness of the caps to shock and the probability that their explosion will fire the dynamite, there are times when separate loading or two trips are very inconvenient and expensive. To provide for such cases and also to care for caps in the field, a safety box has been designed that makes it feasible to transport caps and dynamite in the same vehicle without extraordinary risk, and greatly decreases the risk from flying fragments in field blasting.

This box as illustrated, from the *Du Pont Magazine,* is made of oak $\frac{7}{8}$ in. thick, dovetailed at corners and with rabbeted bottom of oak. The top is of $\frac{1}{2}$-in. pine with blind hinges and staple. The loaded box cannot be opened without destroying the cover. Even the most enterprising pryer will hesitate to use force on a caseful of sensitive explosives.

The box is lined inside with ½-in. felt, obtainable at harness shops. The cap board is removable, but should fit snugly on and between the felts. The space between the bottom of the cover and the top of the bottom felt should be just right to hold caps firmly without undue pressure. The holes in the cap board, 100 in number, should be large enough to permit easy entrance of caps, but not large enough to let them fall out.



A Safe Box To Carry Caps

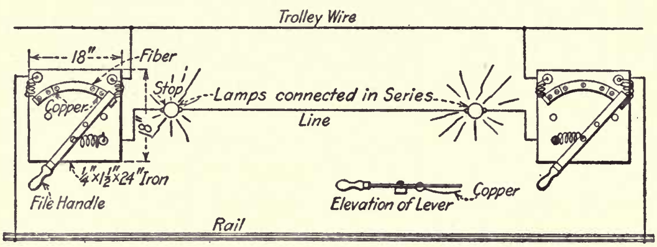
The fact that a box made this way was filled with 100 caps and thrown over a 50-ft. embankment into a quarry, where it bounded around on the rocks and no explosion resulted shows that it should fulfill its requirements.

Signal Lights for Mine Locomotives

The accompanying diagram shows a system of signal lights employed to safeguard the men who operate mine locomotives. As will be noticed from the illustration, the switchboards are inexpensive, considering the important part they play in the matter of safety.

Referring to the diagram, it will be seen that only one conductor is necessary; and this can be made of an old burned-out field coil or, better yet, a No. 18 B. & S. insulated wire. The signal lights are manipulated as follows: When an incoming locomotive passes the first switchboard, the motorman throws the lever and thus opens the circuit, thereby blocking the road. On reaching the next switchboard, he throws its lever, which closes the circuit, causing the two 125-volt lamps to burn and showing the road is clear for following locomotives.

The lights should be placed close to a siding, so that the motorman can clear the road for other locomotives. It should be noticed carefully that the lights are so arranged that they burn when the road is clear and are out when the road is blocked.



A Practical System of Signal Lights

Each switchboard can be made of a well-seasoned board or an old piece of slate or marble and should be placed on a timber in some convenient place, so as to be within easy reach of the motorman.

The system of lights just described is being used efficiently in both the Barker and Glendon mines of the Federal Coal Co., of Straight Creek, Ky., each light doing away with the services of a trapper boy.

Rubber Mats for Mine Locomotive Cabs

A Coal Age subscriber suggests that all electric mine locomotives be equipped with a rubber mat, in the bottom of the cab (or deck).

By this precaution the only ground a motorman need have would be through the hand. His experience has been that a shock from normal voltage (250 to 500 volts) does not prove fatal unless the victim has a good ground.

When the only ground is through the hand, the result of coming in contact with a live conductor is a severe shock of the arm. The large blood vessels are not much disturbed, nor is the nervous system badly shocked.

The writer has often used wood for an insulator in the bottom of cabs. The idea of rubber mats was suggested by R. E. Williams, a motorman in No. 1 mine of the Pond Creek Coal Co.

Simple Shaft Gate

At the Junction shaft of the Calumet & Arizona Mining Co., Warren, Ariz., a shaft gate is used that is simple and cheap and has an inherent tendency to stay shut when it should be shut and to stay open when it should be open.

The gate consists of a piece of 1½- or 2-in. pipe on one end of which is a semi-circular section of cast iron pivoted as shown. When the gate is closed, the weight of the pipe has a greater moment-arm than the counterweight and it naturally stays closed. When the gate is lifted about two-thirds of the way up, the center of gravity changes so that the counterweight tends to keep on rotating and after the

A Simple Shaft Gate

pipe passes the vertical the moment of both pipe and counterweight act together to hold the pipe against the stop. A plate is used on the center post to give a bearing, and the iron straps support the bearing pin and provide a guide for the counterweight so that the far end of the gate never misses the clip and falls down. It is a clever gate.

How Mine Workers May Get Hurt

The *Anode*, published by the Anaconda Copper Mining Co., gives an account of some accidents from which coal-mining men might take heed:

> Several men have been burned by bringing a light close to the refuse carbide dumped from acetylene lamps. The men were burned by the explosion of gas escaping from the unspent carbide waste.
>
> A miner hoisting timber stood at the bottom of the timber slide. The rope broke and the miner received a compound fracture of the leg.
>
> A miner accidentally got some carbide inside his underwear. He received a bad burn when he got wet.
>
> Two miners lost their lives working in chutes without first making themselves safe above.
>
> A machinist chipping steel nearly lost an eye from flying metal. Better to wear goggles than to be blind.

T. F. Reilly, in the same paper, gives some good hints for mule skinners.

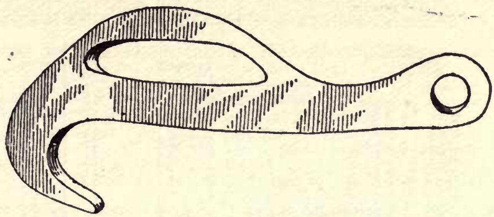
> Don't attempt to ride a loaded trip without making a safe place to sit; a sudden lurch of the car may throw you off.
>
> Once the trip is started, don't look back until you bring the mule to a stop. Looking backward while the trip is in motion may cause you to be knocked off the trip by a chute mouth, or low cap.
>
> Don't ride the tail chain, or door end of a car.
>
> Don't haul powder or caps to the magazine; use a truck or car, and push them in by hand.
>
> Have an understanding with men who are trucking along the roadway, so as to avoid the danger of a collision.
>
> Ride your trip in such a maner that you will be able to cut off the mule at the least sign of danger.
>
> Don't beat or excite your mule; gain his confidence, and he will do all he can.
>
> Men passing a horse or mule in an entry should attract the beast's attention by speaking gently to him, and should walk easily by him.

Hook To Eliminate Crushed Fingers

John O'Neill, who has been attached to the office of the mining superintendent of the Lehigh Valley Coal Co., has the interesting title "investigator of accidents." It is a pity that there are not more of such useful officials. In the performance of his duties Mr. O'Neill has observed that drivers and runners around the mines often crushed their fingers between the tail-chain hook and the link, or "couple," on a mine car.

Under ordinary circumstances there is not much danger in hooking up a mule, but some of them do not stop or start with mechanical precision at the word of command. When bidden to go forward to take up a little slack or to maneuver into place, they continue their journey regardless of the driver's "Whoa," and he must either make his coupling on the fly or do one of two things—back the mule several feet or turn him around. In either event he will have to try again to hook him up with like interesting possibilities.

To turn a mule is a troublesome operation, especially in a narrow place, so most drivers make a desperate lunge forward and make the coupling in the short time the mule graciously affords. In so doing the fingers are apt to get caught and the safety handhold on the back



Use the Handle and Save Your Fingers

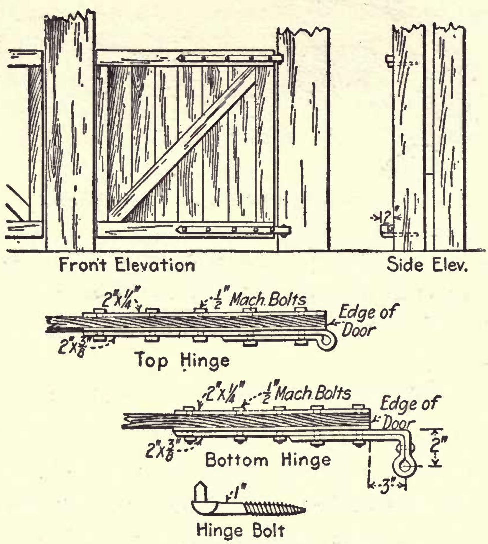
of the hook devised by Mr. O'Neill will obviate this possibility. The hook and its purposes are described in the *Employees' Magazine,* issued by the Lehigh Valley Coal Company.

Finding Splinters in Fingers

Those who have to practice "first aid" in mines and reduction works will probably find the following of great help: "Location in a busy clothing manufacturing district gave rise to the necessity for a simple method of determining the presence and location of foreign bodies, such as needles and splinters, in fingers," says Dr. Roscoe H. Webb, in the *Journal* of the American Medical Association. "A piece of black woolen cloth 8 in. square was fastened to a piece of adhesive plaster of equal size, and in the center an oval opening was made measuring five-eighths by one-half inch. By placing this over an electric light supplied with a reflector and placing the finger over the hole, excellent transillumination is obtained, and by making pressure with a pointed instrument over the suspected area, the object can be brought out more clearly. If the field is rendered bloodless while operating, the finger may be placed over the opening and the object can be again accurately located. This device is simple, inexpensive and indestructible. It is more easily adapted than pocket flashlights, etc., to the finger, and reduces to a minimum the number of cases requiring röntgenograms. Daily use for the last six months by several workers in the accident room has proved its efficiency."

Self-Closing Door for Mine Shaft

Kinks that are not always new are sometimes nevertheless good. While doing some consulting work for a certain company it became necessary to replace the shaft "bars," for reasons of safety, with something that would stay closed.



The Hinges and the Door They Support

The blacksmith did his part, and the boss carpenter, against his better judgment, hung them—and with them his convictions that they wouldn't work.

The gate hangers here shown are only the old hinges that supported the gates we used to swing on when we were kids, but the gates hang straight and stay shut.

Putting Water in Miners' Houses

After doing many things to improve the welfare of the miners and coke workers in mining villages under my charge, says a Pennsylvania engineer, I find that putting good water in their houses is something they appreciate most highly.

The domestic relations of men and women around coke towns have improved wonderfully of recent years, and one of the items bringing this about is water in the house. It used to be a common sight to see women and children carrying water from a common hydrant or pump for 1000 ft. or more, but this will soon be a thing of the past.

I also find after an extended experience in providing water to mining towns that many men do not know how to install water in the houses, and this includes machinists and their helpers. They do not draw any plans before they start, and so after a year or so they do not know the size of the pipes installed, the location of the valves or any details of the installation.

I usually put 1-in. pipes on the main street for the first 500 ft. away from the main 4-in. line. Thereafter the diameter is reduced to ¾ in. The side lines to all houses measure ½ in., and thus ½-in. spigots can be used. Such a location is chosen for the sinks as will give us a uniform length of pipes so as to make the work in the shop

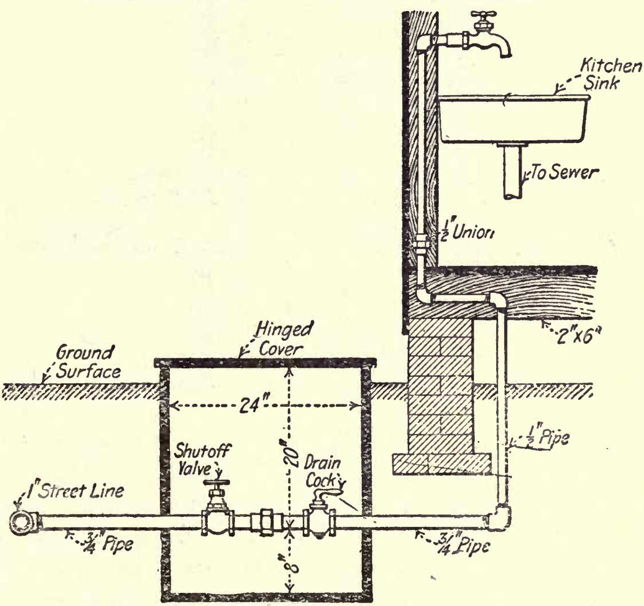


Fig. 1. Connections for Water-Supply

easy and cheap. It also allows the management to keep a few lengths on hand which will fit the requirements of the houses in case of an emergency. After installing the water, rules for its use are left in each house. The tenants are instructed to shut the water off at the globe valve, to open the drain cock outside and to leave the spigots over the sink open every cold night. The line being drained in the house, the water is prevented from freezing.

All sewer pipe to drain water away from the house can be laid in the same ditch as the water line. A provision should be made for flushing the sewers and for the insertion of lye or soda ash, in order that no bad odors may be emitted. This provision, which has successfully removed one of the principal difficulties in operating a water system, is shown in the illustration (Fig. 2).

The box is made of concrete and is 24-in. square. The walls are 4 in. thick, as is also the floor. It can be flushed by putting in a fire hose. Twice a week in hot weather soda ash or lye should be placed

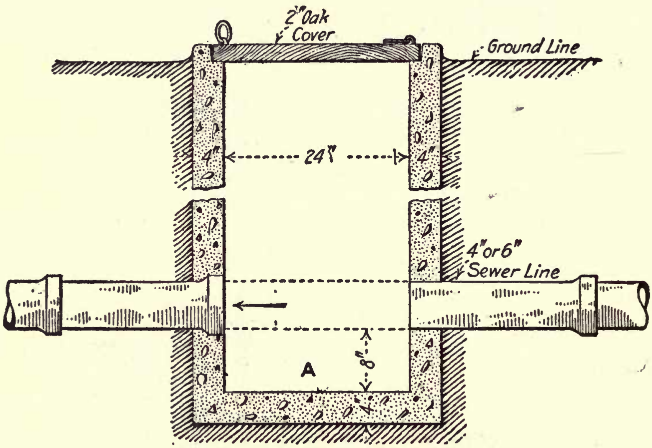


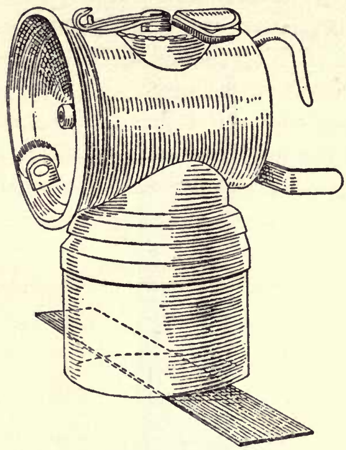
Fig. 2. Manhole for Sewer Cleansing

at A (Fig. 2) in the 8-in. space below the bottom of the sewer pipes.

About once a month, or more often if necessary, a competent man must inspect the flush box; if it is filling up, he must clean it out with a shovel. Such catch basins should be put in the sewer every 300 ft. In coke towns concrete work does not cost much, and the basins can be put in for $6 apiece and may save ten times that amount in one year if the sewer clogs up. Moreover, it makes the sewer sanitary.

Lamp for a One-Handed Man

Last fall a pumper in an Ohio mine had his arm caught in a belt, and as a result of the accident his arm was taken off. When he was ready to go to work again he began using an oil lamp, for he couldn't handle a carbide lamp as he had done before the mishap. A special carbide lamp that he could use was made for him by a local hardwareman, who riveted a light piece of metal across the bottom of an



Carbide Lamp for One-Handed Man

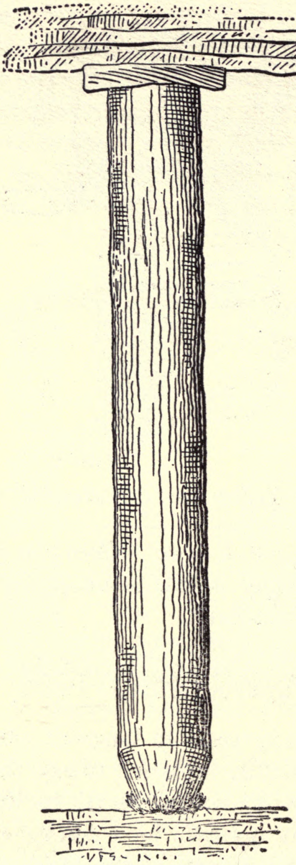
ordinary lamp and soldered it over. When the metal piece is placed in a switch frog the pumper is able to unscrew the top, fill the lamp and replace it with his one hand.

Tapered Mine Posts

My experience of many years in longwall advancing, in England, says a Coal Age contributor, leads me to say that no timber should be left standing in the goaves or packs, in longwall work. Such a practice would, in my opinion, be a source of danger, because it would tend to throw the weight of the overburden forward on the coal face, and this would either break the roof off close to the face or crush the coal and make too much slack.

In my experience, I have known of instances where timber left standing in the goaves caused the roof to break 2 ft. over the coal. The standing timber prevented the roof from settling on the packs. Where timbers were left in the packwalls on the roadside, the packs would be forced out of line and cause much trouble and expense.

Whenever necessary to use timbers in the gateroads it has been my practice to taper the foot of the post, as shown in the accompanying figure. Then, when the post took the weight the bottom would burr up, allowing the roof to settle steadily till it rested firmly on



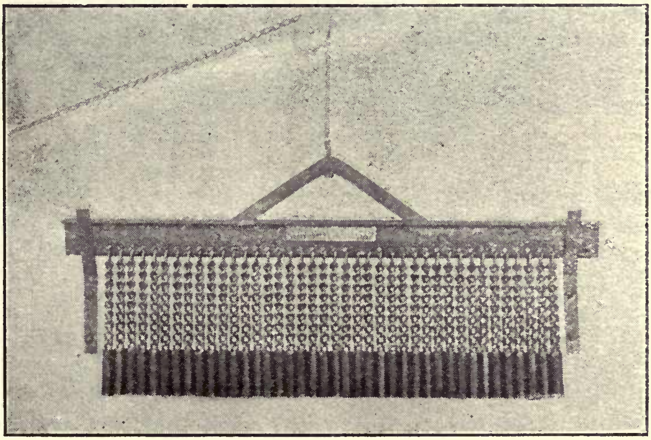
Tapered Mine Post

the packwalls. I have usually found that the roof came to rest and settlement ceased at a distance of from 60 to 80 yd. back from the face of the coal. The principal roads could then be ripped to afford the necessary headroom and no further work was necessary. In longwall advancing, the back timbers should be drawn regularly and moved forward. No posts should be left standing in the gob, as that would prevent a uniform subsidence of the roof strata. Allow me to cite an instance where timbers left standing in the gob caused much trouble and would have eventually destroyed the coal face had they not been removed. Another man and myself were asked to draw these timbers, as it was evident that they were causing the roof to break at the face.

Before starting to remove the back timbers, however, we set three rows of posts parallel to the face of the coal, at a regular distance apart. Then, going back into the goaves, we proceeded to draw the timbers, which was not a comfortable job, as one may readily imagine. The drawing of these timbers, however, relieved the weight on the coal face and the trouble ceased there and on the gateroads, as the roof was thus permitted to settle down firmly on the packs.

Chain Screen Door

The accompanying illustration shows an improved form of chain screen door for oven and furnace openings. This door was designed to eliminate the discomfort of the heat and gases coming out through



Chain Screen Door for Boiler Furnaces

the uncovered opening when the doors are thrown open, and the loss of efficiency through the chilling effect of the inrushing cold air. At the same time the form of chain door shown permits an unhampered view of the interior, as the glare is toned down. The doors are made automatic and nonautomatic.

The automatic is employed mostly in boiler furnaces where the opening of the ordinary fire-door causes the screen to unroll from a cylinder hung above the furnace opening. The nonautomatic, which is for use on ovens and other furnaces, is much simpler in construction. The chains forming the screen are suspended from a bar and may be raised out of the way by a hand chain running through a pulley overhead. When needed, the screen is lowered into supporting brackets.

Mule-Proof Stable Fence

The mule is hard to retain in his compound with any ordinary fence because for appearance' sake the board palings of all such inclosures are nailed on the outside and can easily be kicked loose from

A Fence Proof to the Kicking of Mules

the inside. Seeing this, Superintendent Howard J. Thomas, at the Brookside plant of the Sloss-Sheffield Steel and Iron Co., put the board palings on the inside, and now even an Alabama mule cannot jar them loose. The illustration shows the barn and the fence surrounding it, which is more than "horse-high."

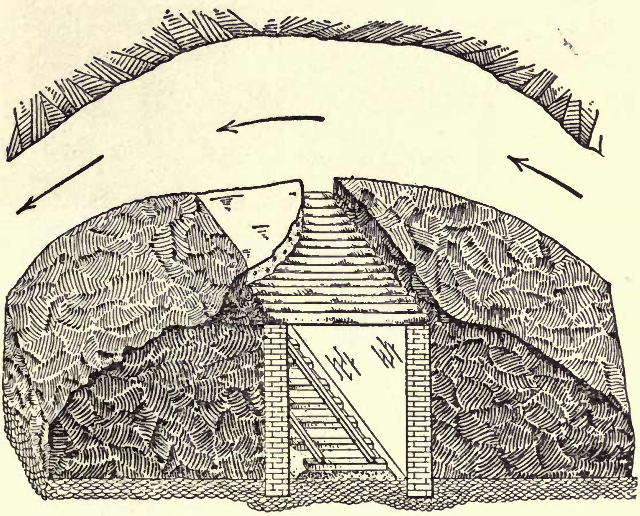
Construction of Mine Overcasts

Here's an economical and serviceable method of overcast construction much employed in the Pittsburgh district:

The first step is to shoot down the roof on the haulage road, at the point where it is proposed to build the overcast. The excavation in the roof must be carried to such a height as to provide an area in the overcast at least equal to the sectional area of the airway. Having blown down the roof over the road, the excavation is carried to the right and left on each side and above the coal. After proceeding a short distance, these side excavations are sloped downward, but not too steeply, as shown in perspective in the accompanying figure, until they connect with the airways on either side.

Having completed this excavation, a cut is now made in the rib, on each side of the haulage road, to furnish room for building substantial sidewalls that will form the foundation of the floor of the overcast. These sidewalls can be constructed of well burned brick or concrete, as desired. They are carried up to the level of the roof of the haulage road, which is but a few inches below the level of the floor of the overcast.

As shown in the figure, old boiler flues or discarded water pipes, up to 3 in. in diameter, are used to form the foundation of the floor of the overcast, or air-bridge. The pipes are cut to the proper length and laid on the sidewalls so as to span the roadway. They are embedded in cement, and cement is spread over them to a depth of 2



Perspective View of Overcast, Pittsburgh Seam

or 3 in. to form a solid air-tight floor, or bridge. All joints or open cracks that would allow the air to leak from the airway into the haulage road are sealed with cement.

In case the rock sides of the excavation above the bridge do not stand without support, sidewalls must be built here also. As a foundation for each of these walls in the overcast, two 60-lb. or 80-lb.

T-rails are laid across the opening and, like the pipes just mentioned, made to rest on the top of the sidewalls in the roadway and embedded in cement. The upper sidewalls are then built and carried up to the roof of the excavation.

This makes an absolutely fireproof overcast that has given good service throughout this district. Where the sidewalls are built of brick, it is possible to use these again, should the overcasts no longer be required. The work is completed by carefully sealing all open joints or cracks that would permit the leakage of air.

