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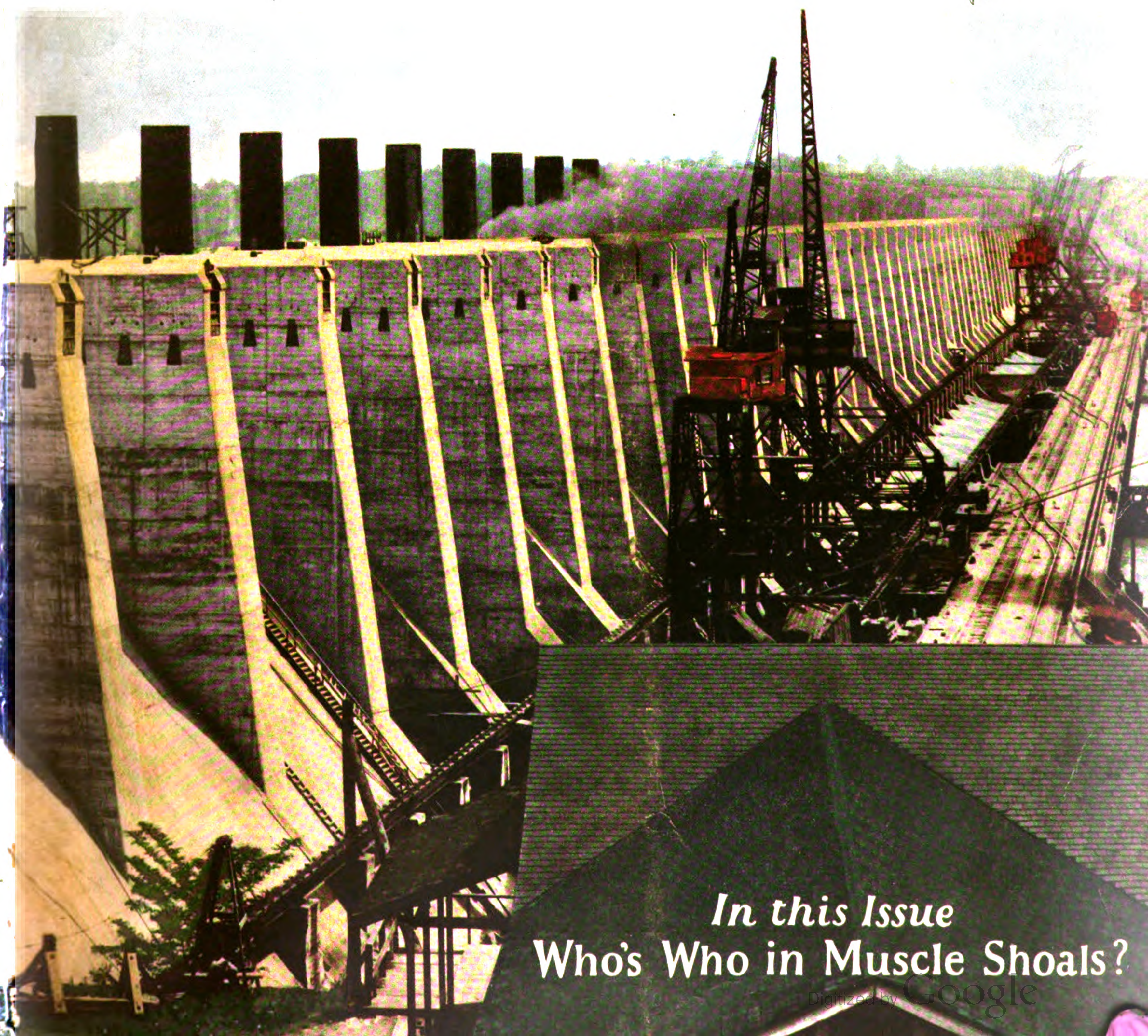
JULY 1924

10 CENTS

Industry Illustrated

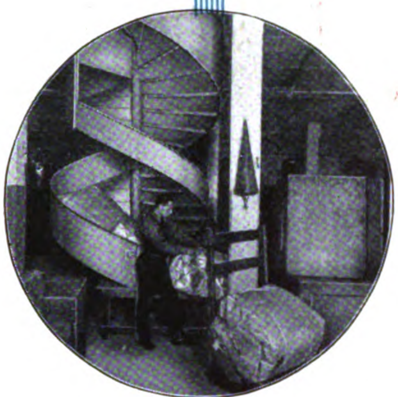
Men, Methods and Machinery of Modern Management

Reg. U.S. Pat. Off.



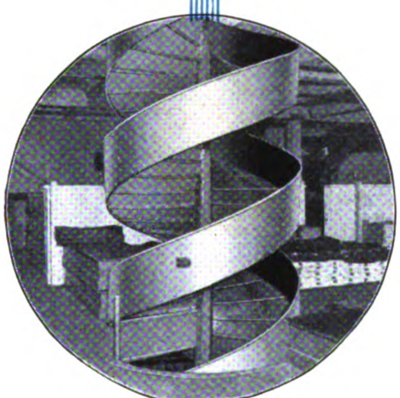
TWICE A YEAR

This Spiral Chute Repays Its Cost



THE B. B. & R. Knight Company, a Textile Mill of River Point, R. I., save in handling with a Spiral Chute $54.00 a week.

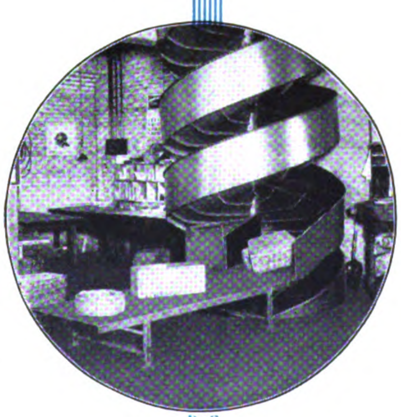
Consider that this chute cost $1133.75 and that it earns in actual cash—$2808 a year.



That to any industry is a worth while investment.

Gravity is without doubt the most willing worker in industry today.

Do you use it?



Booklet S-7 shows how Standard Conveyors make gravity serve many industries. Quite likely there's an application that you could make profitable in your business. Let us send you this booklet.