Handy Flashlight Clamp

The accompanying illustration shows a clamp for a flashlight. This clamp was made so as to be able to take notes and also for use

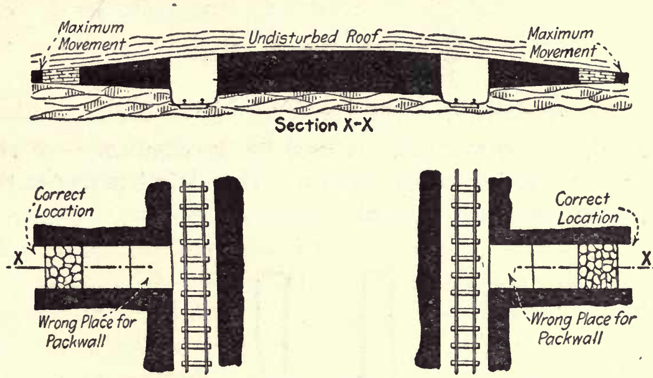
The Clamp and Its Use

in setting up a transit in a mine where safety lamps are required. It is handy and useful and is recommended to mining engineers as well as to inspectors.

The flashlight can be hung on the cap or clothing. The clamp is made of tin ½ in. wide with a small bolt or screw for clamping, and a hook from an old oil pit lamp. This hook is soldered on underneath the clamp.

Protecting Headings from Squeeze

When a heading suffers from squeeze the management of a mine frequently determines to protect it by putting a wall along the rib of the entry at every room, the wall being constructed of roof rock more or less carefully built up. The first thought is to put the wall just



Put Packwalls Where They Do Most Good

inside the room where it will be easiest to build and yet sufficiently out of the way. But a little reflection will show that the wall should be built well in the neck of the room, just about the inner edge of the stump where the room is widened out.

In this way the wall will be erected where the action of creep is the greatest. Hence it will be tightened with the least general movement of the roof and floor. If the wall is located near the heading roadway it is so placed that a movement that would squeeze the wall enough to make it bear its full load would also overwhelm the coal pillars. It is desirable to utilize the remaining strength of these pillars as well as the strength of the rock walls. This is best done by putting the piles of rock "near the firing line," where the motion and loading reach a maximum. Otherwise the coal pillars will be overwhelmed before they get help from the packwalls.

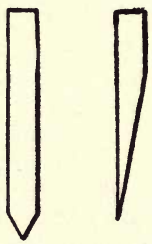
Another reason for putting these walls back is because it leaves room for further packing should that be necessary. It also leaves the needed shelter holes along the roadway. Another point to be remembered is that a packwall placed along the rib line will rest on clay that in all probability will soon be pushed out into the roadway. The foundation on which it is resting will squeeze away from under it, and it will thus tend to travel at the bottom toward the roadway, partly blocking up the available footway alongside the track.

Finally, with a creeping road it is usually found necessary to shovel away oozing clay from the rails. It is best to load this out, but in any emergency the room neck, if not closed at the mouth by a wall, comes in quite handy.

Surveying Kinks

A Survey Stake That "Stays Put"

The ordinary survey stake as used by the engineer is so made as to very easily knocked out of position. This defect is due to the way in which the stake is sharpened.



Wrong and Right Way

The stake sketched on the left-hand side of the accompanying figure is sharpened in the manner most generally in use and may be described as a straight stick sharpened only near the end with a short slope from both sides. When such a stake is driven, the point is the only part firmly seated, for the body of the stake is as large just above the point as the rest of the way up, so that the stake just stands in a hole made by the point. This shape accounts for the ease with which most stakes are displaced. If the stake be made of the form shown by the figure at the right, it will be found to give greater satisfaction. This stake is sharpened only on one side, but the slope extends three-fourths the length of the stake. When driven into the earth, the stake is held very much more firmly than is the other kind, because the taper is much longer and therefore the earth adheres to a greater length of the stake. It is very difficult to draw this type of stake out of the earth when once driven in. If exposed to traffic, as in the case of streets and highways, the stakes are sometimes broken off at the ground, the stake breaking before it pulls up. In this case the point is still in position and can be found and replaced.

On one occasion a test was made of these two types of stakes on a highway on which the traffic was very heavy. The following was the result: Equal numbers of the two kinds of stakes were used, under equal exposure, yet 14 per cent. of the first type and only $2\frac{1}{2}$ per cent. of the other type were lost.

Proper Tension for Steel Tapes

Everyone knows correct measurement of distance is just as important as correct bearing, but far less care is usually employed than in measuring angles.

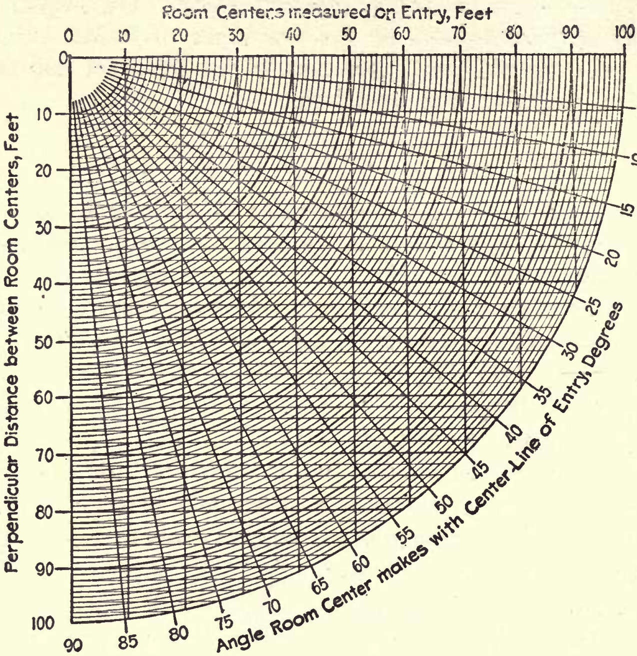
Most tapes when they come from the factory are correct at a 15-lb. pull when supported their entire length. Now this condition is seldom met with in the field. The proper tension when unsupported is what the engineer usually desires. A contributor made some tests recently that may be of general interest:

He first laid out 100, 200 and 300 ft. with a standard tape. This was done on a piece of perfectly level ground. Wooden hubs were driven flush with the ground and a scratch made at the graduation points in order to have as fine a mark as possible. He next laid out the tape to be tested (300 ft. in length), and found it correct at a 16-lb. pull. He then tried the tape unsupported. Lifting a 100-ft. section clear of the ground, he found it correct at 32 lb. In the same manner 200 ft. was correct at 48 lb. From these results he expected the 300-ft. total to require 64 lb., and was rather surprised to find that it only required 56 lb. to pull it up to the mark when entirely unsupported. The tensions were all less than he had expected to find them, as he was using an extra-heavy tape.

Calculating Room Centers

A correspondent submits a diagram that was designed some years ago for calculating room centers when the rooms are turned at an angle with the entry or gangway. Since that time it has been in constant use by the engineers of many coal companies.

As shown in the accompanying figure, this chart consists of horizontal and vertical lines spaced at regular distances apart and crossed by arcs of concentric circles and diagonal lines, the latter radiating from the common center of the arcs and spaced 5 deg. apart, marking angles from 0 to 90 degrees.



Handy Chart for Mining Engineers

This chart can be used in a number of ways; as for instance, where it is necessary to find the projection of a given line on another when the angle between the two is known. Thus, it is useful in finding the latitude and departure for any given course in surveying. It has, besides, a convenient application in ascertaining quickly the distance apart of room centers, measured on the entry, when the rooms make a given angle with the entry, to provide for a certain width of room and pillar.

For example, let the distance between room centers measured on the entry be 55 ft., and let the rooms make an angle of 50 deg. with the entry. To find the perpendicular distance between room centers by means of the chart, in this case, follow the radius marked 50 deg. to its intersection with the circle whose radius is 55 ft. From this intersection follow the horizontal line to the scale on the left, which shows the perpendicular distance between room centers to be 42 feet.

When the desired width of room and pillar and the angle the rooms make with the entry are known, and it is required to find the distance between centers measured on the entry, it is clear that the order just given must be reversed. For example, in this case, first follow the horizontal line corresponding to the given width of room and pillar (42 ft.), as indicated by the scale on the left of the diagram, to its intersection with the radial line marked 50 deg. Then, follow the arc of the circle that would pass through this intersection to either scale on the margin of the diagram, and the reading of the scale will be the required distance between room centers measured on the entry.

Other Convenient Uses of Chart

When surveying a mine the same chart can be used to find the latitude and departure of any course. In that case, follow the radial line marked with the bearing of the course to its intersection with the arc indicating the length of the course, and from this intersection follow the vertical and horizontal lines respectively to the scales at the top and the left side of the diagram. The scale at the top of the diagram will show the latitude and that at the left the departure of the given course.

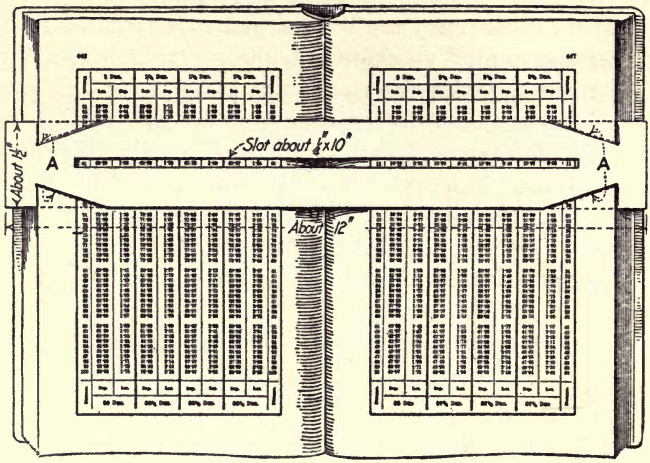
In the solution of any right triangle the diagonal line corresponding to the given angle is the hypotenuse of the triangle, its length being marked by the arc corresponding to the length of the hypotenuse. The two scales at the top and side of the diagram respectively will then give the corresponding lengths of the two sides of the triangle.

Indicator for Tables

T. Edwin Smith has used the instrument described below to a considerable extent in taking data from traverse tables and has found it a great help. It can be made out of a piece of cardboard, although a strip of celluloid would be better.

The construction is clearly shown by the illustration. In operation you open the book at the page desired and insert a couple of leaves on each side under the points marked *A* at each end. In this position the runner can be slipped up or down the page and readings across the page can be secured without any chance of reading the wrong line.

The slot can be made the proper width to show only one row of figures, although it is better to have it a little wider because few

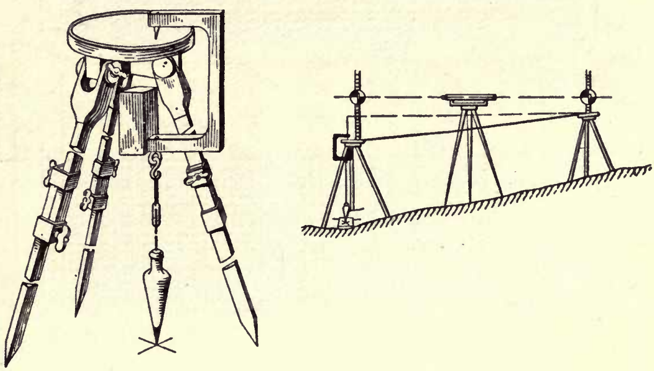


Simple Device To Facilitate Taking Data from Transverse Tables

books open perfectly straight and the lines on the two pages are rarely exactly opposite and parallel. Although intended primarily for traverse tables, this instrument is useful for reading other tabular data.

Plumbing Instrument for Base-Line Work

The device here illustrated is for reproducing a point from below to a point above, or vice versa, and is designed to be used in connection with base-line or other accurate tape measurements. It was devised in the Topographical Bureau, Borough of Queens, of which Charles U. Powell is Engineer in Charge. Distances are measured between points on the tops of small bronze tables mounted on steel extension tripods, the table tops being provided with white celluloid disks on which the measurements are marked. The device consists of a cast-aluminum arm or bracket fitted with a steel pointer in the upper arm, and directly opposite it in the lower arm is a hook and eye for attaching the plumb line. It is held in perfect balance by a counterweight of lead incased in brass attached rigidly to the lower arm, all parts made true and centered. In using, the instrument is brought directly over the point below by shifting on its pointer, and its position is marked above. As a test for error, the instrument is revolved 180 deg. on its pointer. The instrument is designed to be carried in the pocket, its overall dimensions being about 4 x 6 x 1 in. and its weight 19 oz. A patent is pending. A center supporting rod with short sliding arm is set on the line of the table tops to overcome



Plumbing Instrument for Base-Line Work

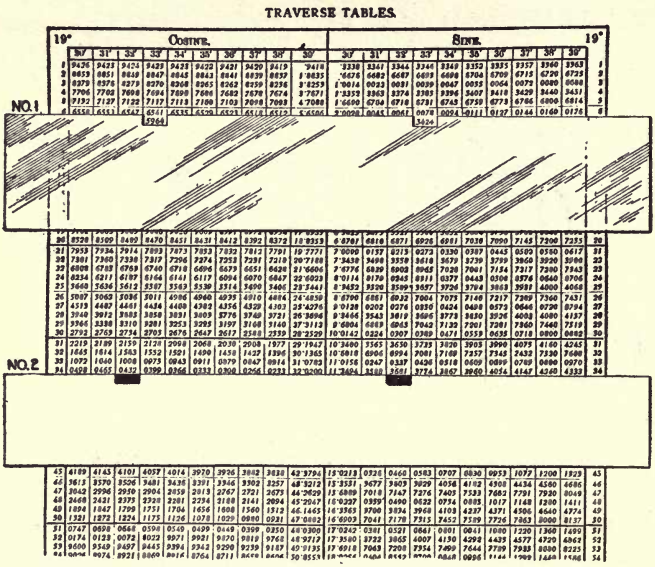
sag. Pluses are obtained with a steel tape and a plumb-bob. Eight men constitute a party, and from 8000 to 10,000 ft. are measured in a day with an error not exceeding $^1/_{100000}$.

Another Indicator for Tables

This suggestion is made by A. C. Collen: secure a piece of transparent celluloid about 8 in. long and 1 in. or more in width. (A piece of an old celluloid triangle will do admirably if it is sufficiently transparent.) Two notches about $\frac{1}{8}$ in. deep and the width of a single column of the tables should be cut in one edge at the distance apart, center to center, of the two columns on the same page having the same minute heading. The method of construction and of using this instrument is apparent from the illustration.

Using it as a straight-edge, it is laid across the page on the line of figures for the proper distance and slid along until either one of the notches coincides with the proper minute column. The numbers in the two slots are then noted, and a glance to the center of the page gives the proper whole numbers to prefix to them.

In case celluloid is not at hand a straight-edge made of cardboard or a thin piece of wood and having the space where the notches would come if celluloid were used blacked in with ink instead of being cut



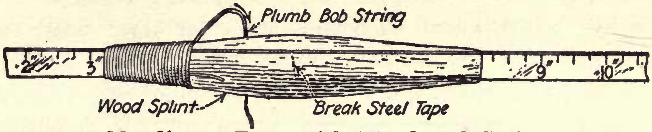
The Two Indicators

out, will give excellent service. In fact some engineers may prefer this style, inasmuch as all the figures are in plain sight and do not have to be viewed through the celluloid.

Field Mend for Steel Tape

Although there are several quick-repair menders for steel tapes on the market, it usually happens that they are in the office when the tape breaks. The writer was taught this simple mend by a practical surveyor years ago, and has used it a good many times since and never has had the least bit of trouble in making it hold as long as he cared to leave it on. It needed no attention other than an occasional soaking.

When the tape breaks, cut a straight piece from a green alder or willow about 3 in. long. When the stick is split down the center and peeled, it should just cover the tape laid lengthwise. Smooth up

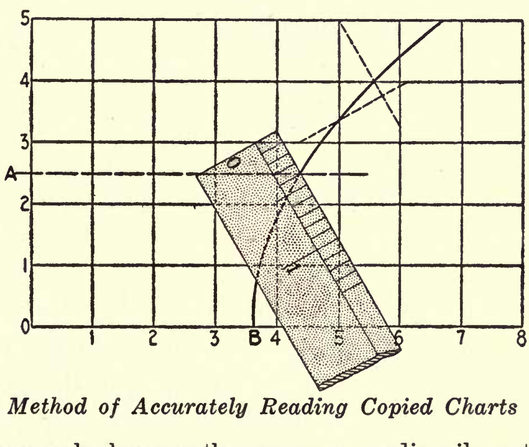


Mending a Tape with Wood and String

the split faces and shave down the outside from the center of each half to a thin edge. About 3 ft. of plumb-bob string or stout cord will serve to wrap the splints. The cord should be wrapped as tight as possible each time and care taken to see that the binding does not have a chance to slacken up. When the splint is nearly half wound, place the broken ends together right side up and finish winding until the splint is entirely covered. A minute's soaking in water will remove any possibility of slipping. If it should slip at all, it will pull entirely out; thus there is very little chance of getting wrong chainage. The mended portion slides readily through the brush and around rocks.

Reading Copied Charts

When it is found necessary to read coördinate values from curves that have been reduced for printing, it is often difficult to measure these

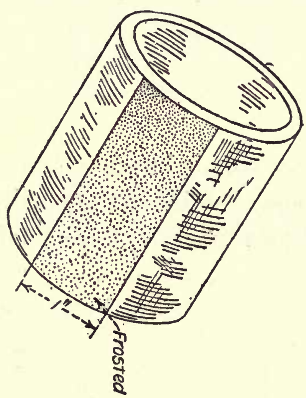


Method of Accurately Reading Copied Charts

directly with a scale, because the curves are ordinarily not reduced to any particular scale for this purpose. When it is necessary to determine these intermediate values closer than can be done by estimating, the following method will give accurate readings, using any scale: As shown in the illustration, place an ordinary graduated scale with one graduation on one ordinate line and another graduation on the ordinate line below it, and then slide the ruler along until the edge intersects the curve at the point to be read. If the scale used is divided into tenths, the reading is a direct decimal and if not divided into tenths the reading is a fraction, which is easily handled. This is based on the theorem of proportional triangles.

Frosted Globe for Sighting

The following suggestion is of particular interest for engineers who use safety lamps for surveying in mines. The glass, or globe, is put on an emery stone and "frosted," the polish being taken off,



leaving a frosted appearance. This is much better than using paper or tracing cloth as a background in taking sights to a plumb-bob in front of a safety lamp.

Rapid Surveying with a Bicycle

A method for rapidly marking geological and topographical details on maps is described by Leslie H. Ower, in the *Proceedings* of the Australasian Institute of Mining Engineers. For the field work he uses a bicycle equipped with a standard make of cyclometer, designed to register distances in miles and tenths of miles. Instead of using but one striker, eight are employed, so that, for each revolution of the bicycle wheel, eight impulses are given to the vanes of the cyclometer. By ignoring the decimal point, the reading is in chains instead of miles. The author has found, by checking distances on existing maps, that with 1½-in. tires the maximum error is 2%, a low reading being obtained when leading the bicycle with tires pumped hard. When riding, the depressing of the tires reduces the radius, with a corresponding reduction of the error.

For field notes an ordinary level book may be used, with the headings as shown herewith:

HEADINGS FOR FIELD NOTES

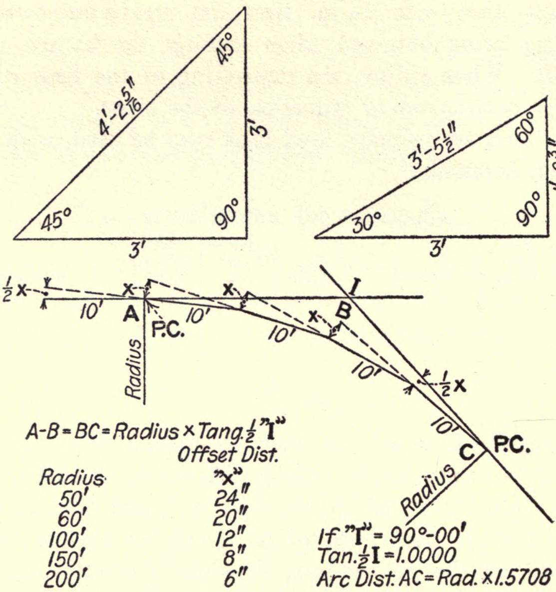
Total Distance	Net Distance	Geology	Time	Aneroid Reading	Reduced Level	Remarks

For noting the time a wrist watch is recommended, and for altitude an aneroid barometer, recording differences of 10 ft., to be carried in the right-hand coat pocket. It is found that after a little practice the average time required to record the cyclometer reading, the direction since the last reading, the class of country, the time, the aneroid height ,the locality, and to offset by eye any physical feature, is about 50 sec. Readings are taken whenever there is an appreciable change in direction or at other obvious points, according to the nature of the work in progress.

Laying out Angles and Curves in Mine Work

Mine foremen, superintendents and engineers are often called upon to lay out many of the most commonly used angles and curves in mine layouts of various kinds. A very simple way to lay out angles without the use of the transit is shown in the accompanying drawings. The methods of laying out 30-, 45-, 60- and 90-deg. angles as here shown are self-explanatory.

The method laying out simple curves in mine work is as follows: After the point of curve *PC* has been determined, measure back a distance of 10 ft. and make an offset equal to one-half of the offset distance *X* in the direction the curve is to be driven. After driving ahead 10 ft. on these sights, set over distance *X* from the second point, or the *PC*, and drive ahead another 10 ft., making the offset the same as before. The first and last offsets are always equal to one-half the distance *X*.



Method of Laying out Curves

Although other distances in proportion to the ones shown on the drawings can be used, the dimensions shown will be found most convenient. Ordinary sight strings or plumb bobs hung from spads are used for line.

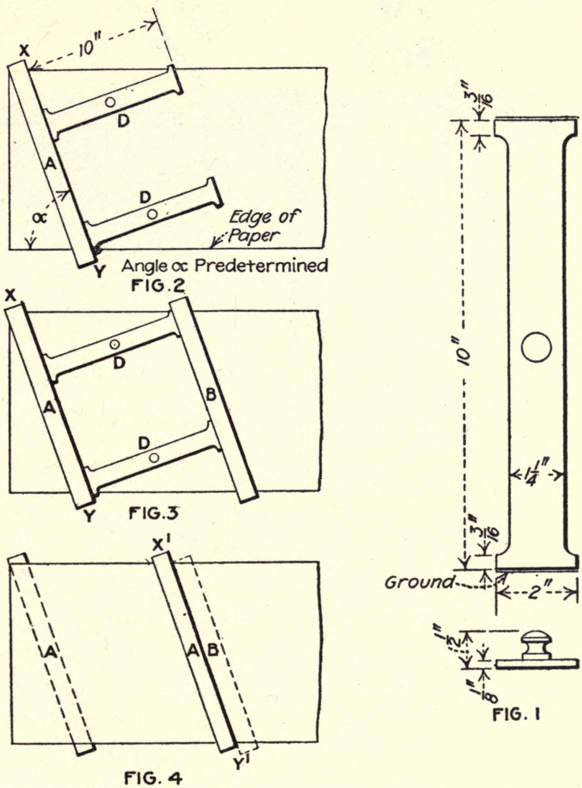
Uniformly Spaced Latitude and Departure Lines

A method is here suggested and described in contradistinction to the usual method of drawing lines through trammed or scaled points, starting from a predetermined line. Use is made of two distance pieces having ends parallel and ground accurately to length (10 in. long), made of 1/8-in. steel and of the form shown in Fig. 1.

On the predetermined line *XY*, shown in Fig. 2, adjust the straight-edge *A* and the two distance pieces *D*, being careful to have them fit snugly. With a little practice, this fitting can be accurately done by the sense of touch.