STANDARD CONVEYOR COMPANY

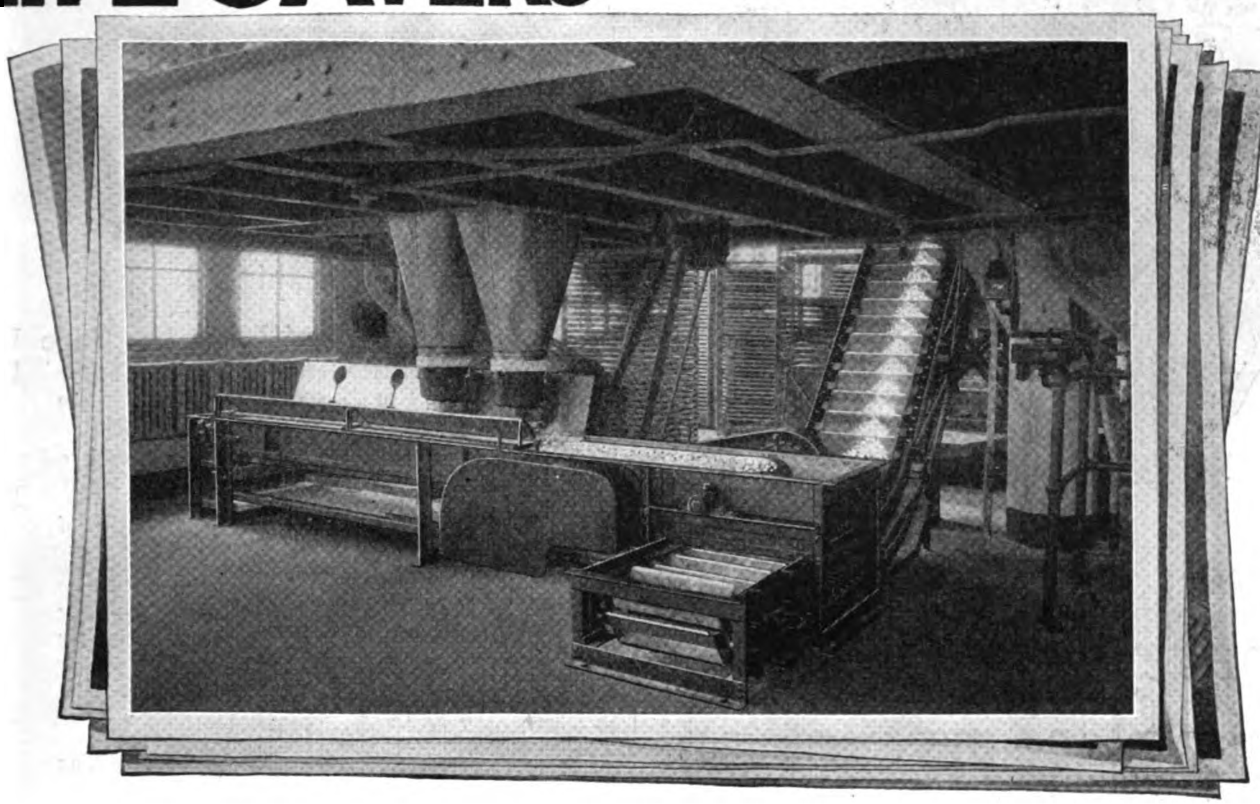
North Saint Paul, Minnesota

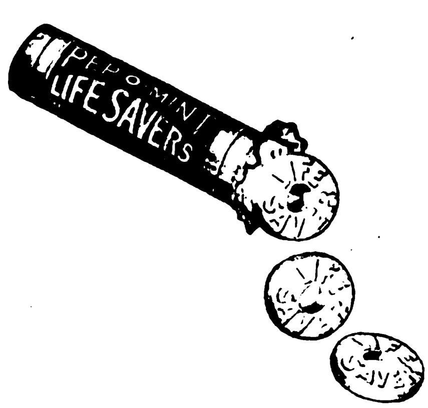
Branch Offices in Every Principal City

Makers of Brown-Portable Products.

eB.

LIFE SAVERS - *another user*





The upper photograph shows a Dow Belt Conveyor delivering sugar from masticators to Dow Pan Conveyor which elevates it to dryer on the floor above.

CLUB, confectioner's or cross-roads store—wherever you are, ask for the candy mint with the hole and you'll get it, fresh and delectable, for a nickel. Such wide distribution, high quality and low price are the results of efficient, economical production in which Life Savers Inc. use Dow Conveyors as time, labor and money savers. Let our nearest office tell you of the saving possibilities Dow Conveyors offer *you.*

THE DOW CO.
LOUISVILLE. KY.

New York Office, 50 Church St. Chicago Office, 343 S. Dearborn St.
Detroit Office, 8855 Woodward Ave. Philadelphia Office, 1830 Arch St.
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Representatives in other principal cities

Cuba: J. H. Mitchell, 517 Manzana de Gomez, Havana

DOW LOUIS-VILLE CONVEYORS

Industry Illustrated
The Pictorial Presentation of Practical Management

CONTENTS

July, 1924

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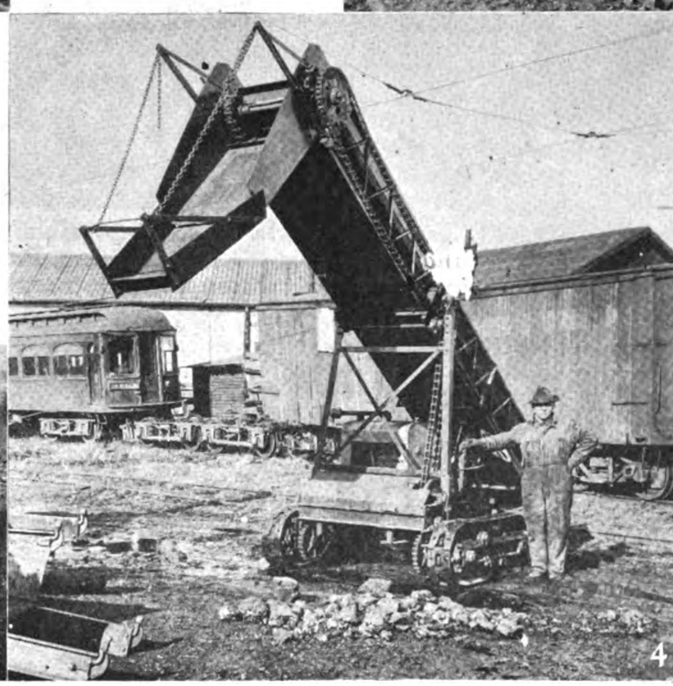
JOHN H. VAN DEVENTER, *President* — HARVEY CONOVER, JR., *Vice President*
JOHN R. DUNLAP, JR., *Secretary*

Index to Advertisers see page 104

1—This Barber-Greene Coal Loader saved the Independent Coal Company of Toledo \$.68 on every ton of coal loaded. It screens out slack as it loads.

2—Showing the Barber-Greene Coal Feeder discharging to Conveyors. It unloaded a 50-ton car in 55 minutes to inside storage.

3—Close-up of the Barber-Greene Bucket Loader in action. Note how the disc feeder is digging into the coal. This machine replaced a steam shovel at the Pennsylvania Edison Company.



4—The Barber-Greene Coal Loader, designed especially for handling mine run or lump coal. It handles 1½ tons of coal a minute, and can also be used for coke, cinders, dry clay or similar material.

5—A Barber-Greene Conveyor and 2 men unload a carload of coal in 95 minutes at the Diamond Coal & Coke Co. of Detroit.

How four companies profit by using Barber-Greenes

At the Wisconsin Lime & Cement Company it took three men 45 minutes to load an 8-ton truck with coal. A Barber-Greene Coal Loader was put to work, doing the same thing in 8 to 10 minutes—which is an 80% saving in time. With hand labor costing \$.50 an hour, the saving in money has also been considerable.

At the Pennsylvania Edison Company of Reading, Pa., a Barber-Greene Loader and Conveyor, with 3 men, replaced 13 men and 7 horses, handling 8 cars of coal and sand in a day.

At the Newark Plaster Company of New Jersey, a Barber-Greene Loader was called into competition with another loader, each one loading two trucks with gypsum.

The other machine required 85 seconds for its first load, and 80 seconds for its second. The Barber-Greene then handled its first load in 70 seconds, and its second in 45 seconds.

In writing of the comparison, Mr. Tomkins of the Newark Plaster Company said: "The test made in our yard clearly demonstrated the superiority of your machine for our particular work. The Barber-Greene Loader dug our material faster and we are especially pleased with the feeding device."

At the Diamond Coal & Coke Company of Detroit, a single Barber-Greene Conveyor and 2 men unload a car of coal in 95 minutes.

Judged entirely by their performance, Barber-Greenes offer you not only the most efficient, but the most economical means of handling your materials. And, as competition grows among coal dealers, it becomes more and more important to cut handling costs to the minimum. Our Catalog will show you definitely how you can add more profit to every ton of coal you handle. Send for it.