Then place the straightedge *B* is contact with the outstanding ends of the two distance pieces *D,* as shown in Fig. 3. The edges *A* and *B* will be parallel and spaced just 10 in. apart.

At this stage it would be well to weight the straightedge *B*. Then remove the distance pieces and shift the straightedge *A* into contact with *B,* as shown in Fig. 4. Transfer the weight from *B* to *A* and remove *B,* thus leaving *A* in a position to draw a second line.

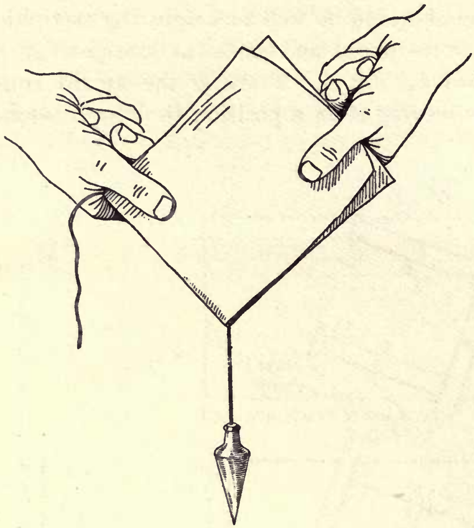


Figs. 1 to 4. Method of Applyirg Distance Spacers

By exercising care in the various shifts, and in manipulation of the ruling pen, accurate spacing may be done.

Taking Long Sights

The accompanying sketch shows a very simple and effective method for taking long sights in outside surveying. It consists simply of folding a large piece of white paper around the plumb-bob string in the manner shown in the sketch, the plumb-bob of course being



Showing Simple Method of Increasing the Accuracy of Long Sights

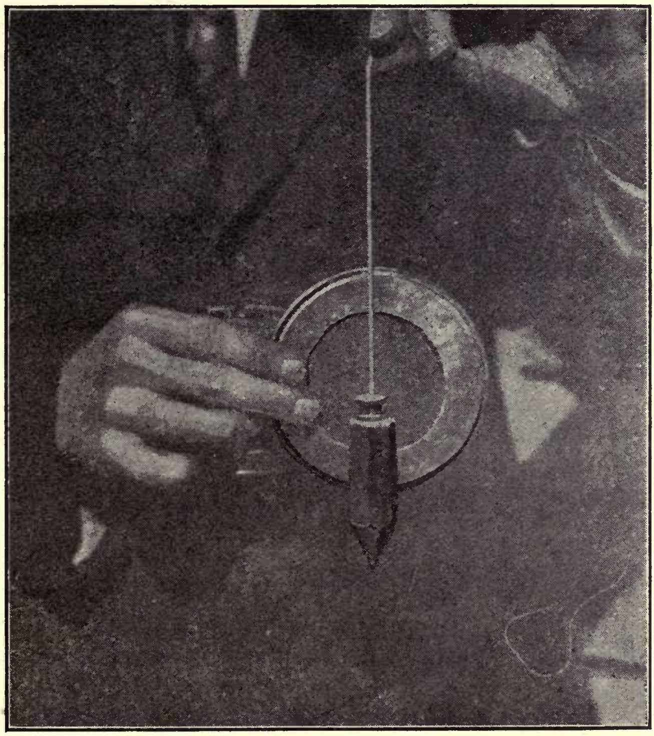
held accurately over the point. The instrument is sighted on the lower corner of the paper, which, having a white field, presents an unusually favorable opportunity for a close and accurate sight.

Bullseye Plumb-Bob Reflector

About a year ago a Coal Age contributor "evolved" a reflector that has proved quite efficient, being durable, of small size (it can be carried in the pocket), cheap, easily made and can be held in the proper position with the lamp, in one hand, leaving the other free to align the bob in setting line sights. The manner in which this is done, as well as an idea of the construction, is shown by the illustration.

The frame of this reflector, or "bullseye," as it is called, is made by cutting the centers from two "push" lids from lard or syrup pails (the kind that are removed with a knife, screwdriver or coin), obtaining a ring about ¾ in. wide with a raised edge from each lid. Two circular sheets of clear mica cut to a little less than the outer diameter of the frame (not the hole) with "onion skin" paper between, form the ground or field. The paper is more transparent than tracing cloth, but is still sufficiently opaque to offer a good background when illuminated. It is also less affected by heat or moisture.

As the frames cannot be forced together close enough without distortion to clamp the mica, two ring gaskets of heavy blotting paper are placed between the mica and the tin, one on each side. This prevents the mica and the paper from shifting and excludes dirt and dampness.



The Reflector in Use

To assemble, place the various parts in one of the frames (laid with the raised edge up), place the other frame in, also with the raised edge up, and force together by pinching the flanges together around the raised edges with a pair of pliers.

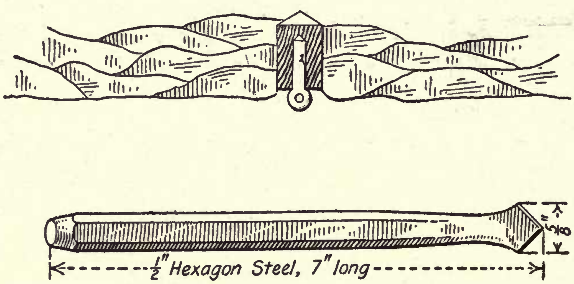
When in use the lamp should be held so that the flame is parallel to the mica. The paper or mica will seldom need renewing, but when renewal is necessary it takes but a few moments' time.

A wire handle arranged to hold the lamp could be soldered to the periphery of the outer frame (so as not to interfere with taking the reflector apart), if desired, but the writer has not found this necessary, as the bob can be steadied with the fingers holding the bullseye and lamp, or after a little practice with the edge of the bullseye.

Drilling Spad Holes

The instrument and process here described are possibly not new, but they may be of interest to many engineers who do underground surveying in mines having a sandstone top.

A hand drill for drilling spad holes is apt to be heavy and cumbersome, and carrying it about through the mine requires much time



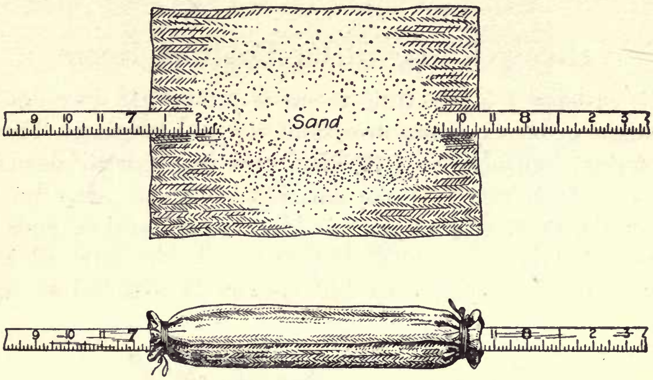
The Drill and a Spad Hole

and energy. A $\frac{5}{8}$-in. pumper drill, similar to the one shown herewith, and a hammer accomplish every purpose. By their use a hole may be quickly drilled into which a $\frac{3}{4}$-in. wooden spad plug may be driven. The drill is light and can readily be slipped into the pocket, so that but little effort is exerted in carrying it about.

Scouring Steel Tapes

Steel tapes that have been neglected or otherwise allowed to become rusty so that the graduations are invisible or indistinct may readily be cleaned by the following method:

The tape is laid across a piece of cloth upon which is placed a small amount of sharp sand or emery. The cloth is then rolled up on the emery and tape and the ends tied with a bit of string to prevent loss of the abrasive. The cloth roll is then rubbed back and forth along the tape to scour it.



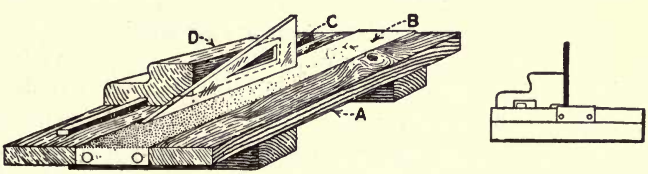
Application of Sand and Cloth

Those who have used this method say that this is a decided improvement over sandpaper, emery cloth or loose abrasive held in the bare or gloved hand. It saves much time and energy.

Kinks for the Mine Draftsman

Truing Worn Triangles

If there is a job that most draftsmen hate to tackle, it is truing up the edges of a worn triangle, whether it is of wood or transparent composition.



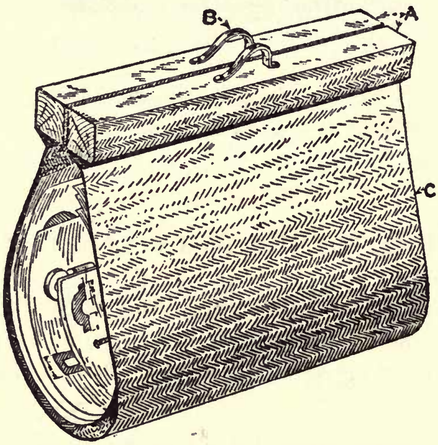
Truing Worn Triangles

The rigging shown in the sketch has been devised to obtain an edge square with the faces and straight for its whole length. On a board *A* approximately 8 x 8 in., of well-seasoned hardwood, strongly reinforced to prevent warping, are tacked a strip of fine sandpaper

B and a guiding rod *C*. The hardwood block *D* has its side perfectly square with the bottom and is shaped to fit the hand; the bottom is recessed to allow the triangle to travel over the sandpaper and is grooved with large clearance over the rod *C*. The operation is evident.

Handy Carry-All for Drafting Room

It is customary for drafting rooms to place their drawings, either every night or once a week, in a vault for safe keeping. The device for carrying drawings herewith illustrated was recently described in Coal Age. It is easy to make, all that is needed being two pieces of white pine *A* 37 x $1\frac{1}{4}$ x $\frac{3}{4}$ in., two black japanned door pulls *B* and a piece of unbleached cloth *C* 37 x 30 in. If the carry-all is likely to be laid down, a small hook and eye can be attached at each end

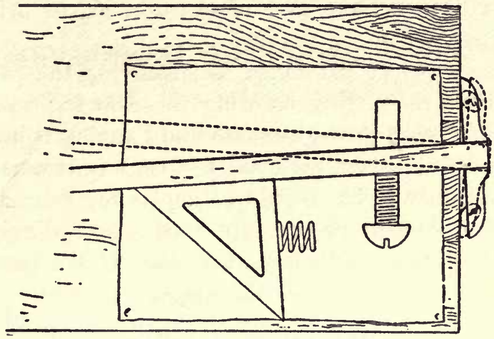


Grip To Hold Day's Drafting Work

of the wood crosspieces to hold them together and prevent the loss of the drawings. Otherwise the grip on the two handles will serve all the purposes of a fastening. In fact the carry-all can be suspended from a hook in the vault, thus taking up a minimum of space and holding the drawings ready for removal at any time.

Drawing Oblique Lines

On shop drawings requiring series of parallel lines at angles, as for threads, springs and section lining, the device shown in the accompanying illustration has been found useful. It consists of an eccentric made of sheet brass and is attached to the T-square head by means of a small thumb-screw. The eccentric may be turned to



Attachment for T-Square

give a variety of angles, and with the aid of the triangle, vertical angles may be obtained. A hole is made at both ends of the T-square head, and the eccentric is transferable to either end.

Waterproofing Drawings

A few methods for waterproofing drawings are noted by F. W. Salmon, all of which are useful and satisfactory.

A. Give the drawing several light coats of white shellac dissolved in a grain alcohol, letting each coat dry before the next is applied. Orange shellac and even wood alcohol may be used; but I much prefer the "white" or bleached shellac, and I object to the wood alcohol because of its injurious effect on the eyes.

B. Give the drawings several light coats of "Zapan" varnish, which, I understand, is made of scrap trimmings of clear sheet celluloid dissolved in acetone and is produced by several Eastern chemical factories and firms manufacturing celluloid articles.

C. When a heavier protective covering is desired than A or B will provide, the drawing may be made wet with the thin celluloid varnish and pressed down evenly on a sheet of thin sheet celluloid, then allowed to dry. This process gives a beautiful clear mounting with 0.01 in. of celluloid on the face.

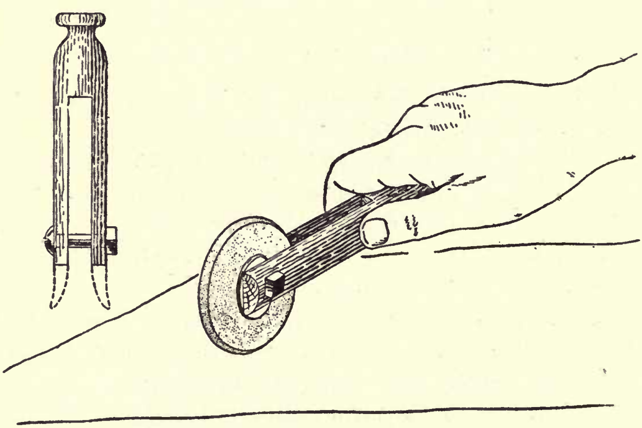
D. Drawings may be made waterproof with paraffin wax, which is applied hot (melted) with a flat bristle brush. The drawing is then put between two sheets of blotting paper, and a hot (electric) sad-iron is passed over the upper blotter, thus causing the paraffin to be distributed more evenly and the surplus to be absorbed by the blotting paper. The blotters must be removed before they cool. If the wax is thick and white over any part of the drawing or print, sponge it off with benzine.

E. Drawings may be paraffined by dissolving the paraffin wax in benzine and then thoroughly painting the drawing with this liquid or passing the drawing through a bath and hanging it up to dry.

Some of the solvents mentioned are very inflammable and even explosive, so all open lights should be kept away from them. Sometimes they affect certain people injuriously; accordingly, such work should be done only in a well-ventilated room, with a fan to keep fresh air moving.

An Erasing Kink

Every draftsman is familiar with the irksome labor involved in erasing ink lines on tracings. It is especially hard when using a circular eraser.



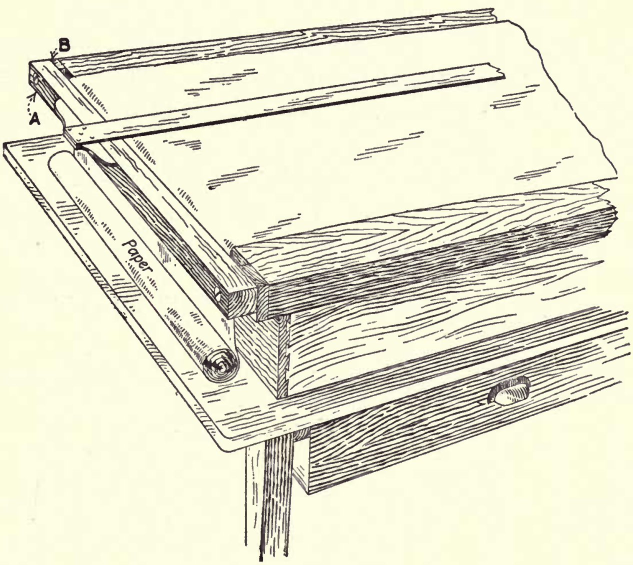
Circular-Eraser Gripping Device

The illustration shows a kink that will help considerably to reduce the tiring effect on the fingers because of gripping the thin eraser and rubbing at the same time.

Take an ordinary wooden clothespin and after cutting away the flared portion at the end drill a hole large enough for a $^6/_{32}$ button-head screw through both lips of the pin. Insert the circular eraser in the slot of the pin, push the $^6/_{32}$ button-head screw through the pin and the eraser, screw on the nut and the eraser is ready for business.

Arrangement of Drawing Board for Handling Large Drawings

In the making of layouts an occasion often arises where it is desirable to use a sheet of paper which is longer than the board. This would prove rather an awkward task were the board handled in the



Arrangement of Device on Drawing Board

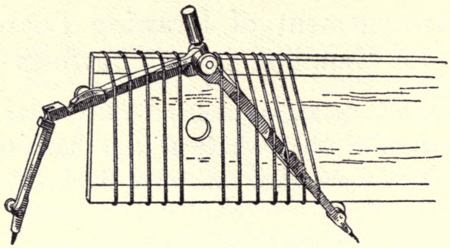
usual manner, but by arranging the board as shown in the illustration a sheet of flat paper of any length may be used.

The arrangement consists of a strip of wood, or steel, *A* screwed in the edge of the board. The blocks *B* are placed between the strip and the edge so as to leave a space through which the paper may be passed.

This scheme permits the paper to be run through the slot and over the board, and allows the roll to rest on the table.

A Beam Compass Kink

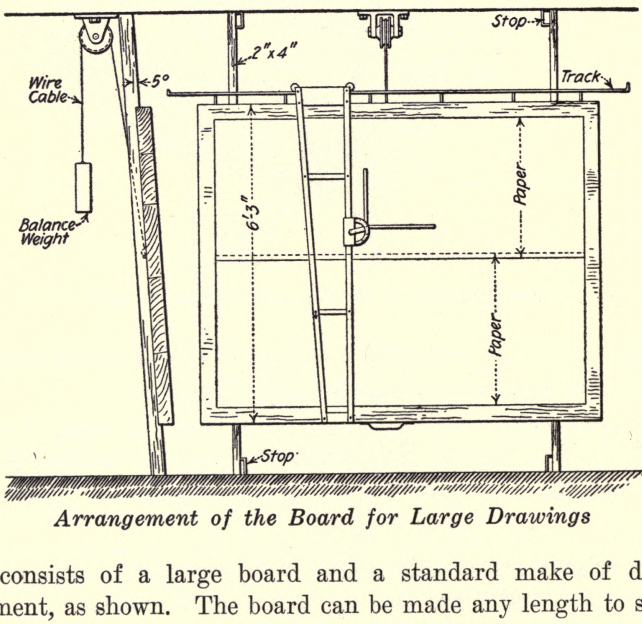
The illustration shows how a compass and a T-square blade may be made to take the place of a beam compass. The compass is spread



as shown. The screw heads and the joint clamp catch against the edges of the blade and are wrapped into place. This arrangement is of advantage when a proper instrument is not at hand.

Drawing Board for Large Drawings

Here is an arrangement of drawing board for handling large drawings which has been used satisfactorily for several years. The



Arrangement of the Board for Large Drawings

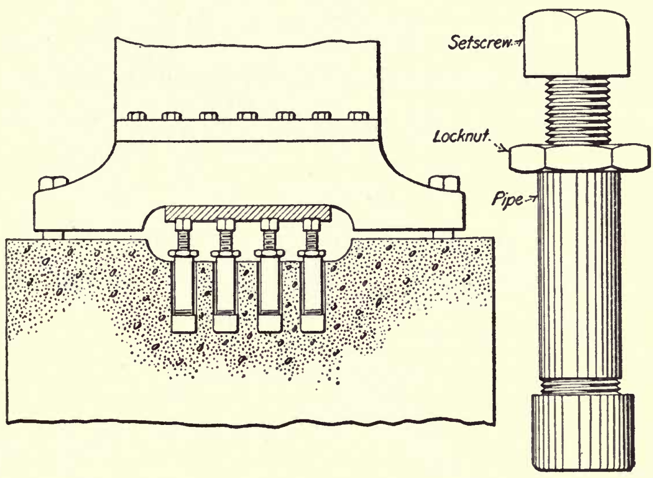
outfit consists of a large board and a standard make of drafting instrument, as shown. The board can be made any length to suit the individual case. They have been used 8, 12 and 16 ft. long. The arrangement can be raised or lowered by using the foot in the stirrup fastened to the bottom edge.

The paper, after two strips the required length have been cut and pasted together, is held on the board with a few thumb-tacks placed about 12 in. from the top edge. It is then dampened with a piece of waste dipped in water, after which the edges are coated with mucilage, the tacks are removed, and small wooden strips are nailed on, to hold it until dry and ready to use. When fastened to the board in this manner, the paper gets very tight and makes a good smooth surface to draw on.

Kinks in Mine Mechanics

Ingenious Home-Made Jack

One of the many disagreeable jobs met with in mining work is lining up heavy machinery, and even where tools and experienced helpers are plentiful, work of this kind is not without its troubles;



Using Setscrews as Improvised Jack

but in the small mine, where the largest hoist is likely to be too small, there is good cause for some apprehension on the part of the engineer in charge of such a job. A writer thus describes the interesting method by which he solved this difficulty.

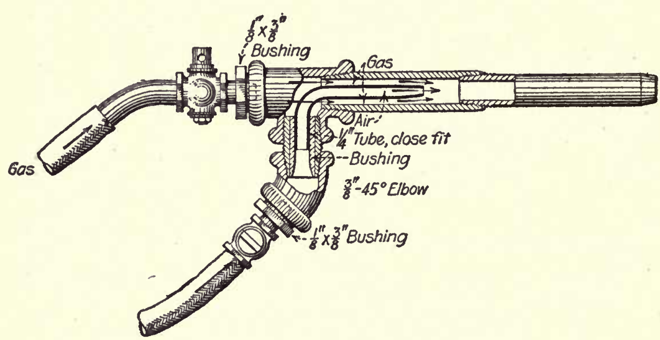
While working in a general repair shop, he was sent out to put a small plant in working condition. One of the machines geared through a countershaft to the mainshaft had settled so badly that the teeth of the gears were only touching at the corners. Mr. Palmer had no heavy jacks or chain blocks, and as he had only one young fellow with him, the job appeared to be beyond his powers. However, while going ahead with the rest of the work, he hit upon the following idea:

He had noticed some large hangers in the basement, and from these he took the setscrews that were used to keep the box in place. These screws were fitted with locknuts, and the threaded portion of the screw just fitted inside a 1-in. pipe. This could be used as a jack by holding the head of the screw and turning on the nut.

Holes were drilled in the cement under the machine, and a plate, with holes countersunk to receive the heads of the screws, was placed between the machine base and the jacks. When the jacks were in position, it was an easy job to lift the machine to its proper level.

Blowpipe Made from Pipe Fittings

The illustration shows a blowpipe for soldering, brazing, etc., made from pipe fittings. A copper or brass tube about $\frac{1}{4}$ in. diameter is filled with melted lead and given a right-angle bend so that it will

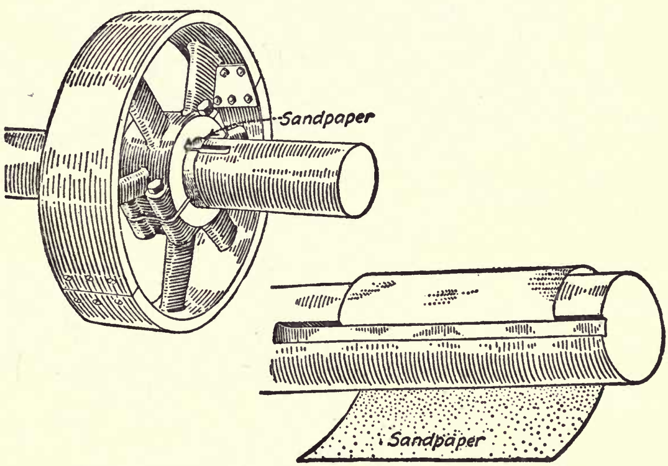


Blowpipe Assembled Ready for Use

go into a $\frac{3}{8}$-in. tee as shown, after which the lead is melted out. A brass or fiber bushing is then driven into a $\frac{3}{8}$-in. short nipple and drilled out to take the bent tube, which should make a close working fit, and the tube is driven into the bushing and the bushing screwed into the tee, the tube turning in the bushing while the nipple is being screwed in. A $\frac{3}{8}$-in. nipple about three inches long is then screwed into the end of the tee over the air nozzle, and a $\frac{1}{8}$ x $\frac{3}{8}$-in. bushing is screwed into the other end. The air tube should be adjusted centrally in the $\frac{3}{8}$ x 3-in. nipple. Valves or cocks are used to regulate the flow of air and gas into the nozzle. The apparatus has been found to work best when the air flows through the bent tube as shown and the gas is led through the straight portion of the tee. Any size or shape of nozzle may be used, depending on the character of work to be heated.

Sandpaper Replaces Pulley Key

The key on the drive pulley of a crusher sheared off and an immediate repair was necessary. As a temporary expedient, the pulley was



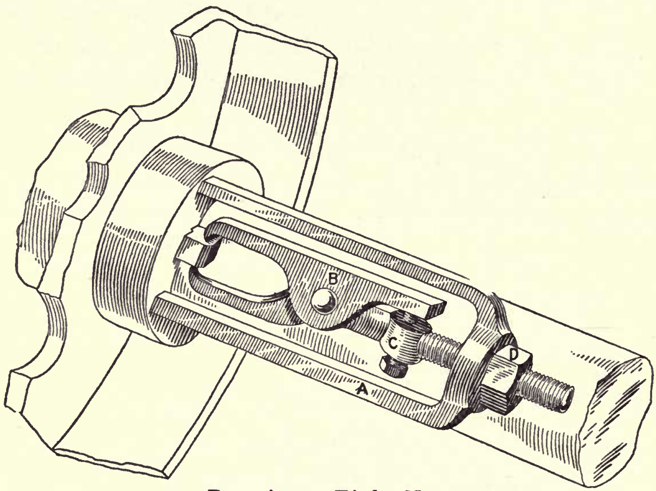
Layer of Sandpaper Takes Place of Steel Key

unbolted, spread, and a layer of sandpaper was placed between the pulley and the shaft. The holding-bolts of the pulley were then drawn up tight and the crusher put into operation.

As a special precaution, the bolts were pulled up as tight as was possible; and though trouble was expected, none developed, the pulley driving the crusher without slipping and giving perfect satisfaction to date.

Drawing Tight Keys

The illustration shows a device especially designed for removing keys that are tight and inaccessible from the inner side of the pulley, as frequently found on line-shafts, electric motors, etc. The apparatus consists of a U-shaped forged bracket *A* lying close to the shaft, toward the key, and pressing against the boss of the pulley. After



Drawing a Tight Key

making a "nick" with a cold chisel, as conditions demand, the tongues *B* are placed so as to grip the key by means of the setscrew *C*. Finally, by the aid of a wrench on nut *D, A* is forced against the boss of the pulley and the key is drawn out. A 1-in. machine screw with an extra-wide nut will generally answer.

Rusted-In Bolts and Screws

There is scarcely any greater annoyance to the mine mechanic or repairman than the twisting off of the head of a screw bolt or a set-screw when attempting to remove the same by applying a wrench to the head of a screw that has become rusted in the hole and refuses to turn. This often happens when the demand for the work is urgent, or when the man's muscular force exceeds his judgment and experience.

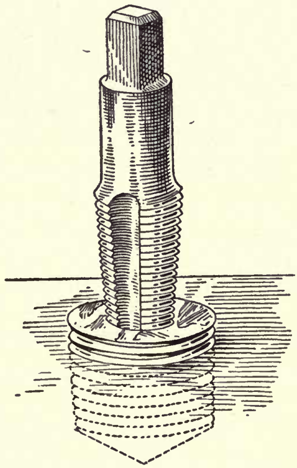
When a bolt or a setscrew has rusted in its hole, any attempt to turn it by applying force is always attended with the risk of breaking the head of the bolt or twisting it off from its shank. A good mechanic's judgment will generally tell him what force can be applied to the wrench with safety.

It is better not to be in too great a hurry, in such a case. Apply coal oil to the bolt and allow the oil sufficient time to eat its way into the rusted hole. At the same time, tap the head of the bolt frequently so that the jar will break the contact formed by the rust and which binds the screw and holds it fast in the hole.

If these means are without avail, a good method to adopt is to apply heat to the bolt and the surrounding parts by means of a torch flame or a red-hot iron. Then, when the part has become sufficiently heated and expanded, try to cool the bolt by applying ice or cold water to its head, as far as possible protecting the other part from contact with the water by rags or other material placed around the head of the bolt or screw. Again, tap the head of the bolt or screw sharply and apply the wrench with sudden light jerks, first in one direction, then in the other, until the screw becomes loosened.

Removing Broken Studs

For some years, says a contributor, I have been using the "old approved method" of getting out broken ends of cap-bolts, etc., as shown

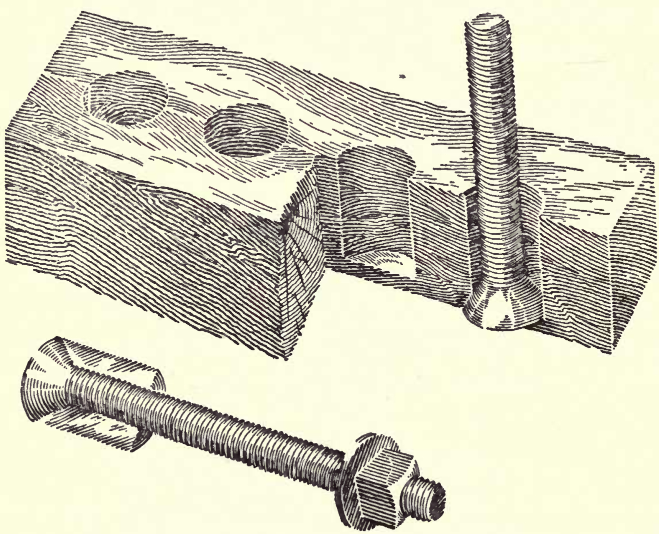


Left-Hand Tap To Unscrew Stud

in the illustration, and find it satisfactory. I first center-punch, then drill a hole about half the full diameter of the bolt, and not quite through the length of the broken end. I have a short and stout pipe tap, with a left-hand thread, that I insert, and cut a left-hand thread until the tap bottoms in the hole. Then by a little force the broken end of the bolt will in most cases unscrew, leaving the tapped hole in perfect condition for a new bolt. Driving in a square drift does not always prove successful, but the left-hand thread tap draws itself in and there is no slip, and by reasonable care the tap will not break.

Making an Expansion Bolt

Making an expansion bolt that is satisfactory, especially for light work, is an easy matter when done as illustrated. Make a mold by clamping together two blocks of wood and boring a hole (half in each block) the size of the hole into which the expansion part of the bolt is to go and the depth required. Into this mold place a stove bolt (any



Mold To Cast Sheath Around a Bolt

other kind will do) threaded well down toward the head as shown, and pour molten lead around it. When the bolt is placed in position and the locknut is tightened down hard, the lead will swage out and hold the bolt securely. A countersunk head will help the bolt to expand the lead sheath.

Kinks in Mine Management

Little Things in Coal Mining

I once had charge of a mine in Ohio, says a contributor to Coal Age, where the coal was delivered to the tipple down an incline plane. About fifty of the mine cars were equipped with wheels held on by invisible linchpins. These pins would frequently wear and allow the wheel to come off the axle, and at intervals I would report delay on account of a wreck caused by a car wheel coming off on the lower end of the incline.

The general manager asked me why it was that I could not prevent those wrecks, and I explained that we could not tell whether anything was wrong with the wheels until one was wrecked. He soon replaced those wheels with new ones that had outside linchpins.

I have known of motormen going half a mile to get a coupling pin if one broke on their trip, when they should have had a couple of extra pins on their motors. Many mines are equipped with gathering locomotives, and in two mines with practically the same natural conditions one will show a considerably higher percentage of efficiency than the other, and the superintendent would be unable to account for the difference. Quite often a large part of it would be due to bad bonding, dirty roads and missing switch-throughs, patchwork in motor repairs and other small things that seem trivial but are necessary to the success of a system. I have seen mines in which cars have been cut over a frog on the main road for years, just to avoid the expense of placing a guard rail. In the selection and preparation of mine timber there are a few little things that are important. Many coal companies buy mine props without any specification except that they be of certain lengths, and they therefore get very unsatisfactory timber. They think they are saving money by getting timber somewhat cheaper per foot, but it is really necessary to use twice the amount that would be needed with a better grade of timber, so it can readily be seen that those companies that do not specify the kind and quality of timber are laboring under a false idea of economy.

On entry tracks in mule haulways one frequently finds wooden connections that are allowed to remain in use until the cars wreck going over them, and side tracks are permitted to get so dirty before they are cleaned that the drivers are disgusted when they try to get their loads together.

Motors, pumps and bonding should be frequently inspected and any small defects immediately remedied. Loose nuts on pumps and motors that could be tightened with very little trouble at the time they are discovered are often neglected, leading to trouble. Broken bonds and bad returns caused by poor wire splicing will cut quite a figure in power costs. Loose slate which is not taken down or properly supported after it is discovered is a little thing that sometimes results disastrously, and no foreman should tolerate such conditions.

The foregoing tends to prove that the mine foreman who is master of the little things in mining is going to minimize his troubles with the larger things.

Waste in Mining

Much has been said and written in recent years concerning the conservation of coal, but little has been done to actually prevent such waste except by some of the larger companies.

A writer recently made the statement in the *Saturday Evening Post* that "for every ton of coal mined, half a ton is lost in the operation." While this is true in some cases of both large and small operations, it must be said that most of the larger concerns are installing equipment and adopting methods of mining which reduce the above estimate considerably.

Improper Opening and Development of Coal Properties

The chief cause for a small percentage of recovery is owing to improper methods of working in the first mining. Frequently, when a new property is to be opened up, instead of taking into consideration the amount of cover, strength and character of the roof and floor, thickness of the seam, texture and inclination of the seam, character of labor available and other important details, the system used at a nearby colliery, if successful, is too often adopted. This plan frequently results in the headings and rooms being driven too wide and not leaving sufficient pillars to support the overlying strata, which often causes a squeeze and the loss of an entire heading or section of a mine.

One cause for an excessive amount of coal being lost is having surveys made merely to comply with the Bituminous Mining Laws. Surveys are made semi-annually (sometimes) and between the time of the surveys, headings and rooms are turned off and driven without sights, usually until they cut into some other place, leaving little if any pillars, with the result that they nearly always cave before the pillar is extracted. Some companies look on engineering only as a bill of expense, when in reality it is a case of spending pennies to recover dollars.

Loss Due To Use of Machines

Another reason for an excessive amount of lost coal is the use of chain machines in seams to which they are not adapted. I have in mind several mines, operated by both large and small companies, where chain machines are being used, the bottom of the seam being extremely rolling and containing numerous pyrites. In these mines coal varying in thickness from 3 to 12 in. is left on the bottom in nearly all places, and I have measured as much as 24 in. left on, with little if any effort being made to have it taken up. If the miner is asked why he does not take up his coal, he will invariably answer that he is not being paid for pick mining. In the mines referred to the lower section is as good and sometimes better in quality than the balance of the seam. The cutter is not to blame in most instances, as it is impossible to incline the machines to meet the pitch of the rolls.

In seams having no rolls or pyrites in the bottom, oftentimes from 3 to 12 in. is left on the bottom, mostly due to the rise or dip of the coal, combined with ignorance and carelessness on the part of the cutter. There is a reasonable excuse for the first cut on a sharp rise or dip leaving some coal on the bottom, but if it were taken up before making the second cut, the cutter would have a better idea of the angle to incline his machines and the next cut would no doubt be cleaner.

A much larger percentage of coal will be recovered if machines are installed to suit the conditions under which they are to be operated. The puncher has long since been termed "behind the times," but there are conditions under which it can be used to great advantage. For instance, I happened in a place recently when the cutter was changing bits for the fifth time in the one room, this being necessary on account of the numerous pyrites encountered in cutting the place. This room could have been cut fairly well with a puncher.

The mine officials do not seem to realize that every inch of coal lost in this manner covering an area of one acre represents a dead loss of approximately 134 tons, or for every foot over the same area 1608 tons. This is a complete loss, as the same yardage and other expenses have been paid as though the full seam were recovered. Another bad feature of leaving coal on the bottom is the fact that the posts are usually set on top of the coal, as most of the miners will cut their props rather than dig a hole to the solid bottom.

Pillars and Stumps Left Standing

In many cases room pillars and heading stumps are left standing. This happens sometimes because of the possibility of encountering gas or water, or both. Also in gaseous mines the ventilating system prohibits the immediate drawing of pillars, and there are many other reasons for allowing them to stand. By the time preparations are made to meet the conditions, the rooms and headings are in such shape that only a small percentage of the pillar coal is recovered, the remaining pillars causing a roof weight that is always a menace to other sections of the mine.

Places Abandoned Temporarily

Then there are the rooms and headings which are abandoned temporarily, with all expectations of having them started up in a short time. Stopped sometimes on account of a poor coal market, sometimes because the coal is not quite so good or so high as in other portions of the mine, and the men are hard to please. Some companies change mine foremen every three to six months. About the time a new foreman becomes acquainted with the mine and located the standing pillars he is removed, and the coal is lost before his successors discover where it is. In the meantime several surveys are made, and often these places are marked on the maps "worked out," when in reality the pillars have never been touched.

There are many other reasons for causing the statement to be made that we lose half a ton for every ton mined, and while on first thought this amount sounds large, there are lots of mines today that are not recovering over 66 per cent. of the coal, especially in the smaller seams and where the roof and other conditions are bad.

Value of Keeping Proper Data

The following incident, says a Canadian Engineer, which occurred at one of the mines with which I am acquainted, illustrates the necessity of keeping proper track of data and also shows the difficulty of blocking off an unexepected inrush of water. The particular instance has to do with the loss of the exact position of an old bore hole.

The field in question contained two seams of coal, 60 ft. apart, only the lower one of which was worked. When the operator took over the area it was stipulated that the owner would first bore it, as it was supposed to be in line with a prominent fault that appeared in surrounding leaseholds. About ten bores in all were put down, mostly on the outskirts of the property away from the shaft positions. No record of the exact location of these bores was kept, although the borers' sheet, which gave the position approximately, was preserved.

Some years later when the mine was under different management, the underground workings approached one of these bores. The first indication of the presence of the bore was a burst of coal from the face, followed by a steady flow of water that streamed into the dip workings. This coal was cleared away and an attempt made to block the hole from below. This proved impracticable, as the water tended to flow through the strata immediately overlying the seam and burst out in other rooms and places of the mine. Old plans and records were hurriedly consulted, and while the approximate position of the bore was found, no one could locate it on the surface.

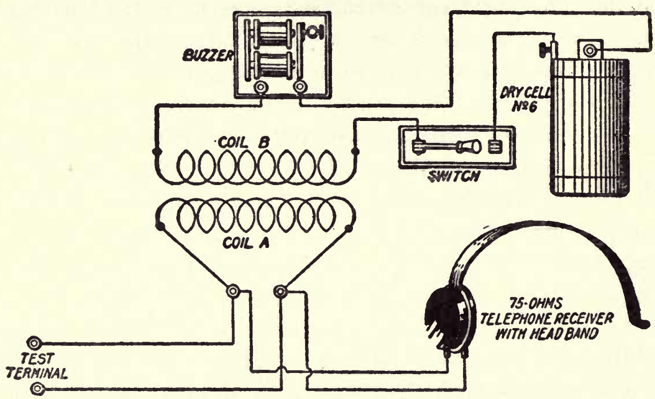
Finally, the old manager of the mine, hearing of the trouble, came on the scene; and he was able, after a little searching round, to locate the bore upon the surface. Tools and a boring rig were obtained as rapidly as possible, and the hole bored afresh, so as to get it thoroughly cleaned, after which it was plugged with cement. But meantime, owing to the time lost in getting at the work and the seat of the trouble, the workings to the dip of the entrance of the water had filled up, and a new pumping plant had to be bought to cope with the difficulty. All this because the position of the bore holes were not accurately marked on a reliable plan and arrangements made underground to leave a suitable small pillar as a protection against accident. Another interesting fact was learned in addition. The bore hole, a chisel-drilled hole, had deviated a distance of 40 ft. in the depth drilled. An accurate survey disclosed this fact.

Kinks in Handling Electrical Apparatus

Portable Armature Test Set

The mine electrician frequently has to repair a motor with the armature grounded; that is, one wherein one or more of the armature wires or a commutator bar is burned and making contact with the iron core. This ground has to be removed before the armature will run and the wires must be reinsulated so as not to make contact with the iron core.

It happens frequently that an armature has grounded coil which, upon careful examination, does not appear on the visble parts, but may be revealed by testing with a lamp between the armature shaft and the commutator. If the lamp will light up to its full candlepower, it indicates that the coils are grounded in some part of the armature. In order to find the exact coil that is grounded, the old-time method



Connections of the Portable Test Set

was to remove all the wires from two or three commutator bars on each side of the commutator, then test with the lamp to determine if by chance the trouble was in one of the halves. It seldom happens that it is, and the next step is to remove all the wires from other sections of the commutator, continuing this process and testing with the lamp until the exact coil is located.

This method takes considerable time, and generally the band wire next to the commutator has to be removed so that after the coil that is grounded is located and cut out or repaired, all the wires that have been removed from the commutator have to reinsulated and replaced and resoldered in the commutator and the band wires rewound on the armature. It is seldom that an armature can be thus repaired and made ready for use in less than 5 to 25 hours.

I have a test set that I made several years ago and have used repeatedly, which can be advantageously employed to locate a grounded coil or commutator bar. I have many times had an armature that tested grounded and refused to run, yet on the visible parts showed no trace of the ground. By using the test set, I have quickly located the exact coil that was grounded. After this is done, the wires are removed from the commutator and tests are made with a lamp to see if there are any more coils grounded and to check up the test set. Finding the other coils clear of a ground, the ends of the grounded coil are cut off or put back away from the commutator. The open circuit caused by the removal of the coil is then closed and the armature is ready for use again. I have on several occasions removed grounds from armatures in the manner just described and had the motor back in operation in less than an hour.

A complete description, with diagrams of the test set, is given herein, so that any electrician can easily make one for his own use at a small cost. In its use the condition of the coils is noted by the amount of sound heard in the head telephone receiver.

If the coil is open-circuited, the sound in the receiver is loud; if the coil is short-circuited, the sound is low. The tests for opens and shorts is made by touching the test terminals on adjacent commutator bars. In testing for a ground, one of the test terminals is held on the armature shaft while the other one is touched to each commutator bar, and as the grounded coil is approached, the sound in the receiver diminishes and when the exact commutator bar is touched that has the grounded coil connected to it, there is practically no sound at all in the receiver. On the commutator bars on each side of the grounded one, however, there is a certain amount of sound heard in the receiver. Upon locating the ground, this bar should be marked and the test continued around the commutator until the other side of the coil is located. The wires from the commutator are then removed and the grounded coil repaired.

The diagram shows the connections of the test set. To make coil *A*, wind enough No. 8 D. C. C. magnet wire on a wooden form $\frac{7}{8}$ in. in diameter to make a single-layer coil 6 in. long. Remove the form and you will have a hollow coil of wire. Form the ends so as to make a support as well as terminals.

To make the coil *B*, cut enough pieces of No. 18 soft-iron wire to form a core $6\frac{1}{2}$ in. long by $\frac{1}{2}$ in. in diameter. Insulate this core and wind on it two layers of No. 20 or No. 22 D. C. C. magnet wire, leaving about $\frac{1}{4}$ in. of the core on each end without windings. This will bring the two ends of the wire out on the same end of the core. Solder a flexible lead on each of the ends. Coil *B* is made so as to slide inside of coil *A*. Mount coil *A* on a suitable base and put coil *B* inside of it. Arrange the connections as shown in the diagram on the preceding page.

The battery current flows through the watchcase buzzer and is there converted into an alternating current. The buzzer is in series with the coil *B*, and the alternating current therein flowing induces a current in coil *A*. The watchcase telephone receiver is fitted with a head band so as to leave both hands free. The receiver is connected across the terminals of coil *A*, and the test terminals are connected in parallel with the receiver. The volume of sound in the receiver may be varied by moving the coil *B* in or out of coil *A*. The amount of adjustment needed depends on the size and style of armature being tested. One dry cell will operate the set and last for months.

Conducting Electric Power

In most cases electric power is conducted to mining machines, pumps, hoists, etc., by extensions from the trolley wire.

Take, for example, a rock drill boring into hard rock. The power is being drawn from the trolley wire, and, when the locomotives are hauling heavy loads the power supplied to the rock drill is low, and the rock-drill operator is using all the power supplied. Should the motors come to a sudden stop, the result, owing to the influx of power, is liable to prove disastrous.

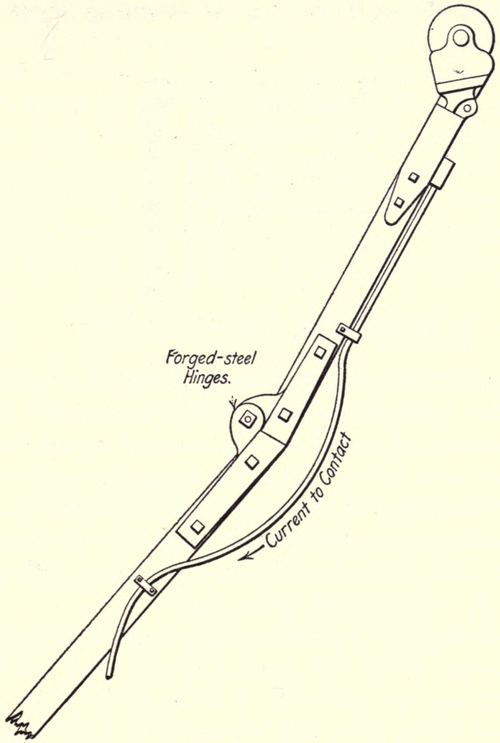
This condition naturally suggests that the power necessary for blasting purposes and to run all machinery (other than the locomotives) should be supplied from an insulated conductor independent of the trolley wire.

To thus provide an extra conductor might at first seem to be adding to the cost of production, but when we consider the irregular and oftentimes inadequate supply, remembering that short-circuits are not infrequent and accidents are likely to result from this irregular supply, we can see readily the advantage of adopting the separate conductors for all machinery other than the locomotives.

Another and very good reason why these separate conductors should be used is that the power should be cut off each branch entry when the locomotive is not in the entry (see Article 2, Section 3, of the Bituminous Mine Law of Pennsylvania), for by so doing accidents from this source will be reduced to a minimum.

Collapsible Trolley Pole Facilitates Reversal in Narrow Roadways

The accompanying sketch shows a collapsible trolley pole for use on underground locomotives. The pole is made in two sections—the upper part making the contact with the trolley wire and the lower part setting on the pole base. A forged-steel hinge, which connects



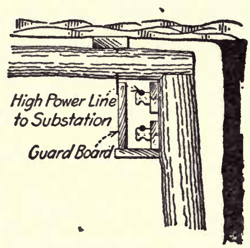
Trolley Pole Suited to Narrow Roadways

the two parts, is so placed that the pole can be doubled back when removed from the wire, permitting it to be turned through 180 deg. in a smaller space than if the pole were constructed of one piece. The tension spring at the base of the pole maintains a pressure on the pole and so prevents collapse.