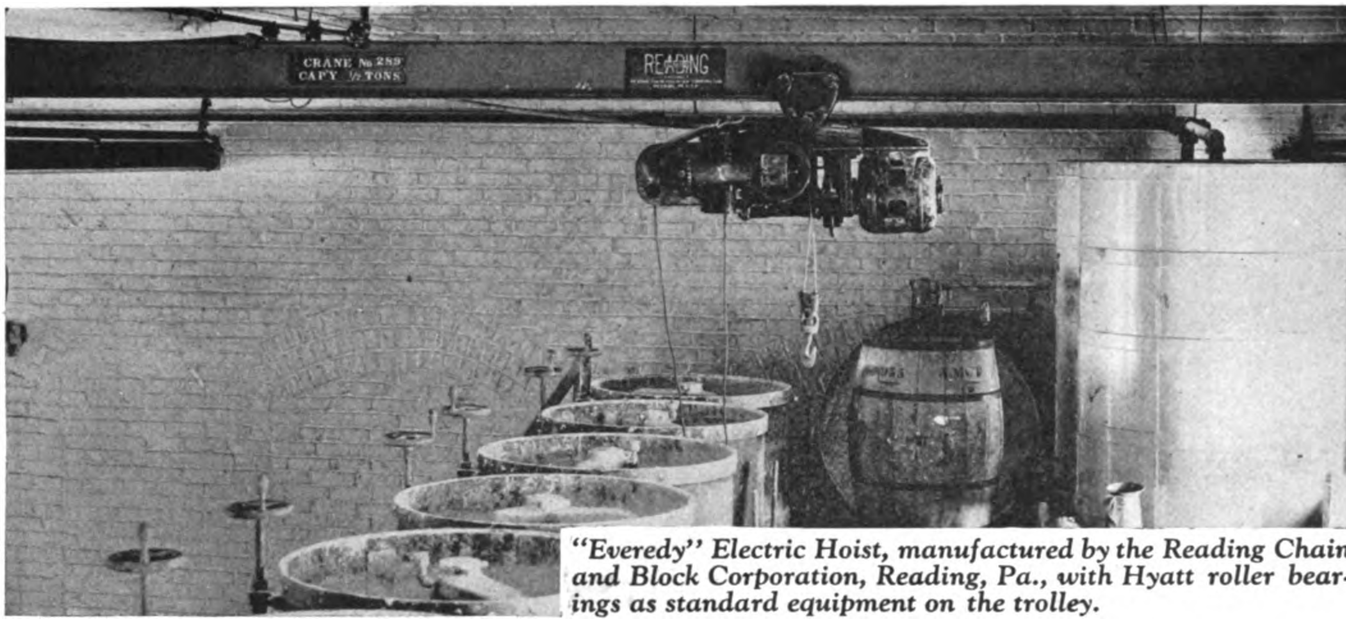
Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

Representatives in fifty cities

BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Automatic Ditch Diggers



"Everedy" Electric Hoist, manufactured by the Reading Chain and Block Corporation, Reading, Pa., with Hyatt roller bearings as standard equipment on the trolley.

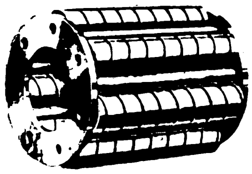
Moving Material Easily and Quickly

MANUFACTURERS and users of overhead handling equipment have proved the value of Hyatt roller bearings. The Reading Chain and Block Corporation, realizing the distinct advantages of these bearings, Hyatt equips all the trolleys furnished with the "Everedy" hoist.

Material can be easily and quickly handled with Hyatt equipped I-beam trolleys. They cut operating costs, release labor for more productive work and keep material on the move.

Hyatt bearing trolleys operate year in and year out without appreciable wear and without adjustment or other attention other than oiling three or four times a year.

You can have the benefits of dependable and economical performance in your cranes, trolleys and hoists by insisting on Hyatt bearings.



HYATT ROLLER BEARING COMPANY
NEWARK HUNTINGTON PITTSBURGH CHICAGO
WORCESTER PHILADELPHIA DETROIT SAN FRANCISCO
BUFFALO CLEVELAND MILWAUKEE MINNEAPOLIS

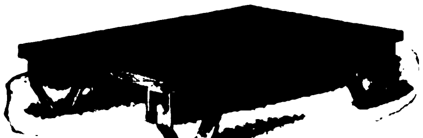
HYATT ROLLER BEARINGS FOR CRANES, TROLLEYS AND HOISTS

12,000 manufacturers *endorse* Cowan System

WHEN the Cowan Truck Co., originators of the "through-ticket" skid and truck system of reducing handling costs, started a few years ago to tell other manufacturers of their discovery, they had no idea that in so short a time 12,000 users would be listed as customers.

These 12,000 include not a few names of outstanding manufacturers known all over the world. To list even the different industries represented is impossible in the space available. Nevertheless, a few typical ones are given below.

Automobiles	Carbon Products
" Accessories	Carriages
" Bodies	Cartons (paper)
Bakery (wholesale)	Caskets
Batteries (Mfg.)	Cement
Bearings	Chemicals
Bindery	Clocks
Bleachery	Clothing (Mfg.)
Boilers	Collars (Cloth)
Bottlers	Concrete Products
Brass Goods	Confectionery
Brick (Mfg.)	Cork Products
Brushes	Dairy
Canners	Dept. Store



Cowan skids better than home-made

ONE manufacturer writes as follows: "Before adopting your skid we were using skids of our own manufacture, but your product is much superior to the skid which we made: in fact, none of yours which have been put into use have as yet been subjected to repairs which we feel is a very good recommendation for them in view of the time which some of these have been in service and the heavy loads which they have been obliged to carry as well as the nature of the same. Our own skids were being constantly repaired when used under the same conditions."

Photograph shows Cowan Electric Lift Truck picking up "skidded" load of coils of wire in plant of Geo. W. Prentiss & Co., Holyoke, Mass.

$9,700 more net profit

Not an unusual instance of the savings made by the Cowan System of reducing handling costs by eliminating unproductive labor

IN THE plant of Geo. W. Prentiss & Co., Holyoke, Mass., the Cowan System is saving $9,700 a year in wages alone. Twelve thousand other manufacturers are using this system, the amount saved depending on the size of the plant and the material to be handled. A Cowan Survey and Plan of your handling problems and costs will indicate, at no cost to you, a proportional saving which you can make.

Saves 40 to 60% of handling costs

COWAN equipment is not just merchandise, but a system of reducing handling costs through the elimination of unproductive labor. Forty to sixty percent. saved is common occurence, often amounting, as you can readily see, to thousands of dollars.

The basis of the Cowan System is the "through-ticket" skid, which may be compared to a movable section of floor space. The skid and the load which it supports may be picked up by a Cowan Truck, carried to a new location, and set down without loading or unloading. This elimination of repeated loading and unloading, as raw materials progress through your factory into finished products, saves time and money.

Survey and plan at no cost to you

REGARDLESS of the size of your plant, or of how much equipment would be required to put the Cowan System into operation, or whether you would need Electric or Hand Lift Trucks, you can engage us, at no cost or obligation, to make an engineering survey and plan that will show you in dollars and cents what this system can do for you.

Send today for complete information

THOUSANDS of manufacturers are today making worth-while savings with the Cowan System. What it has done for them, it can do also for you. Cut out the coupon below, write name and address on it as indicated, and mail to us for complete information on this important subject. Cowan Truck Co., Dept. . .A-2., Holyoke, Mass.