Electric Substations in Mines

The purpose of installing a substation in a mine is to save a large outlay for copper. It is well known that a high-voltage current requires a much smaller wire for its transmission than a current of lower voltage.

It frequently happens that the conditions in a mine are such that the best point for distributing the power is at a considerable distance inby from the mine entrance or the foot of the shaft. In such a case it is clear that there would be a great saving in copper by using a



Safeguarding High-Power Lines

high voltage, say 2200 volts, for transmitting the electric current to the point in the mine where it is to be distributed. At this point it will be necessary to transform the current or step it down to a working voltage, says 500 or 250 volts as may be required.

For the transmission of the high-voltage current from the power station to the distributing point or substation in the mine, it may be possible to use a No. 10 or No. 12 (B. & S.) wire, having a diameter of practically $\frac{1}{10}$ or $\frac{1}{12}$ of an inch.

At the substation, the high-potential current is transformed to one of a lower voltage, which will require larger wires for its transmission to the working face, where it is to be used for the operation of coal cutters and drills. For this transmission a 00- or even a 0000-wire will be required. The 00-wire has a diameter of practically $\frac{3}{8}$ of an inch, while the diameter of the 0000-wire is a little less than $\frac{1}{2}$ in. When it is remembered that a 0000-wire contains more than 20 times the weight of copper in a No. 10-wire of the same length it is evident that a great saving is effected by adopting a high-voltage transmission for long distances.

When the current is to be taken down a shaft, a lead-protected cable should be used and this should be installed in a box having a section of, say 8 x 24 in., the purpose of the box being to prevent the lead covering of the cable being injured by an accidental blow, or by any object falling down the shaft. There should be a switch for cutting out the current, both at the top and the bottom of the shaft.

The best method of conducting the current down a slope and through the mine is to spike two 6-in. boards to the timbers on one side of the road and carry the cable over insulators fastened firmly to these boards, as shown in the accompanying sketch. The cable should be further protected by hanging a guard-board from the roof so as to prevent the injury of the cables and contact of men and animals with them. Such high-power lines should, of course, in all cases be installed in the intake airway. This is required by the Bituminous Mine Law of Pennsylvania. The substation must be built entirely of fireproof material, such as brick or concrete. The station must be well ventilated with fresh, clean air. When the installation is properly made by a competent electrician, there is little danger in locating it at a suitable point in the mine.

Circuit-Breaker Alarm Bell

The device illustrated herewith, says a subscriber, has cut our "power off" time to a minimum and results in a material saving to the company.

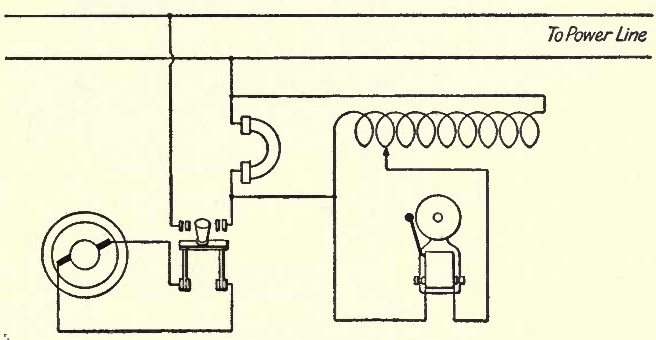


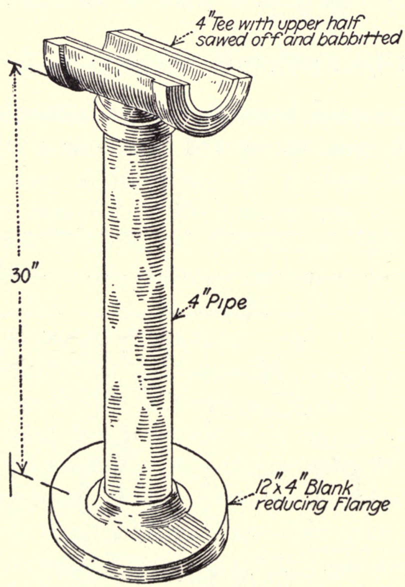
Diagram of Alarm Circuit

In the plant where I am working the mining-machine power line is protected by a hand-operated circuit-breaker in the care of a busy hoisting engineer. Frequently this circuit-breaker would open without attracting the engineer's attention, the machine thus being kept idle until someone in the mine took the time and trouble to call on the telephone.

By connecting a vibrating bell as shown in the accompanying sketch, the engineer was provided with a signal that not only informed also show whenever there was an excessive demand for power, such as him when the breaker opened, but also indicated the cause. If this was a short on the line, the bell would ring continuously; if a momentary overload, it would ring spasmodically. The device would a machine-runner trying to start his machine after moving his controller to the off position when the power failed.

Homemade Armature Stand

It is a common thing to see armatures lying about where they are liable to be damaged—on the floor, in the motor barn, or even in the blacksmith shop. Sometimes they are placed upon wooden horses,



A Cheap and Practical Armature Stand

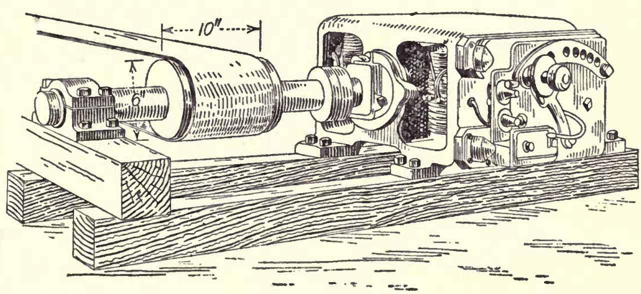
but the trouble with these supports is that they are often required for other purposes; the result is that when they are needed the armatures are placed on the floor.

Having had this experience, C. J. Fuetter decided to build an armature stand that would answer one purpose only—to hold armatures. Most of the material needed he found in the scrap pile. The accompanying illustration shows the stand as it was finally evolved. He used a 12-in. blind flange, which was bored and threaded in the lathe to take a 4-in. pipe. This pipe was about 30-in. long and threaded on both ends. It was screwed into the flange, forming an upright. A 4-in. tee, with the upper half sawed off and babbitted so as to form a bearing for the armature shaft to rest in, was then screwed onto the upper end of this pipe, which completed the device.

Two such stands will hold any size of armature and will invariably be on the job when needed, since they cannot well be used for any other purpose.

An Emergency Fan Drive

A short time ago a correspondent had the misfortune to have two armatures burn out almost simultaneously. As one of these was from the motor driving the ventilating fan, it looked as if the mine would



Arrangement of Temporary Fan Drive

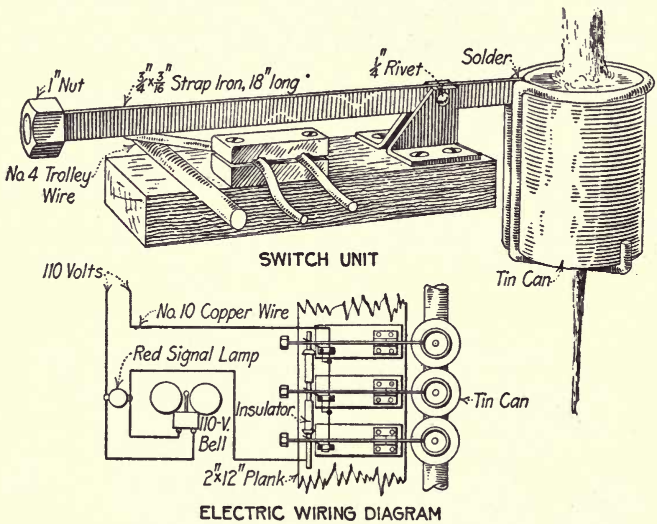
be shut down for some time while either one of the armatures was rewound or a new one procured.

To avoid this he had the motor taken off a Jeffrey No. 17-A machine. When this motor was provided with a suitable extension shaft equipped with an outboard bearing, a suitable belt pulley and shaft coupling, as shown in the accompanying illustration, it operated the fan satisfactorily until repairs could be made to the regular motor. By resorting to this expedient the fan was got back into operation by 8 p.m. of the day upon which the burnout occurred.

There is doubtless nothing radically new in this method of driving a mine fan in case of emergency. The idea, however, may be of value to someone who may some time be "up against it" for a temporary drive.

Cooling-Water Alarm for Transformers

The three main transformers of a mine in Nevada were cooled by water supplied by neighboring springs. As there were frequent breaks in the connecting water line, the danger of burning out transformers

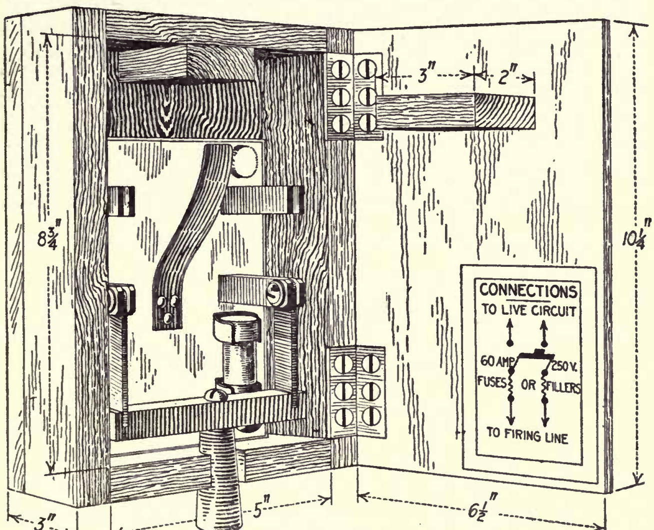


Switch Unit and Wiring Diagram for Cooling-Water Alarm

(which were fully loaded) became too frequent for comfort. To indicate water shortage at any one of the three transformers, the device illustrated was designed. It is extremely simple, consisting of an ordinary lever with a can having a small hole in the bottom at one end and suitable counterweight at the other. When the water from the transformer is running, it will fill the can and thus lower the lever on its end. The size of the hole in the bottom of the can is such that the water runs out slower than it runs in, thus causing the can to overflow. When the water stops flowing, the can will drain itself, and the weights are so arranged that the end opposite the can will lower and make an electrical contact. This is connected to a red signal light and 110-volt bell. A transformer cooling-water alarm is essential where the transformers are heavily loaded or in hot climates, for they will burn out in a short time if cooling ceases.

A Safe Electric Firing Switch

In electric shot firing two general sources of current are usually employed; namely, by means of a hand-operated generator or directly from a source of electrical energy. If the latter method is employed,

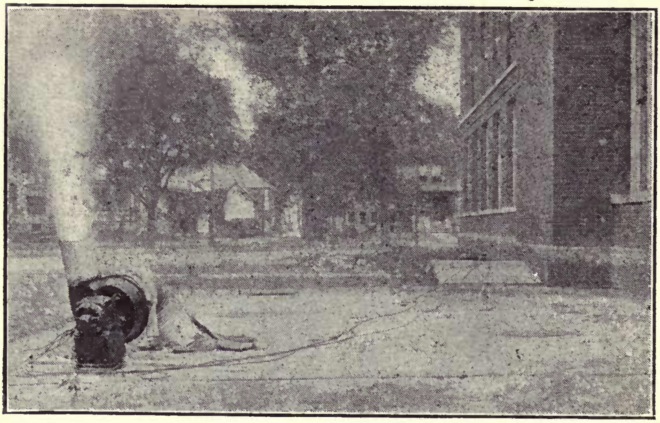


An Electric Firing Switch for Blasting

it is of extreme importance to have a switch that cannot remain closed after contact is made. In the accompanying sketch, which is self-explanatory, have been incorporated many safety-first details in order to make the switch absolutely foolproof.

Putting Out a Coal-Bunker Fire

Early last spring the soft coal in the bunkers of the public school at Charles City, Iowa, took fire by spontaneous combustion. A direct-connected electric fan was placed and connected as shown in the illustration, to draw out the smoke so that the men could shovel the coal over. The construction of the bunkers is such that the fan drew air over the shovelers and kept the space clear of smoke and also pre-



Fan Used To Draw Smoke Out of Coal Bunkers

vented it from entering the building. After several days of hard, dirty work the fire was reached and the smoldering coal taken out.

Kinks in Handling Pipes About the Mine

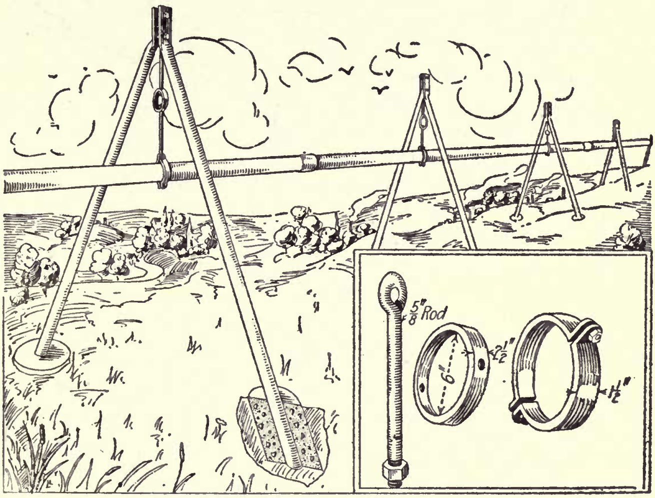
A Useful Type of Pipe Hanger

A type of pipe hanger devised at the shops of the Low Moor Iron Co. of Virginia has proved very successful. The construction is simple, cheap, substantial and efficient. The details of a typical installation for a 6-in. pipe are shown in the accompanying sketch. The dimensions can be altered for other sizes of pipe.

The two legs are made from old 3-in. wrought-iron pipe or boiler tubes cut in 8- to 15-ft. sections depending on slope of ground. One end of each pipe is flattened for a distance of about 8 in. and the flattened portion drilled for ½-in. bolts. Two ⅝-in. rods about one foot long are bent into an eye at one end to admit a ½-in. bolt, and threaded at the other end. A ring, 6 or 7 in. in diameter, 2½ in. wide and ⅜ in. thick is then bored to admit loosely the ⅝-in. rods, the two holes placed diametrically opposite each other. This ring can either be made of strap iron bent and welded, or cut from 6- or 7-in. pipe or couplings. The pipe ring is held by two straps about 1½ in. wide and ¼ or ⅜ in. thick. Each is bent in a semicircle, and the ends are flattened and bored to receive ½-in. bolts.

The manner of assembling the hanger is evident from the sketch.

The purpose of the 6-in. ring is to allow the pipe to swing free from its support in any direction. This provides for expansion and contraction in the line and prevents the force of wind sway from shaking the hangers. By using long threads on the rods the pipe may be leveled up by tightening or loosening the nuts. The legs are embedded in concrete piers about 1 ft. square and 2 ft. deep and given a spread of about 6 ft. Hangers of this size are spaced on about 25-ft. centers.



Low Moor Type of Pipe Hanger

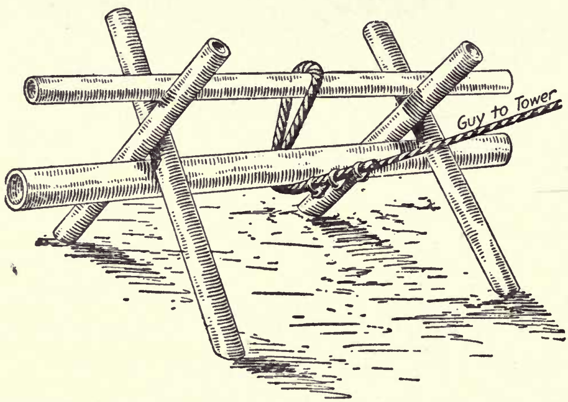
The one used as an example is one of a series supporting a 6-in. compressed air line about a quarter mile long. Most of the material used, with the exception of the concrete, was scrap and consequently cost but little. The advantages of this type of construction are low cost, durability, flexibility and ease of installation.

Self-Tightening Anchor of Pipe

A kink used at the Sistersville filtration plant, and devised by William Francis, of Dayton & Francis, contractors, New Martinsville,

W. Va., will be found useful in raising material around the mine plant. The device consists of a loose-pipe horse the legs of which are of 2-in. pipe driven into the ground to form two standards, each having the form of an X. A transverse pipe is carried above the crotch of the two standards and another pipe is held in the under crotch, the guy rope being wrapped around these two pipes as shown in the illustration below.

Any pull or jerk on the guy line tends to pull the two cross pipes together and thus spread the legs of the standards. This binds the upper sides of the four pipes against the holes in which they are driven.

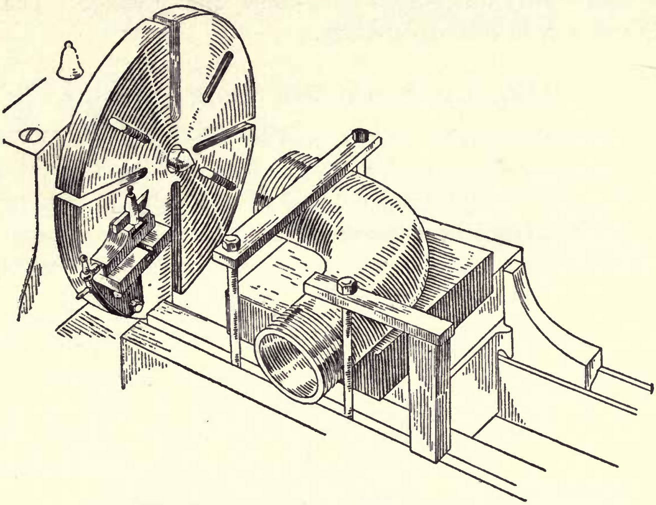


A Pull on the Guy Line Tightens This Conveniently Built Anchorage

It will be observed that it is not necessary to clamp the pipe together, as would be essential if the purpose were to construct an ordinary back-log trestle. Such a trestle, indeed, would be hard to keep from deformation. Moreover, it would be necessary to set it in an excavation, and then it would not be in solid material. The simple form of construction here suggested is made of driven pipe. It is consequently set solidly into the ground and gives almost absolute rigidity.

Threading Ends of Bent Pipe

The problem of utilizing short pieces of bent pipe is an ever present one about mines. Such a policy of utilization keeps down the size of the junk pile and helps toward increasing profits, besides being a great comfort in times of urgent need. Therefore the method shown in the accompanying illustration, is worth while putting on record. By putting an angle plate with a small compound rest on the face-plate, the operator was enabled to use a lathe for the purpose. The

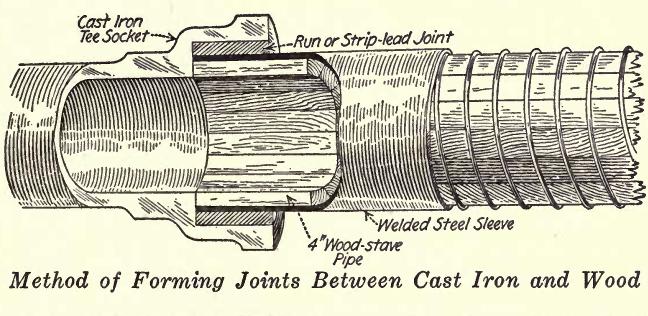


The Rig for Threading Bent Pipe

pipe was fastened in blocks on the carriage, as shown in the illustration. By running the lathe backward it was possible to cut off, turn and chase the thread.

Joints Between Cast-Iron and Wood-Stave Pipes

Where special castings for hydrants, valves and other connections are inserted in wood-stave pipe, necessitating a lead joint between

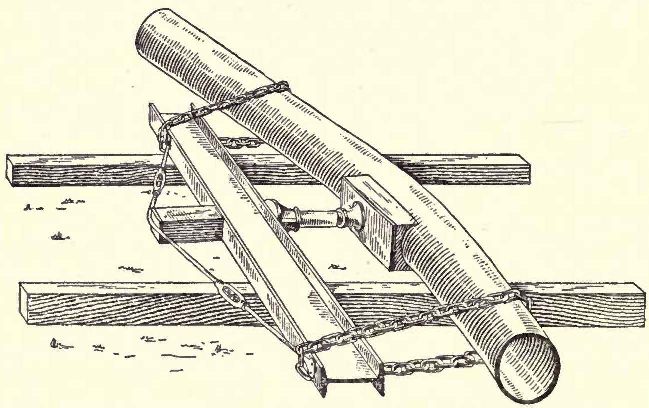


Method of Forming Joints Between Cast Iron and Wood

wood and iron, leakage is liable to occur owing to lack of adhesion beteween wood and lead. The difference in density of the two substances makes the proper calking of the lead packing practically impossible. T. Pridham, in the *Commonwealth Engineer* (Australia), shows a method of remedying this defect by providing a joint that can be made fairly water-tight even under high pressure. The accompanying sketch is self-explanatory.

Labor-Saving Pipe-Bending Machine

A labor-saving device that is used by the Philadelphia Suburban Gas and Electric Co., Chester, Penn., for the cold bending of 8-in. pipe, will appeal to mining men who have long pipe lines to lay. The machine is described by Charles Wilde in a paper presented at the October meeting of the American Gas Institute. The arrangement



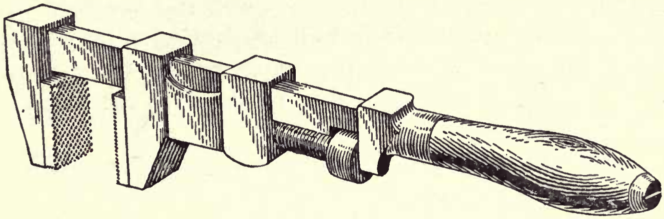
An Easily Made Pipe-Bending Apparatus

consists of a 10-in. I-beam, 10 ft. long, braced with 1¼-in. tie-rod, two ⅝-in.c hains 8 ft. long and an ordinary 20-ton screw jack and block. To operate, all that is necessary is to link the chains around the pipe and I-beam by means of a slip link, place the jack and pipe block in position between the pipe and the beam, and then by the force of the jack make the bend. If the bend required is only a slight one, it may be made without any shift of the machine. If it is of any considerable extent, the machine should be shifted one way or the other, bending the pipe a few degrees until the required bend is made.

With this machine four men can make a bend in an 8-in. pipe, depending of course upon the radius and degree of the bend required, in from ½ to 2½ hr., at a labor cost of from 50c. to $2.50 a bend.

An Emergency Pipe Wrench

A construction gang putting up a small boiler and engine in a mine away out in the country was hampered to some extent because part of the tools (including all the pipe wrenches) had not arrived

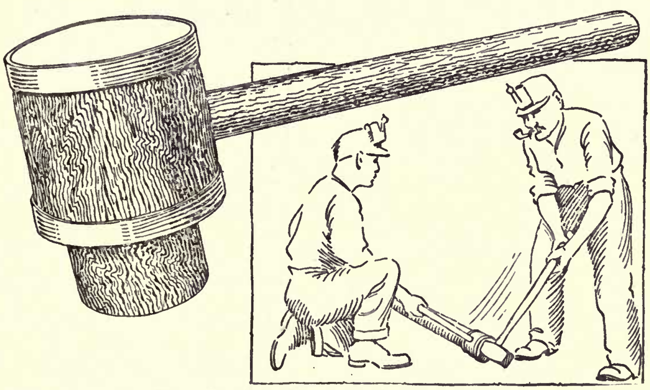


Pieces of Old File on Monkey-Wrench Jaws

on the job. Since no other wrenches were available, the men proceeded to make a pipe wrench out of an ordinary monkey wrench by soldering two pieces of an old rough file on each jaw of the wrench, as shown in the illustration. They used this for two days and did a good bit of work before the lost shipment turned up.

A Useful Pipe Driver

For the benefit of brother mine foremen, a Coal Age subscriber submits a description of a device that he has found useful and handy



A Simple but Practical Pipe Driver

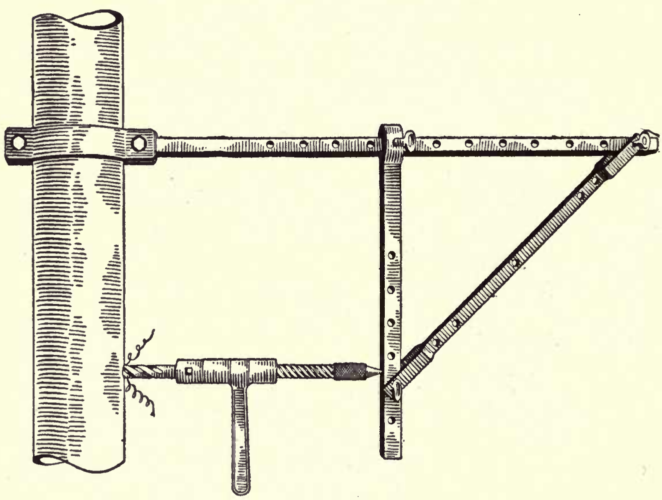
in laying wooden pipe lines. This device does not break the lips of the pipe and may be easily made at any mine blacksmith shop.

A straight, sound, hardwood prop about 3 in. larger in diameter than the recess in the end of the pipe to be laid should first be selected. A piece should be cut from this prop about 10 in. in length. On this piece a band is shrunk at one end and also a similar band about 3 in. from the opposite end. Outside of this second band a cut 1½ in. deep is made with a saw entirely around the block, and the wood between this cut and the end of the block split off, leaving a projection that will fit easily but snugly within the female end of the wooden pipe section. A suitable handle may now be fitted to the block. This completes the tool.

In use this device is employed in a manner similar to a blacksmith's flat or set hammer—it forms a convenient buffer block for the end of the pipe when two sections are to be driven together. By its use there is no danger of injuring the end of the pipe by direct sledging.

Handy Ratchet Brace for Pipes

An "old man" that is handy for use with a ratchet drill, avoiding the usual trouble in getting it fixed solidly, consists of two 1¼-in. bars, a brace and a clamp, as shown. To use this outfit a suitable clamp

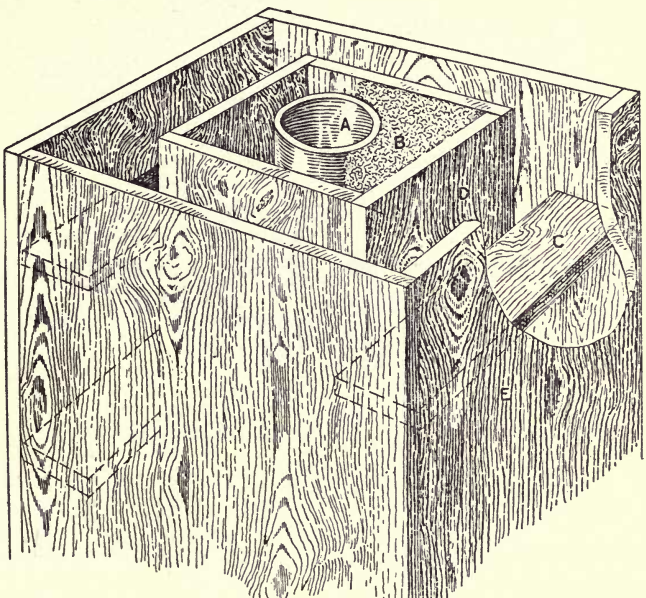


Ratchet Brace, or "Old Man," Attached to Pipe

must be made for the particular size of pipe or shape and size of column to be drilled. A number of small holes should be drilled and countersunk to receive the tapered "center" of the ratchet. The brace is most conveniently made of two bars shaped and fastened together as shown. The same outfit can be used on square columns, I-beams, etc., by having the clamp made of a suitable shape.

Water-Pipe Frost Protection

In cold climates, outside water pipes should be boxed as illustrated. *A* is the pipe to be protected, *B* is dry sawdust with a small quantity of unslaked lime in it (when so treated rats and mice will leave the box severely alone), and *D* is the inner box containing the sawdust,

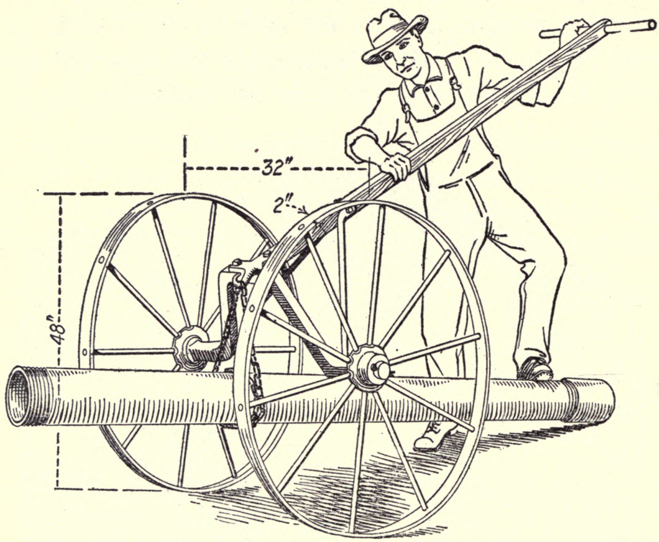


Casing to Protect Water Pipe from Frost

allowing about 2 in. of space clear of the pipe. The inner box is made of $\frac{7}{8}$-in. boards, and the outer box *E* of $1\frac{1}{4}$-in. boards. At intervals strips of wood about 2 in. wide are nailed on, as at *C,* to hold the inner box central. Care must be taken to make a tight job of the outside box, as it is necessary to prevent a circulation of air to any extent in the space between the boxes. Cut straw, asbestos and cement, powdered mica, mineral wood or ground tanbark can be used instead of the sawdust if desired.

Handy Pipe Cart

The illustration shows a handy cart for conveying pipe or similar material in the mine. This is particularly useful in places where pipe must be moved by hand and is too heavy to be easily dragged or carried.



The Pipe Cart in Operation

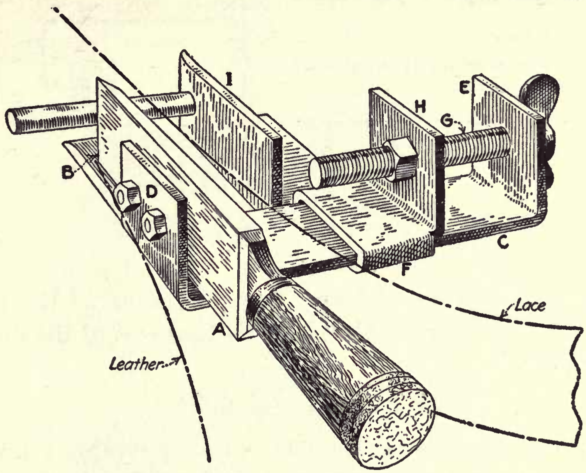
The principle employed in this cart is old, as similar devices have long been in use on the surface. Its construction is simple, however, and the materials employed are inexpensive. Any mine blacksmith can build one.

Kinks for the Mine Power Plant

Gage for Splitting Belt Lace

A practical device for splitting belt laces can be easily and quickly made as follows: It consists of three principal parts. *A* is a knife or wood chisel sharpened at the end and cuts with the front edge *B*. It is fastened to the bent-up part of *C* (marked *D*), which is made of brass or iron plate, with two small bolts. The opposite end *E* is likewise bent up, after *F* has been slid on, and has a hole for the adjusting screw *G*. The third part *F* is made so that the loop *F* can slide over *C*, and part *H* also has a hole for the adjusting screw. A guide *I* for the side of the leather has a top guide, which serves to keep the leather down flat.

The leather is placed on the floor or bench and the screw *G* adjusted to the desired width of the lace. A cut 3 or 4 in. long is first made in the leather the width of the lace and serves to get a right start. This



Cutting Lace of Desired Width from Leather

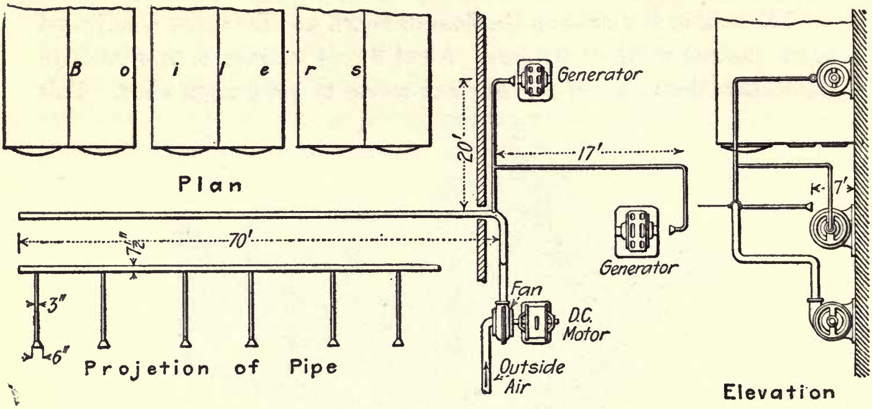
part of the lace is put between the knife and the guide, and the leather is held with the left hand while the right hand pushes the device forward, raising the leather slightly from the bench.

Boiler-Room Ventilation

The following plan for ventilating and cooling the space in front of a battery of boilers was adopted by the Big Creek Colliery Co., of St. David, Ill., after it had been found that firemen could not stand the temperature in front of the boilers on a warm summer day.

A 7½-in. galvanized pipe is suspended in front of the boilers and from this main line, 3-in. pipes, also of galvanized iron, are dropped to within about 7 ft. of the floor, one in front of each boiler.

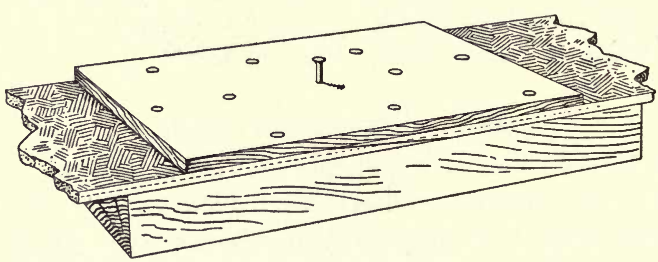
Air is furnished by a No. 4 champion blower, whose capacity is 800 cu.ft. per min. at a pressure of 1½ oz. This is driven by a direct-connected direct-current motor. Air is taken from outside the building. Pipes are also laid to two generators for the purpose of cooling them.



The general arrangement and the dimensions of the pipes are shown on the accompanying sketch. The total cost of the installation was about $200.

Splicing Belts

A good belt-splicing kink consists in simply placing a thick board under the joint and a thin one over it and nailing the two together, driving slender wire nails right through the belt and putting in

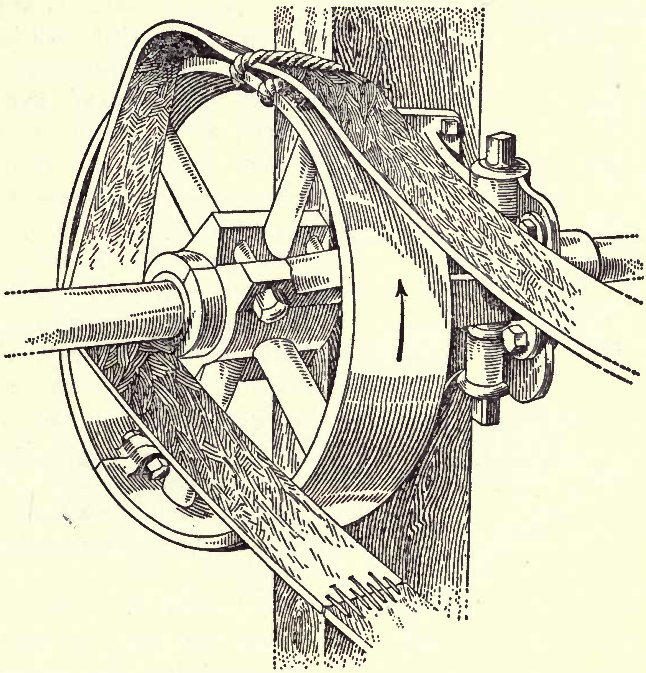


Glued Belt Being Held While Drying

enough of them to make sure that all parts of the joint are pressed firmly together. If half-inch boards are used on top, sixpenny nails are large enough. The holes made do not injure the belt, and they disappear almost entirely after it has been in use a short time.

Putting Belts on Pulleys

To put a heavy belt on a pulley, first pull the belt over the pulling side of the driving pulley, wrap a rope around the pulley rim and over the belt where it rests on the pulley face; pull the ends of the rope from under the rim and pass them over the face of the pulley, between it and the belt, the ends pointing in opposite directions. The power may then be thrown on, and the belt will clamp the ends of the rope and both will be pulled along with the pulley. The rope will release itself and drop off as soon as the belt is on.

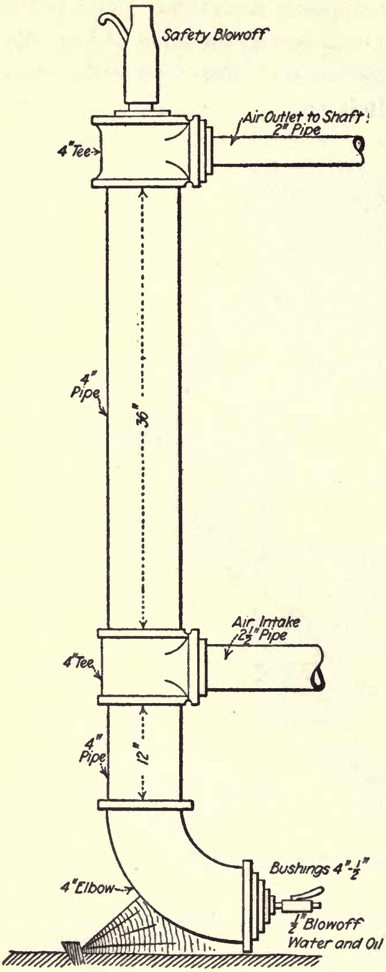


A Safe Way To Hold a Belt to a Pulley

This may be an old idea, but it is a safe and sure method of putting on belts. There is one precaution that should be observed: Do not use too long a rope as it may become entangled. As shown in the illustration, the ends should not project beyond the face of the pulley.

Oil and Water Separator for Compressed-Air Line

In any remote prospecting operation an oil and water separator such as that illustrated will be found to be a useful and handy piece of apparatus. The use and care of compressors on such work is not scientific, the men available for the work are ignorant, and so it frequently happens that oil troubles develop in the machines underground. When you add to that the freezing due to moisture in the air, the value of any kind of apparatus that will help to mitigate these drawbacks is apparent. A separator should, of course, go along with every compressor, but we all know what prospecting outfits are—there is always something that should be there but never is sent, and a separator on the air line is one of the things frequently conspicuous by its absence. Usually there is nothing available from which to make one. This at least was the case on the work where the separator described was used. Its construction will readily be understood from the illustration, pipe and fittings being all that is required. The air intake from the compressor was a 2-in. line and the outlet 2½ in. The separator itself consisted of 4-in. pipe with the necessary tees and elbows to suit. Above the air exit the 4-in. tee was bushed down to hold a 2-in. safety valve, while the foot of the separator, which ended in an elbow, was also bushed down to hold a ½-in. turn-cock taken from an air drill. By watching

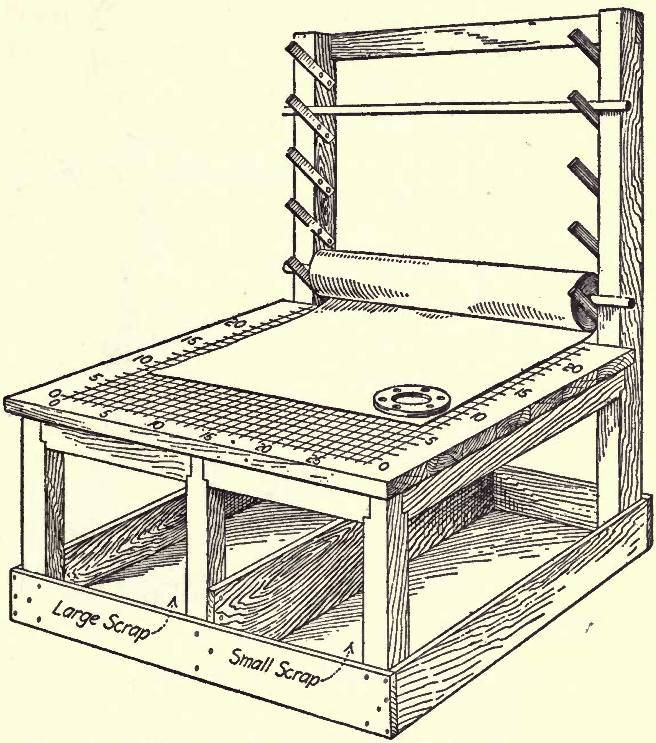


Details of Water Separator

and keeping the lower space clear of the collected moisture and oil that came over from the compressor, a great improvement in the quality of the air was obtained.

Rack and Bench for Packing

The illustration shows the construction of a bench for sheet packing, which is particularly useful in small mining plants purchasing from a distance, and in large plants keeping a supply independent of

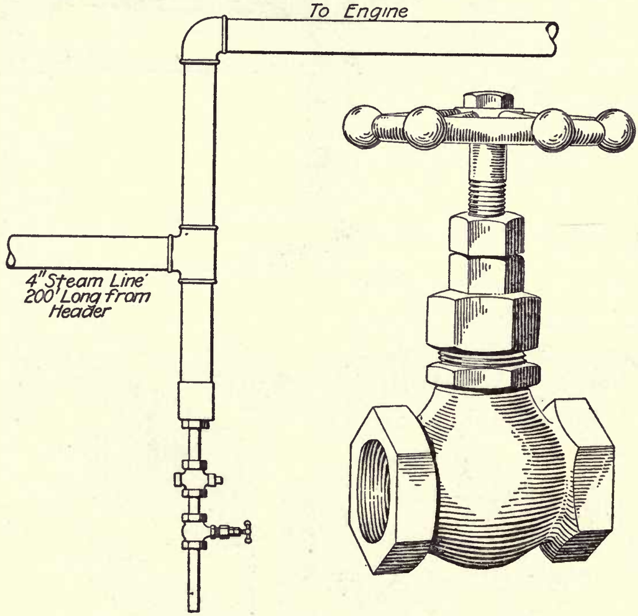


Sheet Packing Kept Ready for Use

the main warehouse. Several kinds of thicknesses can be kept on the rack and the desired packing pulled out on the bench and cut to size, using a straight-edge and the scale of inches marked across the bench. In case of small flanges that can be brought in, the bench is made heavy enough so that the packing can be cut directly from the flange either by marking or peening. The under part of the bench is divided into two compartments, one for large and the other for small scraps.

Locknuts on Valve Stem

A 16 x 18-in. throttle-governed engine driving a ventilating fan and situated over 200 ft. from boiler house has the piping arrangement as shown in the illustration, for collecting and draining the condensate from the line through a ½-in. plug-cock and globe valve in the



Valve Stem Locked To Avoid Closing

bleeder. Someone shut the globe valve on the bleeder at a time when trouble was being had with dirty feed water, resulting in a partly wrecked engine caused by water carrying over. To insure against further trouble of this kind we cut threads on the valve stem and put on a nut and locknut. The valve is now opened the desired amount, and the nuts are screwed against the packing nut and locked tight so that the valve cannot be closed without slacking the nuts.

Pulley Computation Chart

The accompanying chart will be found to be useful for determining the sizes of pulleys required for given power-transmission requirements. It removes the necessity for the use of the various formulae and is extremely flexible in its application. For example, a motor running 1200 r.p.m. is to drive a lineshaft at 300 r.p.m. What sizes of pulleys should be used? On the slip of paper in position *A* make marks opposite the 300 and the 1200, as shown. Then slide the slip of paper up to wherever you want it. Position *B* shows that pulleys 15 in. and 60 in. diameter respectively will do the work very well. Of course, if those diameters are considered too large, the slip can be moved a little higher and the best diameters can be chosen. No matter where the slip is placed, the ratio is always correct. The chart also lends itself readily to the solution of such a problem as—Knowing the pulley diameters and the speed of one of the pulleys, what is the speed of the other pulley? For example, pulley diameters of 8 and 50 in. are used. The speed of the 8-in. pulley is 200 r.p.m. What is the speed of the other pulley? The answer is 32 r.p.m. Try it by means of the chart. As speed of rotation and diameters bear an inverse ratio to each other it will be necessary to invert the figures when obtained or else reverse the slip of paper between position *A* and *B* in the figure.

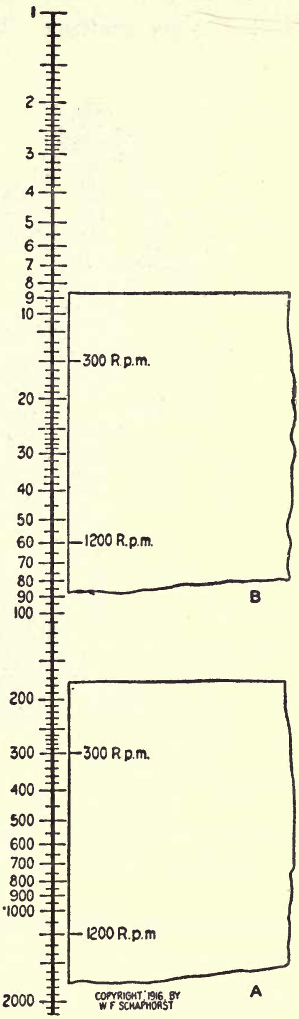
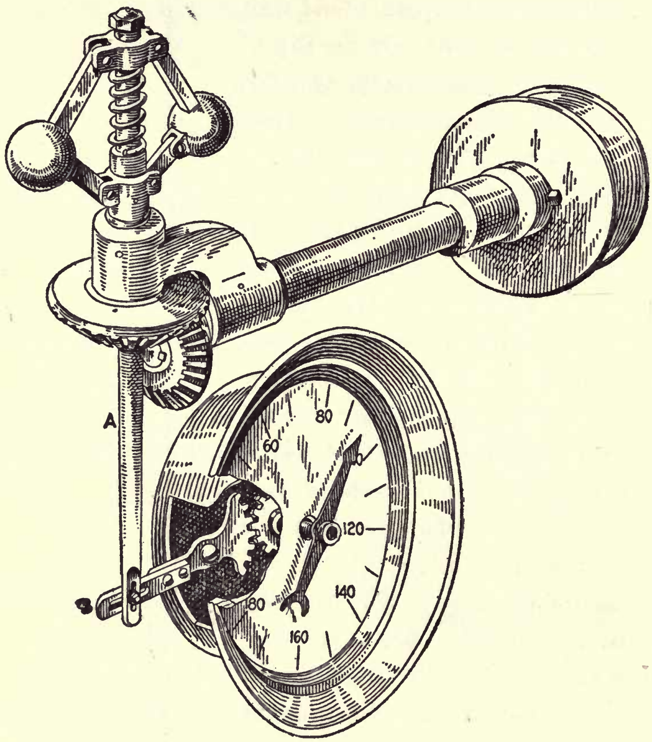


Chart To Calculate Pulley Ratios

Shafting Speed Indicator

An improvised speed-indicating gage was made as follows for attachment to variable-speed shafting, where it was desirable to observe and to alter the speed in accordance with differing requirements:

A small governor, taken from a discarded high-speed engine, is belted to the shafting. The valve stem *A* is lengthened to reach the

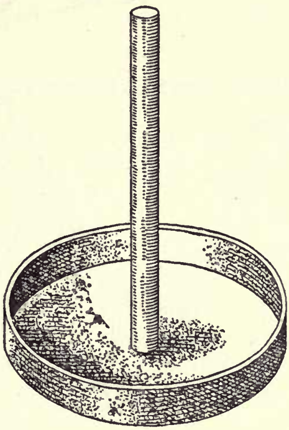


Shafting Speed Indicator

lever *B* of an old steam gage, as shown, and a portion of the gage casing is cut away to accommodate the changed mechanism. The pressure tube is eliminated. The lever *B* is made adjustable as to length, so that by changing it the gage is set in proper ratio, making the original dial graduation correspond to the speed of the shafting.