COWAN
"TRANSVEYORS"
HAND AND ELECTRIC LIFT AND CARRY TRUCKS

COWAN TRUCK CO., Dept. A-2 Holyoke, Mass.
Gentlemen: Please send complete information about the Cowan System of Reducing Handling Costs to:

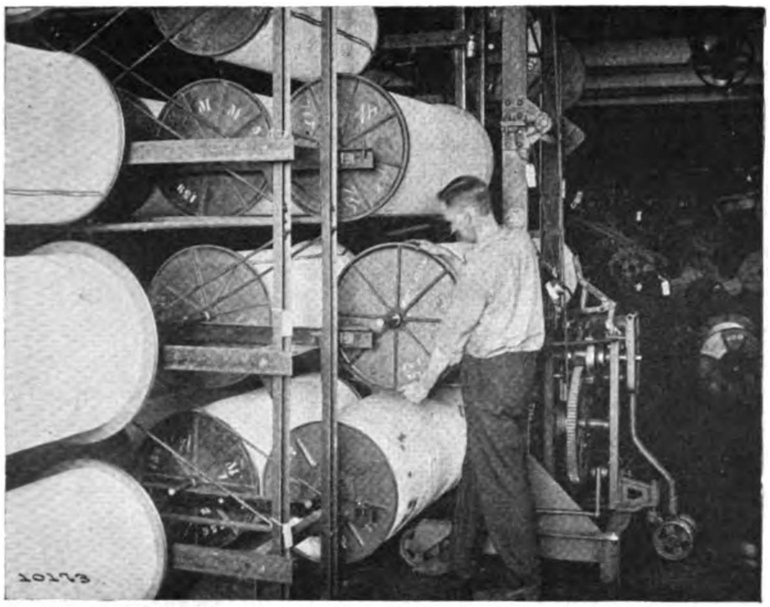
Name of Company ....

Name of Individual ....

Street ....

City .... *State* ....

We do......we do not......use lift trucks at present (please check). (Please send along as much information as you can conveniently about your handling conditions and problems.)



Hyatt bearing equipped Economy Little Lifter manufactured by The Economy Engineering Co., Chicago, Ill. This photograph was taken in the Monument Mills, Housatonic, Mass.

Another model of Hyatt equipped Economy portable elevator, being used for loading and unloading freight cars.

Easy Lifting Of Heavy Loads

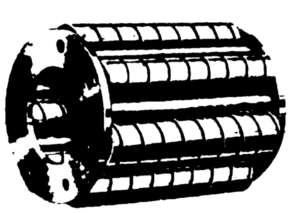
EFFECTIVE performance of heavy duty elevating and stacking trucks is dependent largely upon bearings that eliminate friction, stand the shocks of abuse and overloading and that require little attention.

Such bearings keep the trucks in uninterrupted operation, speed up work and save power and labor.

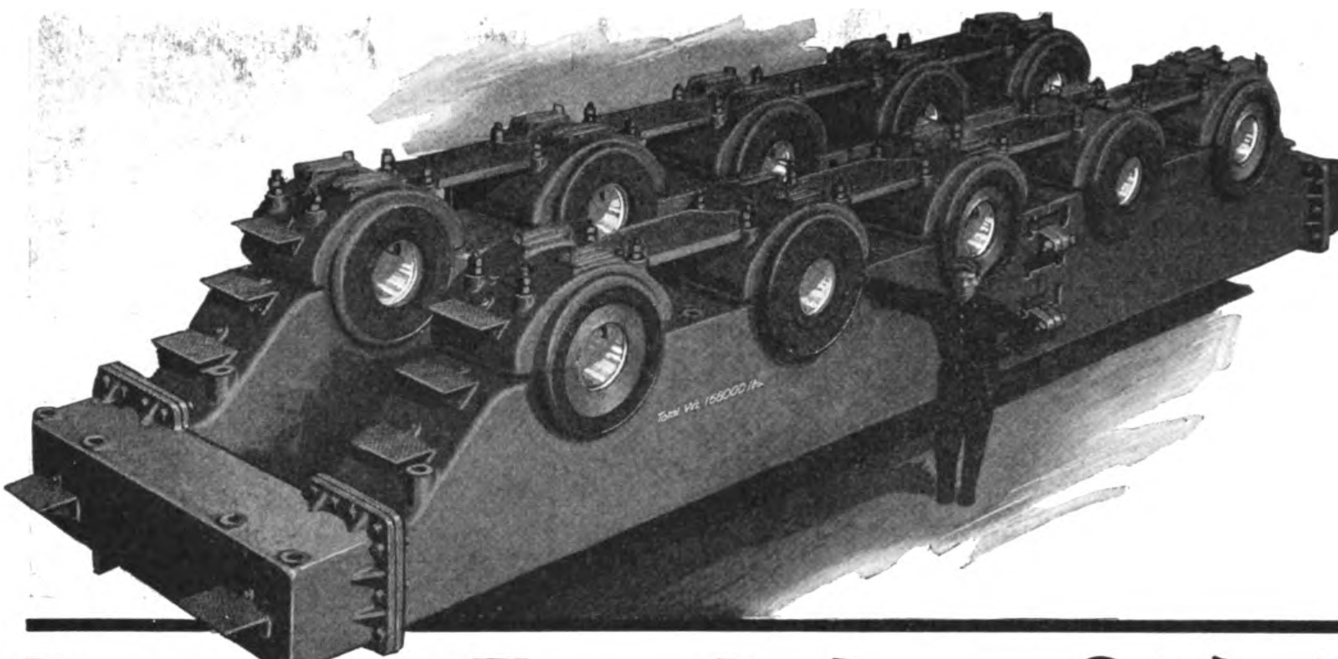
The Economy Engineering Company, appreciating the importance of the right bearings, standardized several years ago on Hyatt roller bearings and now builds them into all of its portable elevators.

In the hand operated types, the easy turning of the Hyatt bearings saves human energy and greatly adds to the volume of material handled. Corresponding advantages in the power driven models are power saving and increased speed of operation.

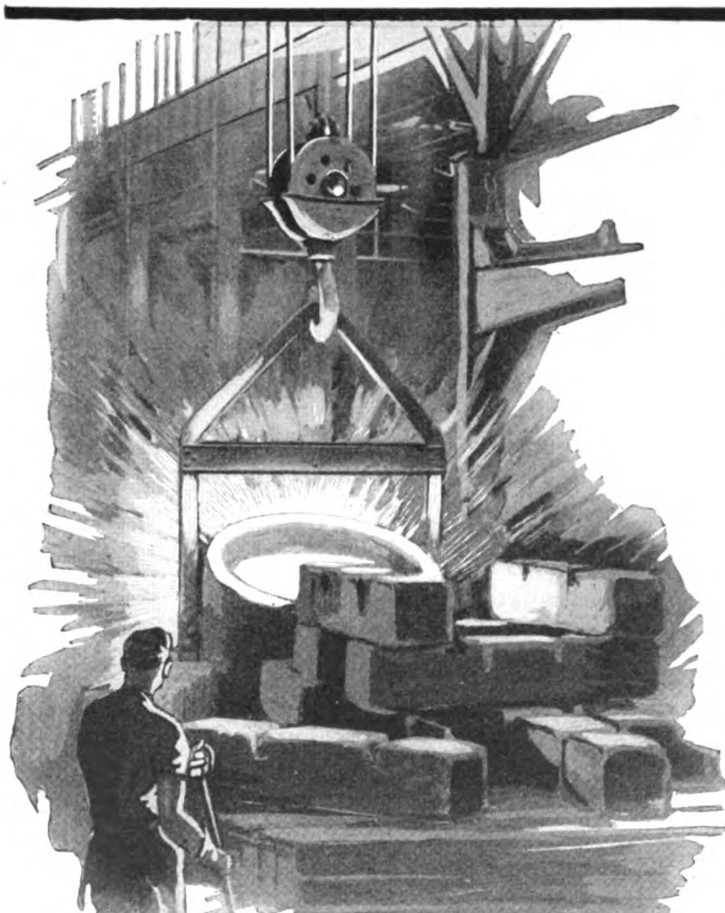
For fully reliable and economical material handling in your plant specify Hyatt roller bearings on all equipment.



HYATT ROLLER BEARING COMPANY
NEWARK DETROIT CHICAGO SAN FRANCISCO
HUNTINGTON PHILADELPHIA PITTSBURGH MINNEAPOLIS
WORCESTER BUFFALO CLEVELAND MILWAUKEE



Pounds or Tons-*Dodge can Make it*



INDUSTRY'S diversified requirements for power transmitting and special built to order equipment ranging from the smallest pulleys, hangers, etc., to the 84 ton rolling mill bearing pictured above have been supplied by Dodge for over forty years.