Substitute for Regular Valves

It is sometimes difficult, says a writer of experience, to get repair parts when located in a country power plant. The way one man overcame such a difficulty in getting new pump valves, when the old ones had been ground down at various times until they were so thin that they warped and the stem holes were enlarged so that considerable



Mold for Pump Valves

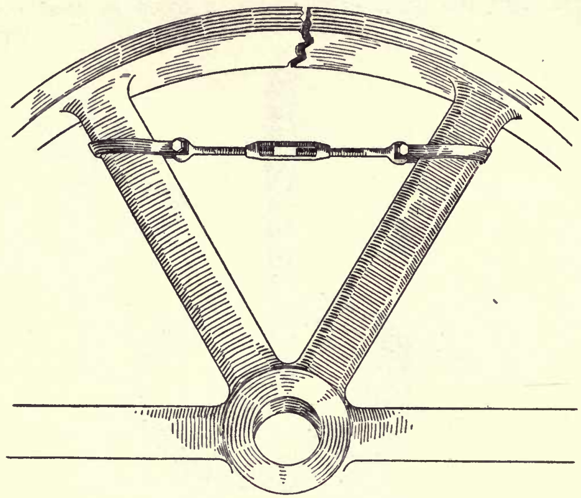
water was lost through them, was as follows: A cardboard box lid, the same diameter as the valves, was secured, and an iron rod the diameter of the valve stem was placed in the center, as shown in the illustration. A mixture of lead and babbitt was melted and poured into the lid. This process was repeated for the required number of valves, several cardboard lids being used in the operation. A sheet of fine sandpaper was tacked down on a board, and the castings were rubbed over it until a fairly smooth face was secured. These valves gave such good service that they were left in permanently. When they started to leak, they were simply removed and "sandpaper faced" again.

Indentifying Valves

Aluminum tags with protected white writing spaces should be attached by light chains to the bodies of all valves, with an inscription as to the service of the valve, its size, make, date installed and any special instructions thought necessary.

Emergency Pulley Repair

During some changes and additions to a power plant a pipe fitting was accidentally dropped on an iron pulley that drove a low-pressure air fan, making a crack across the face midway between two of the



Clamps on Cracked Pulley

spokes. As it was a special-diameter pulley (about 31½ in.), it could not be readily duplicated. The pulley was strengthened by making up a couple of clamps, which were fitted about the two arms adjacent to the crack and then drawn tight by means of a turnbuckle which drew the broken rim tightly together in its former position.

Priming Caused Engine Trouble

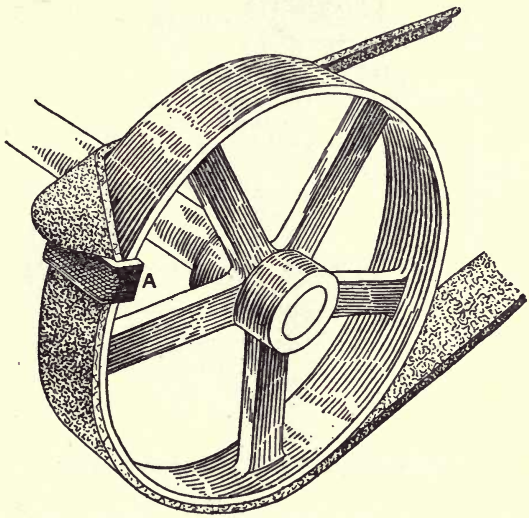
A new compound Corliss engine gave out a peculiar groaning sound in its high-pressure exhaust valves when working on small overloads. The valves and operating connections were refitted and considerable oil was forced in by means of hand-pumps, but all to no avail.

After a lot of experimenting, it was found that the steam was very wet, at overloads, from priming caused by the use of too much soda ash in the boilers. Cutting down the soda ash reduced the priming and the valve trouble disappeared.

Placing Tight Belts on Pulleys

At a mine where a number of belts are used very tight and in consequence are difficult to place on their pulleys, the small device shown at *A* in the illustration makes the task of placing a tight belt an easy one.

The device is made of $\frac{1}{8}$-in. flat steel about 2 in. wide. It is bent at right-angles at the ends, the bends being made so that the contrivance will fit the width of the pulley face. The ends are about 2 in.



Replacer for Tight Belts

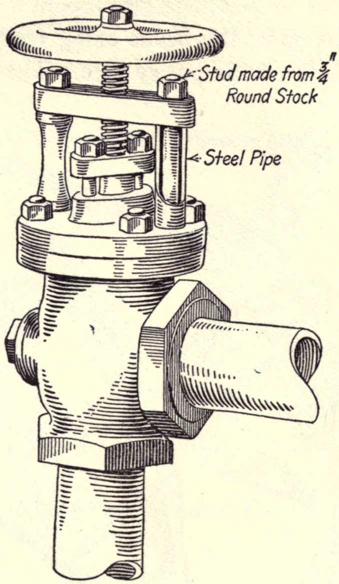
long. By starting the belt on the pulley and holding this angle iron over the belt, the latter can be run on without difficulty. To avoid accidents the belt should be run on either by hand or at a very slow speed.

A Simple Shafting Level

To level shafting, it is common practice to take a common garden hose, insert a glass tube in each end and fill the apparatus with water almost to the tops of the tubes. From the height of the water in the tubes the inequality of level betwen any two points can be ascertained.

Valve Yoke Stud Repair

While making repairs to a blowoff valve, it was found that one of the yoke studs had corroded away to less than half its original size, owing to a leak from the stuffing-box dripping on it. Not having a



Straight Stud and Pipe Substituted

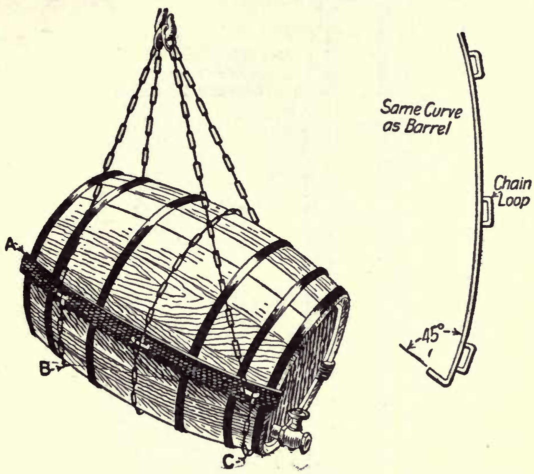
lathe to turn out one like the original, a piece of $\frac{3}{4}$-in. round steel stock was threaded at each end and a piece of $\frac{3}{4}$-in. steel tubing put on, as shown in the illustration, care being taken that the length equaled the distance between the shoulders of the old stud so that the valve stem would work freely in the yoke.

Lubrication Kinks

Transferring Oil to Tank

To empty barrels of heavy engine oil by the hand-pump method in cold weather is "some job," but much of the labor may be eliminated by the device shown in the illustration. Two pieces *A* of iron $\frac{3}{8}$ x $1\frac{1}{4}$

in. and 1 in. longer than the barrel were bent as shown, the 1 in. extra length being bent back at about 45 deg. to hook over the edge of the barrel. The chain loops are of $\frac{3}{8}$-in. round with the ends put through the drilled holes and riveted on the inside of the side pieces, or "spacers," and are about 5 in. from the ends. The "cradle" chains *B* and *C* are the length of half the circumference of the barrel near the ends. The length of the four sling-chains depends upon the angle at which the barrel is to hang. It may be wise to extend the chains over the



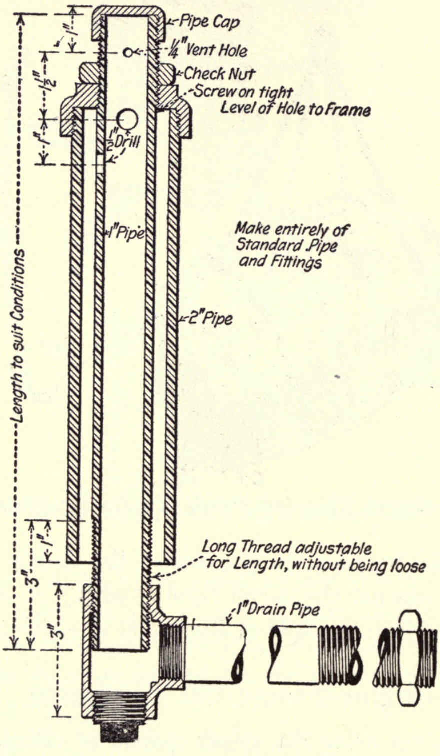
Barrel Elevated Ready To Be Emptied

top or around the barrel or to put one in the middle fastened with a clamp to guard against the barrel tipping over. A short nipple with a valve is screwed into the head of the barrel to regulate the flow of oil.

Engine-Frame Oil Separator

In some engines using the splash system of oiling there is a false head placed in the end of the crosshead barrel or end of the frame, and the rod is packed with two or three rings of packing, forming a reservoir for the water that may work out from the cylinder through the packing and prevent it from getting into the oiling system. Some oil works into this space which, if wasted with the water, would mean considerable loss in a year. In order to save this oil, there is a hole through the false head at a certain level and the oil is supposed to drain back into the frame, and the water must be drained off at the bottom at intervals to prevent it from flooding over into the oiling system.

Such engines may be equipped with a drain for the water, made as shown in the illustration, by means of which the oil is saved without allowing water to get into the oiling system. The separator is placed within the reservoir space with the drain pipe extending out at some

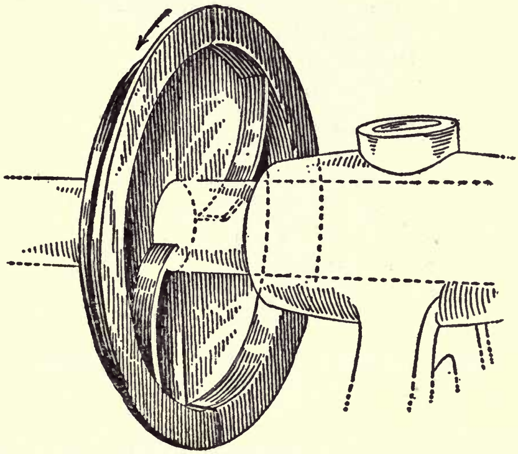


Bottom Inlet to Overflow Drain

convenient point, and the action is as follows: The water rises in the outer pipe until it reaches the level of the holes in the inner pipe, when it flows down the inner pipe and out to the sewer. The height of the overflow holes in the inner pipe is just below the level of the oil hole in the frame, so that the water cannot rise high enough to flow into the frame unless the drain pipe becomes stopped up. A siphon action is avoided by the vent hole at the top, and the oil is drained back into the engine frame through the regular overflow.

Shaft Oil Shield

The accompanying illustration shows a method that can be used to prevent oil from creeping along a shaft and getting upon belts and pulleys. The disk should be put facing the bearing, with the wings pointing in the direction the shaft is to revolve so that any



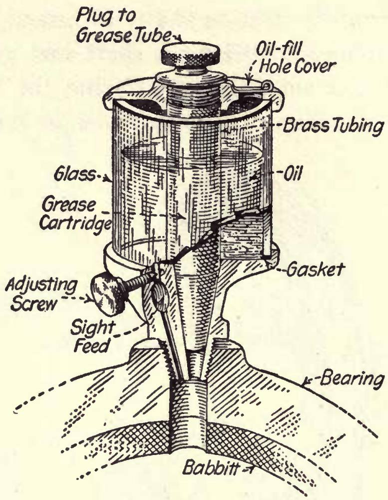
Shaft Oil Guard

creeping oil will be forced back into the bearing by the slight air pressure created by the wings. The size of disk and the number of the wings can be determined to suit any speed and diameter of shaft.

Combination Grease and Oil Cup

This combination grease- and oil-cup device will be found well adapted for machinery in inaccessible places, or such machinery as can be stopped only at intervals. It can be used with advantage on parts of machines the motion of which would make it impossible to ascertain if the reservoir was at all times supplied with oil. It will be found serviceable where the machinery can be stopped only at agreed times, because at other times, lives and property would be destroyed.

Other opportunities are where unskilled labor is used, where rotative speeds are high, and where failure to lubricate would entail costly repairs and the monetary loss that always results from curtailment of production.



Gives Oil When Properly Fed and Grease When Neglected

This type of cup could be installed on mine fans, coal-handling, grinding or other machinery, where dust or grit is present, in dark places or where it is hazardous to go while the machinery is in motion. In fact, it would be available and desirable on all machinery dependent on intermittent or hand lubrication.

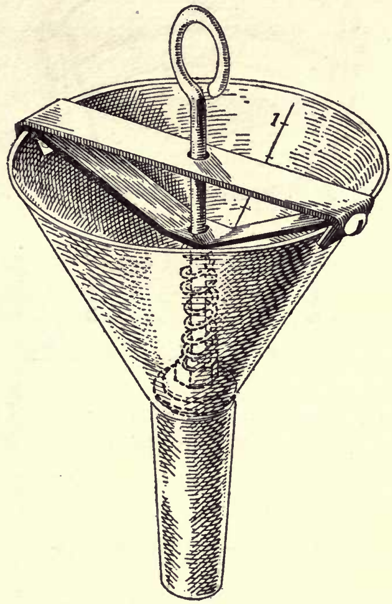
Such a device would prove an additional safeguard and would reduce to a minimum the liability of having hot bearings and of experiencing shutdowns.

Mica for Hot Bearings

A little pulverized mica, fed into a bearing that is getting overheated, helps to hold it and causes it to cool off. At the same time it stops any cutting of the bearing or shaft.

Combined Oil Measure and Funnel

The combination shown in the illustration serves as a measure and a funnel as well. The marks for different quantities of course are found by once pouring in different measured amounts and mark-



Stopper in Base of Funnel

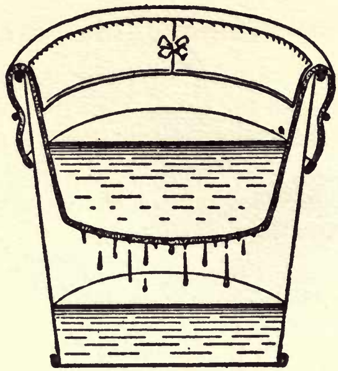
ing the scale accordingly. The spring holds the stopper down to prevent the oil from flowing out. The construction may be simplified by using only the upper guide and a tight-fitting cork on the end of the rod.

Keeping Lubricator Feed Nozzles Open

The oil-feed nozzle of lubricators sometimes get stopped up, necessitating the removal of the regulating-valve bonnet and cleaning it with a wire. A piece of slender steel wire, not large enough to interfere with the flow of oil, is fastened to the end of the valve to extend up through the nozzle nearly to the tip. Each time the valve is used, the wire loosens any small particles of foreign matter that might adhere to the walls of the tube and stop the passage.

Oil Filter for a Small Mine Plant

A tin can and a felt hat combined, as shown in the illustration, make a first-rate and inexpensive filter for oil, in a plant that does not



Oil Filtered Through a Felt Hat

justify the purchase of an expensive apparatus. If there are holes in the top of the hat, pieces of felt (taken from the brim) can be stitched over them.

Miscellaneous Kinks

Eschkas Method of Determining the Sulphur in Coal

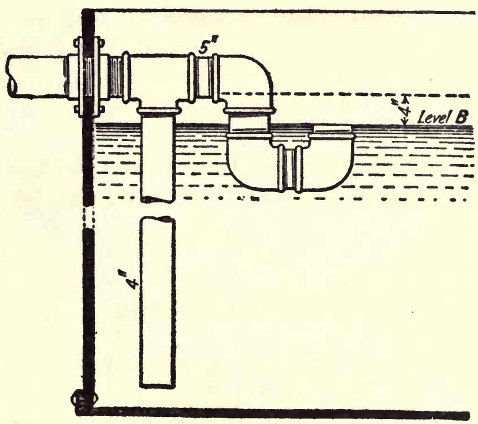
To determine the sulphur content of coal weigh out $\frac{1}{2}$ gram of a pulverized sample and place it in a porcelain or platinum crucible together with $\frac{1}{2}$ gram of Eschka's mixture. (Eschka's mixture contains $33\frac{1}{3}$ per cent. of magnesium oxide and $66\frac{2}{3}$ per cent. of sodium carbonate.) Mix thoroughly; heat slowly at first, then gradually, until the carbon is driven off or until the contents of the crucible become white in color.

Transfer the contents of the crucible to a glass beaker containing about 200 c.c. of water; wash thoroughly, then add 15 c.c. of a 10 per cent. solution of bromine water. (Bromine is an oxidizing agent and takes up the sulphur.) Let settle and filter off the impurities. Boil the filtrate for 5 min. then, drop by drop, add 15 c.c. of a 10 per cent. solution of barium chloride ($BaCl_2$); let settle for a few hours; filter, and retain precipitate. Its weight $\times$ 2 $\times$ 0.1374 (the factor that gives the amount of sulphur) $\times$ 100 gives the percentage of sulphur in the original sample.

Removing Sediment from Tank

Here is a useful arrangement for removing sediment from a tank. The overflow takes water from the bottom, but it also takes some from the surface (skims the water), and the pipe forms a trap and prevents the escape of sewer gas.

The overflow is 5-in. threaded pipe on the U end and 4-in. on the drop pipe. When there is a small overflow the water is all taken from



Surface and Bottom Openings to Overflow

the bottom of the tank, but when there is a heavy overflow it starts the siphon and the water is largely taken from the surface of the tank for a depth of 4 in. at a time, taking most of the floating pieces, leaves, etc., with it, and the siphon breaks at level *B* so that the overflow is always sealed.

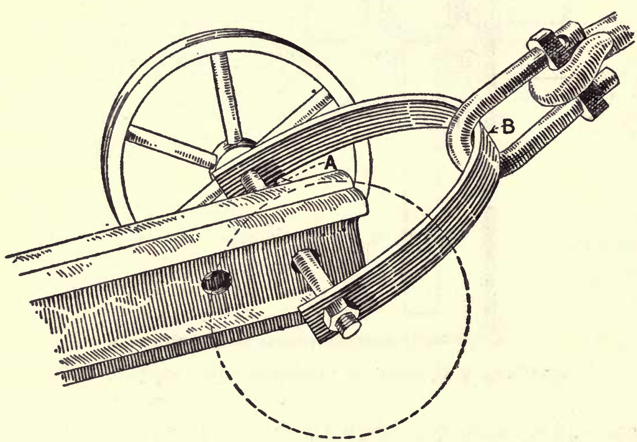
Solderless Copper-Wire Splice

Small jobs of line extension or repair work are expensive and difficult, and it is often impossible, at the time, to solder the joints. If the wires are carefully scraped and the joint made a good length and tightly twisted, then wrapped with tinfoil before being taped, the result is almost as good as if soldered.

If heat is not applied to a joint until the solder is thoroughly worked into all the crevices between the wires, the flux will remain and cause corrosion and render the joint worse than if no attempt had been made to solder it. A good wrapping of tinfoil excludes moisture, and the wires will remain bright.

Method of Packing Rails

The ordinary method of packing rails on muleback, namely, that of fastening the upper ends of three or four rails on each side of the pack saddle and allowing the other ends to drag, will not work on narrow and steep mountain trails, because the dragging ends have a tendency to spread out like a fan. This results in the rails on one side falling off the trail, probably being suspended in space, if the trail is



A Method of Rail Transportation

around the face of a cliff, while the rails on the other side interfere with the bank. In order to overcome this difficulty, the clevis shown in the accompanying illustration was used with success. This was made of $\frac{1}{4}$ x $1\frac{1}{2}$-in. iron and with an 8-in. span (any similar dimensions will do). To transport the rails, the rod *A* is passed through the bolt holes of several rails laid close together. A chain is then passed through the clevis at *B,* and fastened to the mule. The load of rails may then be dragged over as rough and narrow a trail as the mule can travel. If the trail is not too rough, the weight of the rail may be taken up, and consequently more of them transported at a time, by using a slightly longer rod and a small iron wheel on either side of the clevis. Wheels from old wheelbarrows are just the right size for this work and will stand a great deal of hard usage. Other heavy material, such as large timbers, may also be dragged successfully with this two-wheel arrangement.

Repairing a Headframe

A defective timber at the top of the main braces of a wooden headframe caused an accident which resulted in the necessity of some "home-made" repairs.

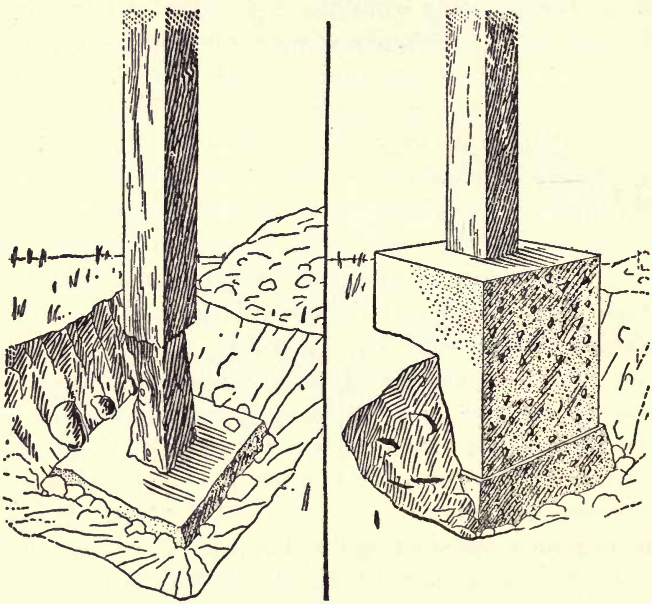
The timber gave way while the cage was hoisting a loaded car, breaking the 10 x 10 crosspiece which supported the double 10 x 10 beams onto which the sheave-wheel bearing boxes were bolted. The beams became loose, and in some way the sheave slipped out and fell down the shaft onto the cage which was, at the time, 110 ft. below. It struck the cross channel iron of the cage and bent it 4 in. out of line, breaking the wheel, which was of the bicycle type, 5 ft. in diameter. The impact tore the rope loose from the hitching at the top of the cage, which fell 12 ft. before the safety catches caught and held it securely.