Experienced engineers, skilled mechanics and the modern facilities of two big factories make Dodge the nation's market place for power transmitting equipment, elevators, conveyors and special machinery.

Three factory warehouses, fourteen branches and five hundred local dealers supply a service that offers complete protection to the man responsible for uninterrupted production.

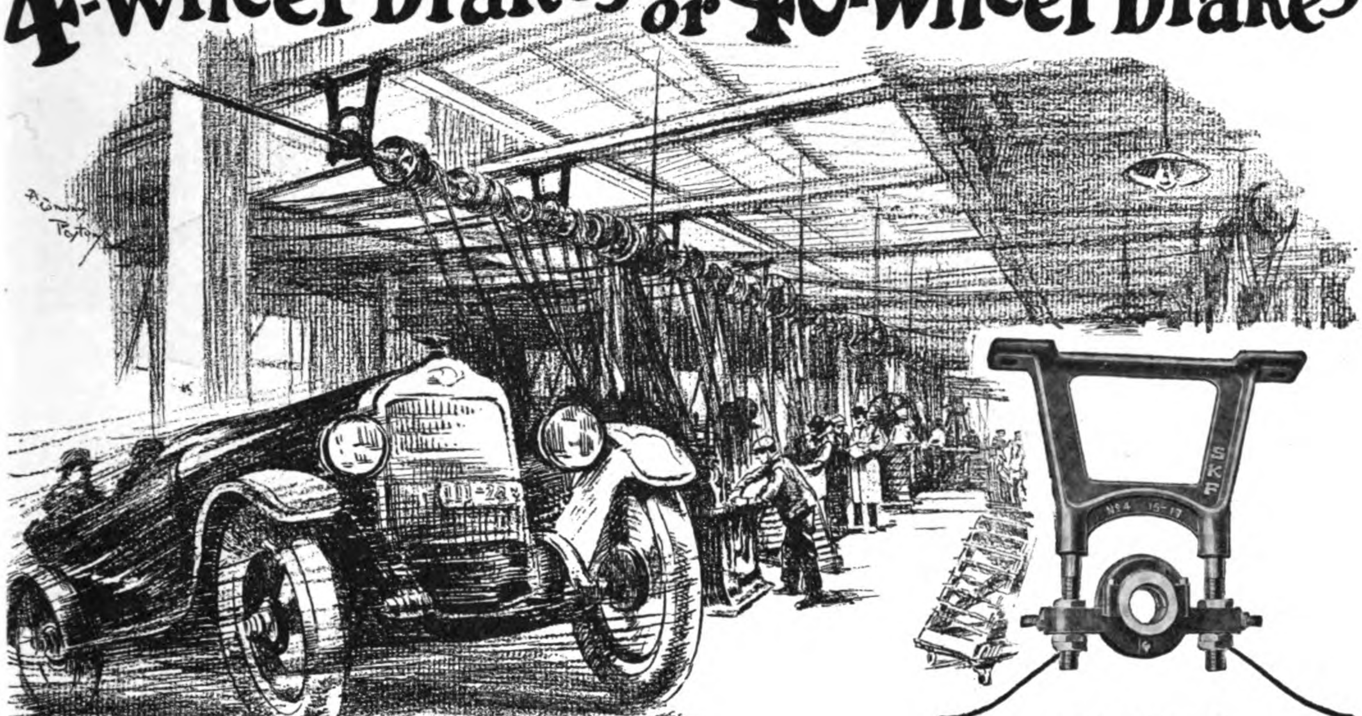
DODGE

DODGE MANUFACTURING CORPORATION *General Offices:* Mishawaka, Indiana *Works:* Mishawaka, Ind., and Oneida, N. Y.

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF **Power**

Branches: New York, Atlanta, Philadelphia, Minneapolis, Pittsburgh, St. Louis, Boston, Houston, Cincinnati, Seattle, Newark, San Francisco, Chicago

4-wheel brakes or 40-wheel brakes



THE automotive engineer gives the world a supposedly new principle for STOPPING automobiles. He has made FRICTION work for him. He has multiplied its usefulness by two.

And yet this principle of multiple brakes is *not* new. It has been employed for years in the very plants that today are heralding the development of a new braking system. It has been employed, not in the form of 4-wheel brakes but, often, in the form of 40-wheel brakes!

Count the plain bearings in use in your plant and KNOW just what braking power is being applied to your transmission equipment. Every plain bearing in use is applying friction to your shafting just as surely as you apply it to your brake drums through your brake pedal.

Let our engineers estimate on Skayef Self-Aligning Ball Bearing Hanger Equipment and prove to you that it is costing more to USE plain bearings than to REPLACE them.

For Nearest Distributor See MacRae's Blue Book

1161

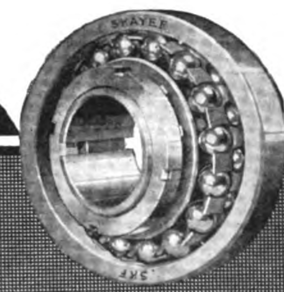
SKAYEF
—the 4-Saving Hanger

1st Saving Skayef Hangers save from 50 per cent upward of the energy which plain bearings consume in friction. This means a saving of 15 to 35 per cent of your power cost.

2nd Saving Considerable time is saved by eliminating shutdowns for replacing or adjusting bearings; forced idleness of machines and men is a cost-factor too big to be ignored.

3rd Saving Lubricant consumption reduced 60 to 80 per cent as compared with plain bearing hangers. Lubricant required only at infrequent intervals and it cannot leak out and ruin belts or product.

4th Saving There is no discernible wear of the hard steel balls and races and absolutely no shaft wear. Dust and grit cannot enter the bearings and Skayef self-aligning ball-bearings have the exclusive inherent ability of compensating automatically for shaft deflections.

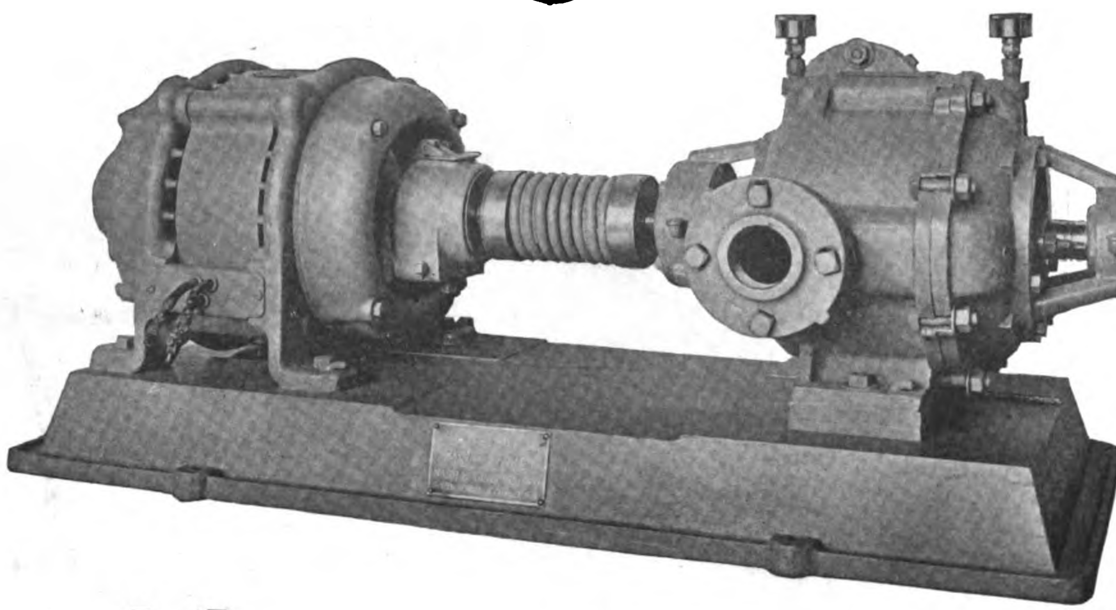


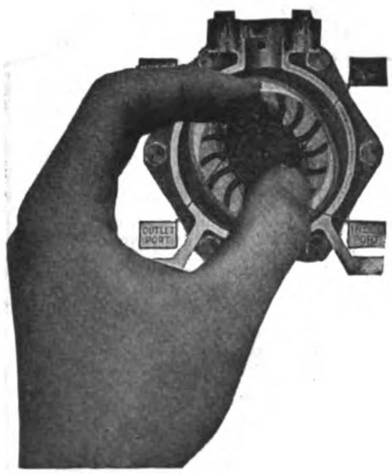
SKAYEF
Self-Aligning Ball-Bearing
HANGERS