Investigation proved that the primary cause of the accident was the defective timber, which had dry rotted in the center, leaving a deceptive shell. On account of its inaccessibility this had escaped detection. There were other contributory causes, however. The posts of the headframe had rotted below the ground level and this condition had allowed the headframe to settle 6 in. out of plumb, weakening the entire structure.

The headframe was built on the side of a hill, and while the posts had been set on concrete footings, in obtaining the required grade at the mouth of the shaft these had been covered with dirt 3 ft. above the level of the concrete. It was found that the posts were badly decayed throughout this 3 ft. This decay extended in some cases almost to the heart of the timbers, although above the level of the fill they were still sound.

The broken timbers at the top of the headframe were replaced and a temporary sheave wheel installed. Operation was then resumed, but hoisting was done on only one side of the shaft as it was deemed unsafe to trust a loaded car upon the old rope, which in the accident had been badly kinked. Furthermore, the cage was unsafe on account of the bent channel iron, which threw the pull off center and also prevented the safety catches from being replaced.

Work was commenced at once on the decayed posts as their condition made some action imperative in order to avoid a repetition of the accident. Te replace these posts meant an expensive and extended shutdown, so it was decided to reinforce the decayed parts with concrete, with as little delay in running the mine as possible. There were 14 posts in all, and these were treated four at a time. Work was started on successive Saturday afternoons.



Decayed Post Before and After Concreting

The posts were cut as shown in the accompanying illustration. It was estimated that the core and the cross-bracing on the headframe would be sufficient to sustain the weight during repairs. This assumption proved correct and no trouble was experienced on that score. After the decayed portion of the timber had been cut away, the remainder was surrounded by a concrete pillar. A mixture of 1 : 2 : 4 was used and mixed drier than customary in order to have it harden sufficiently to permit operation by the following Monday. Several pieces of scrap iron were also placed in the forms to give all the weight possible.

This method permitted the mine to be operated without delay, and in five weeks the job was finished, the result proving quite satisfactory. The pillars completely prevented any vibratory motion in the headframe; the weight of the concrete seemingly giving as much, if not more stability than if the posts had been solid to their original foundations.

In due time a new sheave wheel and rope arrived and were installed, but the bent channel of the cage presented another problem. This was solved in the following manner: The cage was placed at the surface level with several 12 x 12 timbers extending from one side of the shaft to the other under the channel, with sufficient space between the channel and the timbers to permit the operation of three 40-ton jacks. These bent the channel back into shape in short order and permitted the safety catches to be replaced, thus completing the repairs.

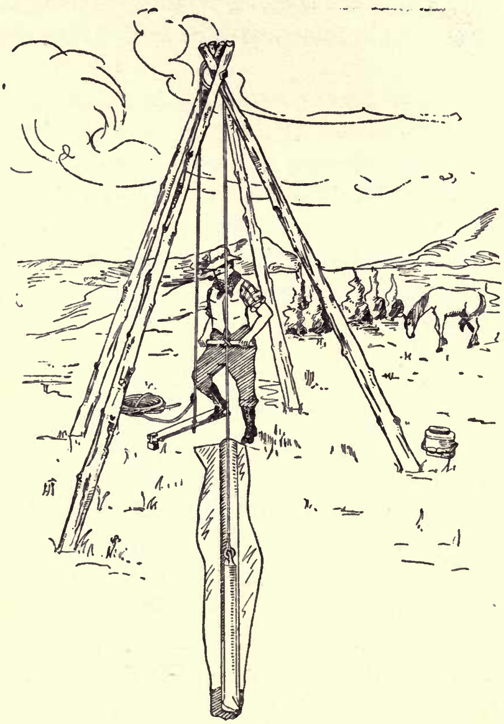
Handy Prospecting Drill

I once had occasion, in Snake Valley, Alberta, says T. Edwin Smith, to drill a hole to prospect a coal seam. In the course of the work I struck a stratum that was of unknown thickness and too hard for my augers to penetrate. Since the depth of the hole and the value of the work would not warrant the expense of hiring a machine, I rigged up the apparatus shown in the drawing.

I made the drill from a piece of 2-in. cold-rolled shafting with a piece of tool steel welded to its lower end for a cutting edge. A hole punched in the upper end enabled me to attach the rope by means of a small clevis.

The frame, or derrick, consisted of four poles each 16 ft. long. I bored a 1-in. hole through each pole about a foot from the small end and passed a ¾-in. iron rod through the four poles, placing a pulley between the center pair.

The rope from the drill passed over the pulley and down to the ground, where it was attached to a foot treadle. The treadle consisted of a 4 x 4-in. stake driven into the ground and a piece of 2 x 6 about 4 ft. long bolted at one end to the upper end of the stake and so arranged that it would swing in a vertical plane. At the other end was a hook with an opening smaller than the diameter of the rope. To attach the rope to the treadle I had merely to draw it up into the hook, where it held with sufficient firmness to enable me to lift the drill by pressing my foot down on the treadle. I also attached a wooden handle to the down-coming portion of the drill rope, for turning the drill and to assist in lifting.



Arrangement of a Cheap and Practical Drill

To operate the drill, I would push down on the foot treadle at the same time that I lifted on the handle, then take my foot off the treadle and bear down on the handle. I could lift a 60-lb. drill without difficulty by this method.

I also made a slush pump from a piece of 3-in. pipe 3 ft. long. I made a plug to fit the inside of the pipe, and after fitting it I bored a 1-in. hole through it. I cut a leather flap valve to fit over the hole in the plug and fastened it to the small end of the plug with $\frac{5}{8}$-in.

shoe nails. I drove the plug into the pipe about 1½ in. and sawed it off. I then stood the pipe in a barrel of water to swell the plug. The plug held as long as I used the drill, and is probably holding yet.

With this outfit I could drill holes to a considerable depth, and while it is not to be recommended for speed of drilling and ease of operation, it was a good one-man rig, being cheap and easily made.

Index

Air, rock-dusting mine........ 54
Airshaft, upraising........... 50
Alarm bell, circuit breaker.... 109
Alarm for transformers, cooling-water................ 112
Alarm signal for transmission ropes.................... 36
All-around tilting dump car... 16
Anchor made of pipe, self-tightening................ 115
Angles and curves, laying out.. 81
Angle sheave, useful.......... 8
Armature stand, home-made.. 110
Armature test set, portable... 103
Arrangement of drawing board for large drawings.... 91, 92
Attaching rubber hose coupling...................... 49
Augurs, sharpening coal...... 24, 25
Automatic suction control..... 46

Base-line work, plumbing instrument for.............. 76
Beam compass kink.......... 92
Bearings, mica for hot........ 138
Bell, circuit-breaker alarm.... 109
Belt lace, gage for splitting.... 122
Belts on pulleys, putting...... 125
Belts placed on pulleys, tight.. 133
Belts, splicing............... 124
Bench and rack for packing.... 127
Bending pipe, labor-saving machine for............... 118
Bent pipes, threading ends of.. 116
Bicycle, rapid surveying with.. 80
Bits for coal-cutting machines, sharpening................ 23
Blowpipe, made from pipe fittings.................... 94
Board for large drawings, I and II.................. 91, 92
Boiler room ventilation....... 123
Bolt, making an expansion.... 98
Bolts and screws, rusted-in.... 96
Box, convenient safety cap...... 56
Brace for pipes, handy ratchet. 120
Brattice cloth, hanging in gaseous places............. 49
Breakthrough, extraction of coal in.................. 18
Broken rubber hose mended... 48
Broken studs, removing....... 97
Buffer in coal chute, pole...... 17
Bullseye plumb-bob reflector.. 84

Cable-detaching hook........ 28
Cabs, rubber mats for locomotive.................. 58
Calculating room centers...... 73
Cap box, convenient safety... 56
Car kinks.................. 1
Carry-all for drafting room, handy.................... 88
Car stop, safety............. 7
Cart, handy pipe........... 122
Cast-iron and wood-stave pipes, joints between...... 117
Catching loose pump valves.... 39
Cause of engine trouble, priming was.............. 132
Centers, calculating room..... 73
Chain screen door............ 67
Charts, reading copied........ 79
Chart, pulley computation... 129
Chute, pole buffer in coal.... 17
Circuit-breaker alarm bell... 109
Clamp for flashlight, a handy. 70
Coal augurs, sharpening...... 24, 25
Coal-bunker fire, putting out. 113
Coal chute, pole buffer in.... 17
Coal-cutting machines, sharpening bits for............. 23
Coal, extracting in breakthroughs................. 18
Coal, method for determining sulphur in............... 140
Coal mining, little things in.. 99
Coal, safety in shooting....... 55
Collapsible trolley pole...... 107
Combination grease and oil cup..................... 137
Combined oil measure and funnel................... 139
Compass kink, beam........ 92
Compressed-air line, oil and water separator for....... 126
Computation chart, pulley... 129
Conducting electric power... 106
Connections on sinking pump, hose.................... 40
Construction of mine overcasts 68
Contiguous pitching seams, working................. 20
Control, automatic suction.... 46
Convenient safety cap box.... 56
Cooling-water alarm for transformers................. 112
Copied charts, reading........ 79
Copper-wire splice, solderless.. 141
Cotton rope, three strands best in..................... 30

Coupling, attaching rubber hose.................... 49
Crushed fingers, eliminated by hook.................... 60
Cup, combination grease and oil.................... 137
Curves, laying out angles and.. 81
Cutting wire rope........... 3

Data, value of keeping proper.. 102
Departure lines, uniformly spaced.................. 82
Derailing device............. 9
Determining mine-car friction. 15
Determining sulphur in coal.. 140
Device, a handy rope-detaching.................. 28
Dips, unwatering............... 43
Dogs, safety................... 3
Door, chain screen........... 67
Door, self-closing for mine shaft.................... 62
Drafting room kinks......... 87
Drainage Kinks............. 38
Drawing Board for large drawings, I and II........ 91, 92
Drawing oblique lines....... 88
Drawings, waterproofing.... 89
Drawing tight keys......... 96
Drill, handy prospecting..... 145
Drilling Spad Holes 86
Drive, an emergency fan..... 111
Driver, useful pipe.......... 119
Drums, small gravity....... 34
Dryer, efficient sand........ 3
Dump car, all-around tilting.. 16

Easily preventing pump trouble.................. 38
Economical prospect hoist... 37
Efficient sand dryer......... 3
Electrical Apparatus, Kinks in handling............... 103
Electric firing switch, a safe.. 113
Electric power, conducting... 106
Electric substations in mines.. 108
Eliminating crushed fingers by hook.................... 60
Emergency fan drive........ 111
Emergency pipe wrench..... 119
Emergency pulley repair..... 132
Ends of bent pipes, threading 116
Engine-frame oil separator.... 135
Engine trouble caused by priming 132
Erasing kink............... 90
Eschkas method of determining sulphur in coal........ 140
Extraction of coal in breakthroughs................ 18

Expansion bolt, making an... 98
Extinguishing fire in a gassy mine.................... 52

Fan drive, an emergency.... 111
Feed nozzles of lubricator, left open................ 139
Fence, mule-proof........... 68
Field mend for steel tape...... 78
Filter for a small mine plant, oil...................... 140
Finding splinters in fingers... 61
Finding the size of rope required.................. 32
Fingers, hook for eliminating crushed................. 60
Fire in a gassy mine, extinguishing............... 52
Fire, putting out in coalbunker.................. 113
Firing switch, a safe electric.. 113
First Aid Kinks............. 55
Fittings, blowpipe made from pipe..................... 94
Flashlight clamp, handy..... 70
Friction, determining minecar..................... 15
Frogless switch............. 10
Frosted globe for sighting.... 80
Frost protection for water pipes.................... 121
Funnel and measure, combined oil................ 139

Gage for splitting belt lace... 122
Gaseous places, hanging brattice cloth in............. 49
Gasket surfaces, roughening.. 39
Gassy mine, extinguishing fire in...................... 52
Gate, a simple shaft........ 59
Gathering locomotive parting 4
Getting out the coal, kinks in. 17
Globe for sighting, frosted.... 80
Gravity drums, small........ 34
Grease and Oil cup, combination.................... 137

Handy carry-all for drafting room.................... 88
Handy flashlight clamp....... 70
Handy pipe cart........... 122
Handy prospecting drill..... 145
Handy ratchet brace for pipes. 120
Handy rope-detaching device. 28
Hanger, useful type of pipe .. 114
Hanging brattice cloth in gasous places............... 49
Haulage kinks.............. 26

Haulage, method for avoiding ing inside parting......... 26
Haulage, trouble saver on rope..................... 29
Headframe, repairing a...... 143
Headings, protected from squeeze.................. 71
Hoist, an economical prospecting.................. 37
Hoisting kinks.............. 26
Holes, drilling spad.......... 86
Home-made armature stand.. 110
Home-made jack, ingenious... 93
Hook, cable-detaching........ 28
Hook to eliminate crushed fingers.................... 60
Hot bearings, mica for....... 138
Houses, putting water in miners'.................. 62
Hose connections on sinking pumps.................. 40
Hose coupling, attaching rubber...................... 49
Hose, mending broken rubber.. 48
How mine workers may get hurt..................... 60
How to cut wire rope......... 34

Ice, keeping out of shaft bottoms.................... 48
Identifying valves........... 131
Indicator for tables, I and II.... 75, 77
Indicator, shafting speed...... 130
Ingenious home-made jack.... 93

Jack, ingenious home-made... 93
Joint, a new track and rail..... 2
Joints between cast-iron and wood-stave pipes.......... 117

Keeping ice out of shaft bottoms.................... 48
Keeping lubricator feed nozzles open................. 139
Keeping proper data, value of.. 102
Keys, drawing tight.......... 96
Key replaced by sand paper, pulley.................... 95

Labor-saving pipe bending machine.................. 118
Lace, gage for splitting belt... 122
Lamp for a one-handed man.. 64
Large drawings, board for I and II................. 91, 92
Latitude and departure lines, uniformly spaced.......... 82
Laying out curves and angles... 81
Level, a simple shafting....... 133
Lights for mine locomotives, signal.................... 57
Lines, drawing oblique...... 88
Little things in coal mining... 99
Locknuts on valve stem..... 128
Locomotive parting, gathering 4
Locomotive, rubber mats for cab of................... 58
Locomotive signal lights..... 57
Long sights, taking.......... 83
Loose pump valves, catching. . 39
Lubrication kinks........... 134
Lubricator feed nozzles dept. open.................... 139

Machine for bending pipe, labor-saving.............. 118
Machines, sharpening bits for coal-cutting............... 23
Making an expansion bolt.... 98
Management Kinks, mine ... 99
Mats for mine locomotive cabs, rubber.............. 58
Measure and funnel, combined oil...................... 139
Mechanics, Kinks in Mine.... 93
Mending a broken rubber hose 48
Mending steel tape in field... 78
Method of packing rails..... 142
Mica for hot bearings....... 138
Mine-car rerailer........... 9
Mine-car friction, determining 15
Mine haulage............... 26
Mine overcasts, construction of...................... 68
Miners' houses, putting water in...................... 62
Mining, Waste in.......... 100
Miscellaneous Kinks........ 140
Mule-proof stable fence...... 68

Narrow roadways, collapsible trolley pole facilititates reversal in.................. 107
New track and rail joint.... 2
Nozzle of lubricator left open, feed..................... 139

Oblique lines, drawing...... 88
Oil and water separator for compressed-air line....... 126
Oil cup, combination grease and..................... 137
Oil filter for small mine plant. 140
Oil measure and funnel combined.................. 139
Oil separator, engine-frame.... 135
Oil shield, shaft............. 137
Oil transferred to tank...... 134

One-handed man, lamp for... 64
Overcasts, construction of mine 68
Overcoming roof troubles.... 19

Packing, rack and bench for.. 127
Packing rails, method of..... 142
Parting, a gathering locomotive 4
Pipe bending machine, labor-saving 118
Pipe cart, handy 122
Pipe driver, useful 119
Pipe fittings, blowpipe made from 94
Pipe Hanger, a useful type of 114
Pipe, self-tightening anchor.. 115
Pipes, frost protection for water 121
Pipes, handy ratchet brace for 112
Pipes, joints between cast-iron and wood-stave 117
Pipes, Kinks in Handling.... 114
Pipe, steadying the suction... 45
Pipes, threading ends of bent. 116
Pipe wrench, emergency..... 119
Pitching seams, working contiguous 20
Placing tight belts on pulleys. 133
Plates, underground 13
Plumbing instrument for base-line work 76
Plumb-bob reflector, bullseye.. 84
Pole buffer in chute 17
Portable armature test set.... 103
Posts, tapered mine 65
Power, conducting electric... 106
Power Plant, Kinks for the Mine 122
Preventing pump trouble, easily 38
Priming Cause of engine trouble 132
Proper tension for steel tapes. 73
Proper data, value of keeping. 102
Prospect hoist, an economical. 37
Prospecting drill, handy..... 145
Protecting headings from squeeze 71
Protection for water pipes from frost 121
Pulley computation chart..... 129
Pulley key replaced with sand paper 95
Pulley repair, emergency....... 132
Pulleys, placing tight belts on. 133
Pulleys, putting belts on..... 125
Pumping kinks 38
Pumps, hose connections on sinking 40
Pumps, strainer for sinking... 42
Pump trouble easily prevented 38
Pump valves, catching loose.. 39
Putting out a coal-bunker fire. 113
Putting water in miners' houses 62

Rack and bench for packing.. 127
Rail joint, a new 2
Rails, method of packing.... 142
Rails, sanding 12
Rapid surveying with a bicycle 80
Ratchet brace for pipes, handy 120
Reading copied charts 79
Reflector, bullseye plumb-bob 84
Regular valves, substitute for. 131
Removing broken studs..... 97
Removing sediment from tank 141
Repair, emergency pulley.... 132
Repairing a headframe...... 143
Repairing steel ties 6
Repair of valve yoke stud.... 134
Replacing pulley key with sand paper 95
Rerailer, mine-car 9
Reversal in narrow roadways facilitated by collapsible trolley pole 107
Roadways, rock-dusting mine 53
Rock-dusting mine air....... 54
Roof troubles overcome..... 19
Room centers, calculating.... 73
Room tracks 1
Rope, cutting wire 34
Rope-detaching device, handy 28
Rope, finding size required... 32
Rope haulage, trouble-saver on 29
Rope, three strands best in cotton 30
Ropes, alarm signal for transmission 36
Roughening gasket surfaces.. 39
Rubber hose coupling, attaching 49
Rubber hose mending....... 48
Rubber mats for mine locomotive cabs 58
Rusted-in bolts and screws... 96

Safe electric firing switch.... 113
Safety cap box, convenient... 56
Safety car stop 7
Safety dogs 3

Safety in shooting coal...... 55
Safety Kinks............... 55
Sanding rails................. 12
Sand dryer, efficient......... 3
Sand paper replaces pulley key 95
Screen door for ovens and furnaces openings.......... 67
Screws, rusted-in........... 96
Scouring steel tapes......... 86
Seams, working contiguous pitching................. 20
Sediment from tank, removing 141
Self-closing door for mine shaft.................. 62
Self-tightening anchor of pipe. 115
Separator, engine-frame oil... 135
Separator for compressed-air line, oil and water........ 126
Set, Portable armature test... 104
Shaft bottoms, keeping ice out of 48
Shaft gate, a simple........ 59
Shafting level, a simple...... 133
Shafting speed indicator..... 130
Shaft oil shield............ 137
Shaft, self-closing door for.... 62
Shaft, upraising an air....... 50
Sharpening bits for coal-cutting machines........... 23
Sharpening coal augurs....... 24, 25
Sheave, useful angle......... 8
Shield, shaft oil............. 137
Shooting coal, safety in...... 55
Sighting, frosted globe for.... 80
Sights, taking long.......... 83
Signal for transmission ropes, alarm.................... 36
Signal lights for mine locomotives................. 57
Simple derailing device...... 9
Simple shaft gate........... 59
Simple shafting level........ 133
Sinking pumps, hose connections in................. 40
Sinking pumps, strainer for... 42
Siphon in mines, use of the.... 47
Size of rope required, finding.. 32
Small gravity drums......... 34
Solderless copper-wire splice.. 141
Spad holes, drilling.......... 86
Speed indicator, shafting.... 130
Splice, solderless copper-wire. 141
Splicing belts............... 124
Splinters in fingers, finding... 61
Splitting belt lace, gage for... 122
Squeeze, protecting headings from.................... 71
Stable fence, mule-proof...... 68
Stake that stays put, survey.. 72
Stand, home-made armature.. 110
Steadying the suction pipe.... 45
Steel tape mended in field.... 78
Steel tapes, proper tension for. 73
Steel tapes, scouring......... 86
Steel ties, repairing......... 6
Stop, safety car............. 7
Strainer for sinking pumps... 42
Stud repair, valve yoke...... 134
Studs, removing broken...... 97
Substations in mines, electric. 108
Substitute for regular valves. 131
Suction control, automatic... 46
Suction pipes, steadying..... 45
Sulphur in coal, method of determining................ 140
Surveying Kinks............ 72
Surveying with a bicycle, rapid 80
Survey stake that stays put.. 72
Switch, a safe electric firing.. 113
Switch, frogless............ 10

Tables, indicator for I and II.. 75, 77
Taking long sights.......... 83
Tank, removing sediment from 141
Tank, transferring oil to..... 134
Tape, mending steel in field... 78
Tapered mine posts......... 65
Tapes, proper tension for steel.................... 73
Tapes, scouring steel........ 86
Tension for steel tapes, proper 73
Test set, portable armature... 103
Threading ends of bent pipe.. 116
Three strands best in cotton rope.................... 30
Ties, repairing steel........ 6
Tight belts on pulleys, placing. 133
Tight keys, drawing......... 96
Tilting dump car, all around.. 16
Track Kinks............... 1
Tracks, room.............. 1
Transferring oil to tank...... 134
Transformers, a cooling-water alarm for................ 112
Transmission ropes, alarm signal for................. 36
Triangles, truing worn....... 87
Trolley pole, collapsible..... 107
Trouble caused by priming... 132
Trouble easily prevented, pump.................... 38
Trouble-saver on rope haulage 29
Troubles, overcoming roof... 19
Truing worn triangles....... 87
Turnout tables............. 5

Underground plates........ 13
Uniformly spaced latitude and departure lines........... 82
Unwatering a dip........... 43
Upraising an air shaft....... 50
Useful angle sheave......... 8
Useful pipe driver.......... 119
Useful type of pipe hanger.... 114
Useful underground plates.... 13
Use of the siphon in mines.... 47

Value of keeping proper data.. 102
Valves, catching loose pump.. 39
Valve stem, locknuts on..... 128
Valves, substitute for regular... 131
Valve yoke stud repair...... 134
Ventilation, boiler room..... 123
Ventilation, kinks in........ 49

Waste in mining............ 100
Water in miners' houses, putting..................... 62
Water-pipe frost protection... 121
Waterproofing drawings..... 89
Welfare Kinks.............. 55
Wire rope, how to cut....... 34
Wire splice, solderless copper.. 141
Wood-stave and cast-iron pipes, joints between...... 117
Workers, how they may get hurt in a mine............ 60
Working contiguous pitching seams.................... 20
Worn triangles, truing....... 87
Wrench, emergency pipe..... 119

Yoke stud repair, valve...... 134