Made Under
SKF
Supervision

THE SKAYEF BALL BEARING COMPANY . . . . 165 Broadway, New York City

NASH HYTOR





An Original of this Graph Furnishes a Demonstration

MEANWHILE, consider the special advantages of Nash Hytor Vacuum Pumps on dry and wet vacuum service. First and foremost, no precautions need be taken to prevent slugs or liquid reaching the pump. They handle liquids and air with absolute reliability.

They therefore make ideal, economical equipment for application on—

SUCTION FILTRATION
CLOTH DRYING GAS EXHAUSTION
PAPER MILL SERVICE
Flat Boxes—Wires—Felts—Suction Rolls

By using special liquids as the displacing medium, Nash Hytor Vacuum Pumps often provide a simple solution to difficult chemical problems such as handling chlorine gas.

Other characteristics are pulsation-free vacuum and thoroughly washed air or gas—whichever is being handled.

We'll be glad to furnish you with complete descriptive data and the movable graph which illustrates the operating principle. May we do so?

NASH ENGINEERING CO.

South Norwalk, Conn., U. S. A.

Industry Illustrated
The Pictorial Presentation of Practical Management
JOHN H. VAN DEVENTER, EDITOR
W. THOMSON LEES } Associate Editors
MATTHEW W. POTTS }
ADOLF SCHILDKRAUT
Art Director

Editorial

Men and Ideas

MOST of us know that the art of printing dates from the middle of the fifteenth century, when John Gutenberg conceived the idea of using movable type. Yet records show that printing was known in China as far back as the latter part of the sixth century. So, too, with the making of paper, of glass, of gunpowder, of many drugs—these things, which the Western world discovered or invented at various times, had already been discovered or invented by Chinese scholars many centuries earlier.

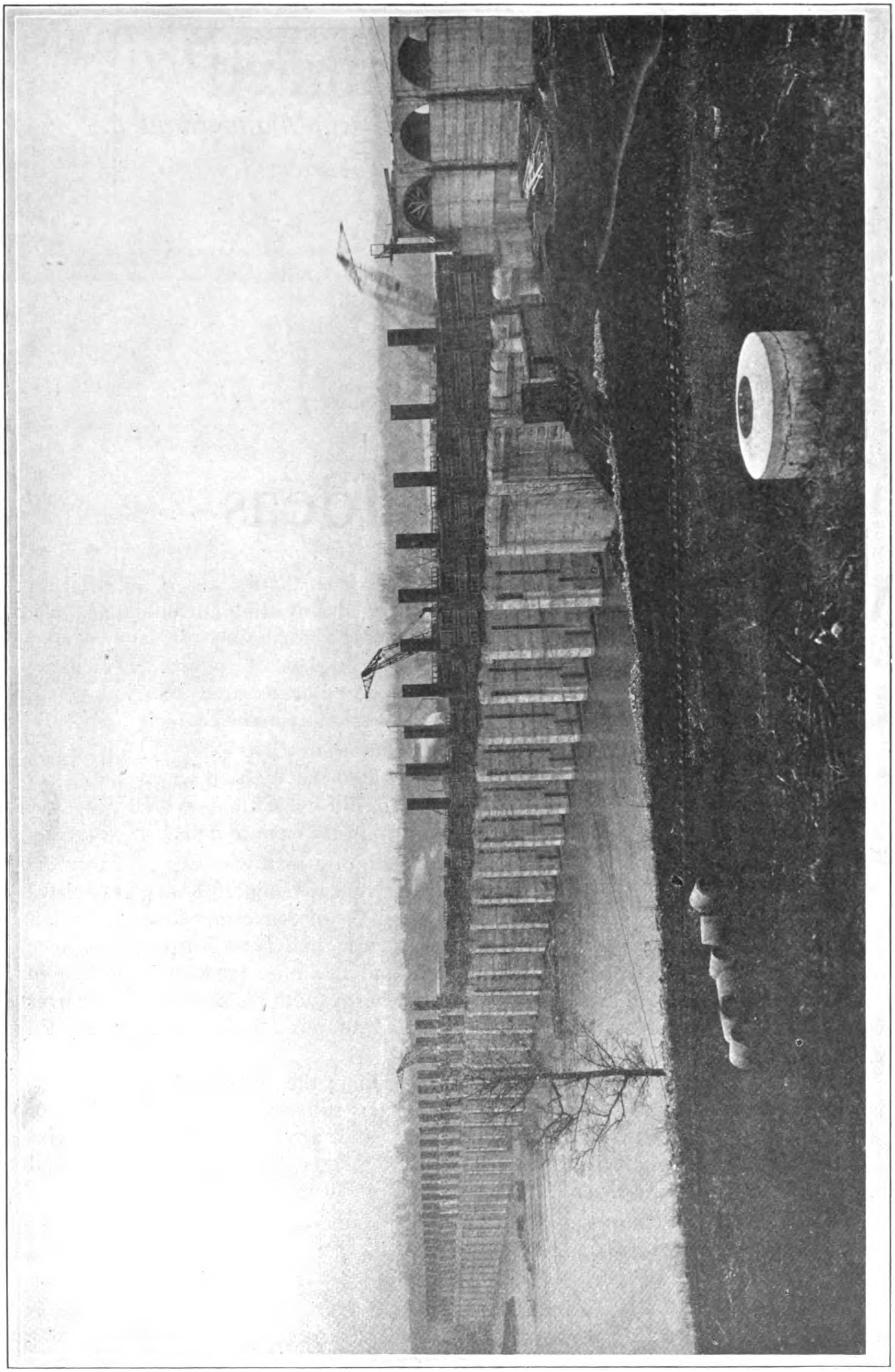
In the march of civilization, each of these inventions or discoveries was an *idea* of real, practical worth; each of these ideas, as it came to the Western world, helped to push civilization forward and upward. Why, then, did not China—which possessed these ideas so much earlier—why did not China lead in the onward march of progress?

A few months ago, in Russia, occurred the death of a man who was probably the best-loved and most-hated figure in recent history—Nicolai Lenine. A man of decisive force and driving power, he was animated by the object of converting first Russia and then the world to an idea—Socialism. He had power such as no Russian Czar ever enjoyed, force and energy far above the average, and an almost fanatical following to do his bidding. Why, then, with all his dynamic energy, with his absolute power over Russia's immense resources—why did Lenine fail to put his *idea* into successful operation?

Here are two of the most tragic failures in history; the one, negative, the other, positive. Tragic, because of the prolonged needless suffering of untold millions of people through famine and disease. On the one hand, a wealth of practical, useful ideas wasted through lack of force and energy; on the other, leadership and force and power misapplied because devoted to an impractical idea.

Ideas, alone, are valueless. Even practical ideas, unless backed up by the driving force to carry them into execution, are but dreams. Energy, driving power, unless coupled to a practical idea, is not merely useless—it is destructive.

Many men are capable of originating ideas. Comparatively few are able justly to appraise the worth of an idea. And rare indeed is the man who combines with these two faculties the energy and driving force which convert the static idea into the dynamic actuality.



A view of the north end of Wilson Dam, from up-stream. The roadway shown at the extreme right will, when completed, extend across the dam. The water level will, of course, be materially higher than shown here.

Who's Who in Muscle Shoals?

A Review of the Present Offers and the Men Behind Them

By John H. Van Deventer

"WHAT shall we do with Muscle Shoals?"

Five years ago this question was asked with mild interest by a few army officers and government officials. Today it is perhaps the biggest question before the engineering world and there is no citizen able to read or write who is unaware of the political and industrial agitation which this big question mark has created in all sections of our country.

While every intelligent American knows that a number of offers have been made and are being considered for this gigantic industrial property, it is doubtful if many beside those who have made an intimate study of the situation are conversant even with the general terms of the various bids. It is also probable that even among those who may be more or less familiar with the fact that Henry Ford, the Associated Power Companies, the Union Carbide Company and the Hooker - Atterbury - White Corporation, have made separate proposals, there are many who do not know the leading personalities back of these various plans. In affairs of this sort it is the *man* rather than the *plan* which counts and it is with the intention of introducing to our readers the men who are back of the various bids for Muscle Shoals, as well as to the gist of the bids, that we have prepared and are presenting this article.

But first let us give a very brief description of the Muscle Shoals "project" so called, so that we may have this as a background in studying the various men and their different plans.

Muscle Shoals is located on the Tennessee River, near Sheffield in the northwestern corner of the state of Alabama. The district through which the Tennessee River flows is rich in mineral, timber and agricultural resources. In addition to these natural advantages, the river has a fall of 134 feet in a distance of thirty-seven miles in the shoals section, providing power possibilities for nearly a million hydraulic horsepower. The development of this power requires the construction of a series of dams, for two reasons; first, because the Tennessee is a comparatively shallow stream, scarcely more than five feet deep at high water and without abrupt

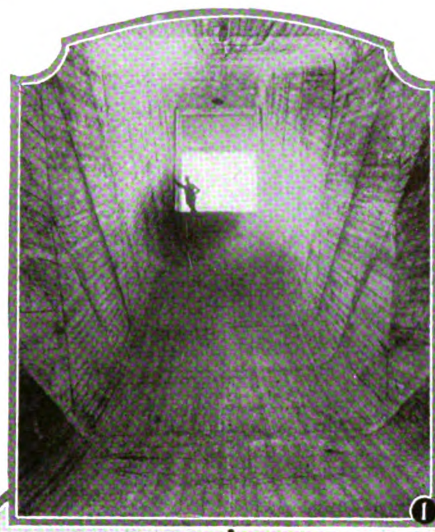


Fig. 1. Above—one of the penstocks leading to the turbines of the Wilson Dam power house.

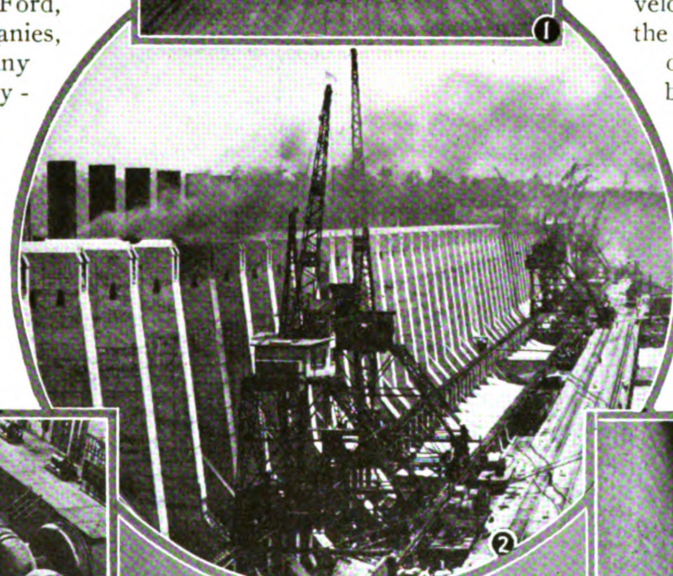


Fig. 2. Spillway section of Wilson Dam—the "biggest dam that has ever been built in the world."

Fig. 3. Inside the power house, where huge turbo-generators transform the water-power into current.

Fig. 4. Draft tube section of a turbine setting, showing the water's path after leaving the turbine.

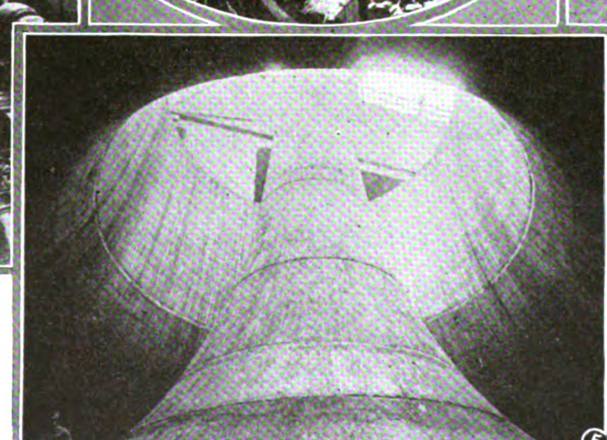
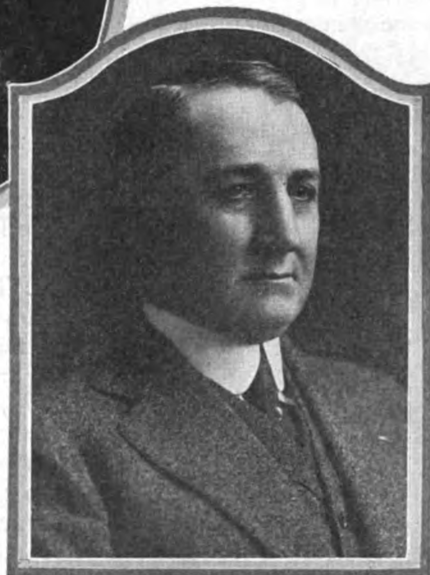


Fig. 5. View of one of the immense turbine settings at Wilson Dam power house.

falls, and second, because the volume of water flowing in this stream varies seasonally and according to rainfall from an enormous amount to a comparatively small quantity. Thus, to make use of the power possibilities of this river the surplus in periods of heavy rainfall must be conserved or stored in artificial lakes created by dams since otherwise there would be no regularity of supply.

Previous to the war this section was comparative wilderness. And in fact, even now, in spite of the development work for war purposes which has been started and completed in this section by the government, it is still rather wild and impenetrable country. If some of the venturesome purchasers of lots in real estate devel-

Thomas W. Martin, president of the Alabama Power Company, and one of the outstanding figures back of the proposal of the Southern Power Companies. Mr. Martin is a lawyer by training, a graduate of the University of Alabama, and chief executive of a large number of Southern manufacturing and power corporations.



Thomas H. Tutwiler, president of the Memphis Power and Light Company and of the Memphis Street Railway Company, is associated with Mr. Martin in the bid of the Southern Power Companies. He is an engineer of distinction; had charge of the New Orleans Street Railway System for nine years, then became engineer for the Birmingham Street Railway. In 1903 and 1904 he rehabilitated the Nashville Street Railway System.

Hugh Lincoln Cooper, supervising and designing engineer for the entire Muscle Shoals project, has been engaged in hydraulic engineering and power development since 1891. Among other great constructions he is responsible for the Keokuk, Iowa, hydroelectric plant of the Mississippi River Power Company and the Toronto Power Company's plants at Niagara Falls.

Henry Ford needs no introduction to our readers. Twenty-five years ago a mechanic earning a few dollars a day, today the richest man in the world. This genius for organization has made an individual offer to lease and develop the world's greatest hydraulic power project.

The view extending across these two pages is the Nitrate Plant at Muscle Shoals. Rushed into beopments now offered by unscrupulous promotion sharks should attempt to locate their own holdings or to find the elaborate golf courses, country clubs, hotels and city streets that are indicated on the real estate dealers' maps, they would be compelled to search for them in airplanes to keep out of the entangling growth of primitive underbrush.

This district was selected by the United States Government in February 1918, as a suitable source of power and raw materials for the production of nitrogen from the air for military purposes. Previous to this, laboratory research in nitrogen fixation had been carried on and the U. S. Nitrate Plant No. 1, located at

(*Continued on page* 62)

J. G. White is recognized as one of the foremost builders of hydro-electric power and transmission lines, steam-power and industrial plants in America. He constructed Nitrate Plant No. 1 and the steam power station of Nitrate Plant No. 2 at Muscle Shoals and at Syracuse, New York, has built the only successful Haber nitrate plant in the United States.

W. W. Atterbury is vice-president in charge of operations of the Pennsylvania Railroad system, and considered one of the ablest transportation executives in the railroad business. He was chosen by the United States Government to direct and operate the railroads in France during the Great War, because of his record for efficiency and for the successful management of men.

Elon H. Hooker, president of the Hooker Electrochemical Company of Niagara Falls, and trustee of the University of Rochester, has been engaged for thirty years in the application of water power to industrial chemistry. He is now completing at Niagara Falls on a large scale the most modern process for producing ammonia. He is president of the Manufacturing Chemists' Association.

Maj.-Gen. Lansing H. Beach, Chief of Engineers of the United States Army, is the head of the Corps of Engineers of the U. S. A. which has been directly concerned with the actual construction of the Muscle Shoals Dam and Nitrate Plants in accordance with the plans of Mr. Cooper.

ing through war needs, the war ended before this plant was ready for operation.

The Watchdog of Industrial Production

Lubrication and Its Many Problems

By Allen F. Brewer

THE matter of production has developed over the past decade into the essential factor in industrial plant operation. Primarily it is based upon intensive operation and maximum machine efficiency, but to many these are a rather vague basis. Actually, what do they mean? Efficiency has been rather overdone in its application to everything from the steam turbine down to the wheelbarrow; intensive operation in turn is also subject to a wide range of interpretation.

Perhaps the clearest explanation of their meaning is:—The production of the maximum amount of product over the shortest period of time, with the consumption of the minimum amount of power and labor and the development of the least possible wear and tear. All these conditions are tied up to one ultimate proviso:—the reduction of friction to a minimum, so the remedy for friction—*lubrication* becomes the essential factor. Neither steam, electricity, nor water power can be effectively used unless we give the strictest attention to lubrication, for every machine must involve a certain number of wearing parts, and any unnecessary development of friction between these will naturally require the use of more power to overcome it in order to develop the desired output.

In the attainment of effective lubrication there are three defi-

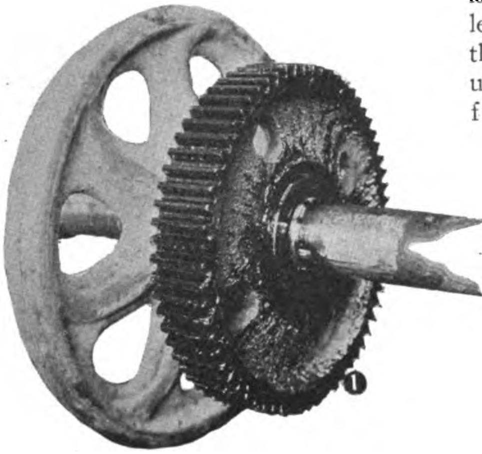


Fig. 1. Trolley car gears are a piece of equipment where careful lubrication is decidedly essential. A heavy bodied, semi-solid mineral gear lubricant has been found to meet these conditions most effectively.

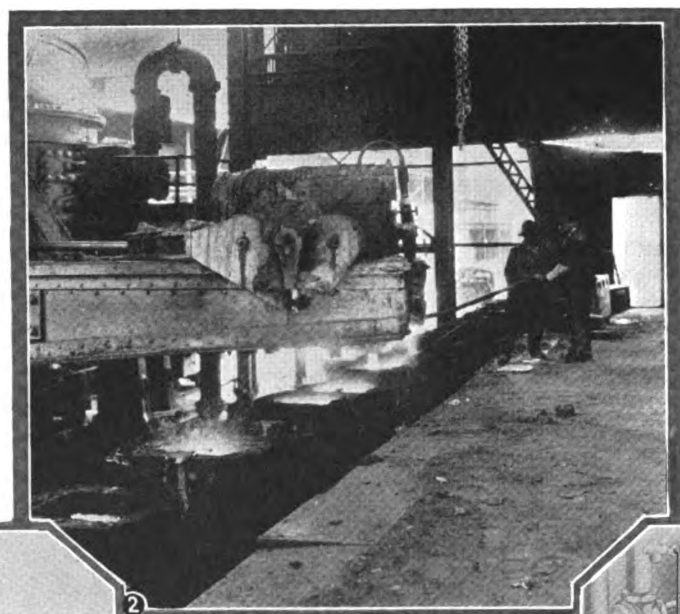


Fig. 2. In the operation of the Bessemer converter there is considerable heat, dust, dirt and flying metal at hand, and lubricants, more than anything else, suffer the consequences. For gears a mineral lubricant which will resist heat, prevent the entry of dirt or other foreign matter, and stick to the wearing surfaces tenaciously should be used. For bearings it is the custom in many mills to use the cheapest oil available, and plenty of it.

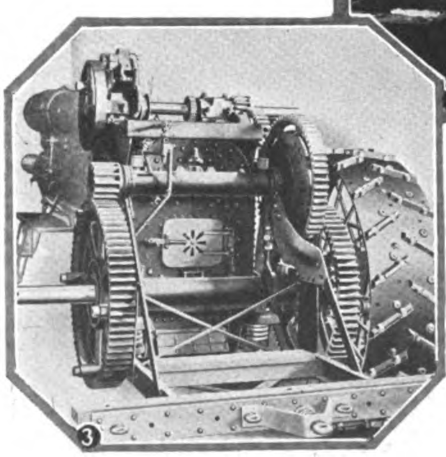


Fig. 3. The driving gears of the steam traction engine are located in close proximity to the traction wheels. These latter operate sometimes several inches deep in mud. Therefore, it takes little imagination to picture the adjacent gears literally running in mud. So a specially prepared, straight mineral lubricant of high adhesive characteristics is necessary.

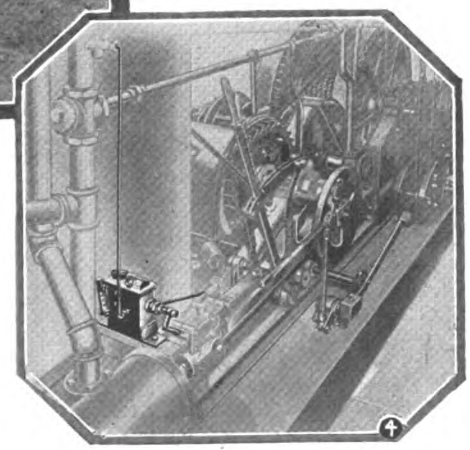


Fig. 4. Where hoisting machinery is concerned, steam engine lubrication is a decidedly important factor on account of the detrimental operating conditions to which the cylinder oil is subject. For example, frequent starting, stopping, and reversing is so customary that it is a relatively difficult matter to get any steam cylinder oil to resist the abnormal effects of condensation, unless it is practically flowing into the cylinder. The automatic force feed lubricator has been found to meet these conditions most effectively.

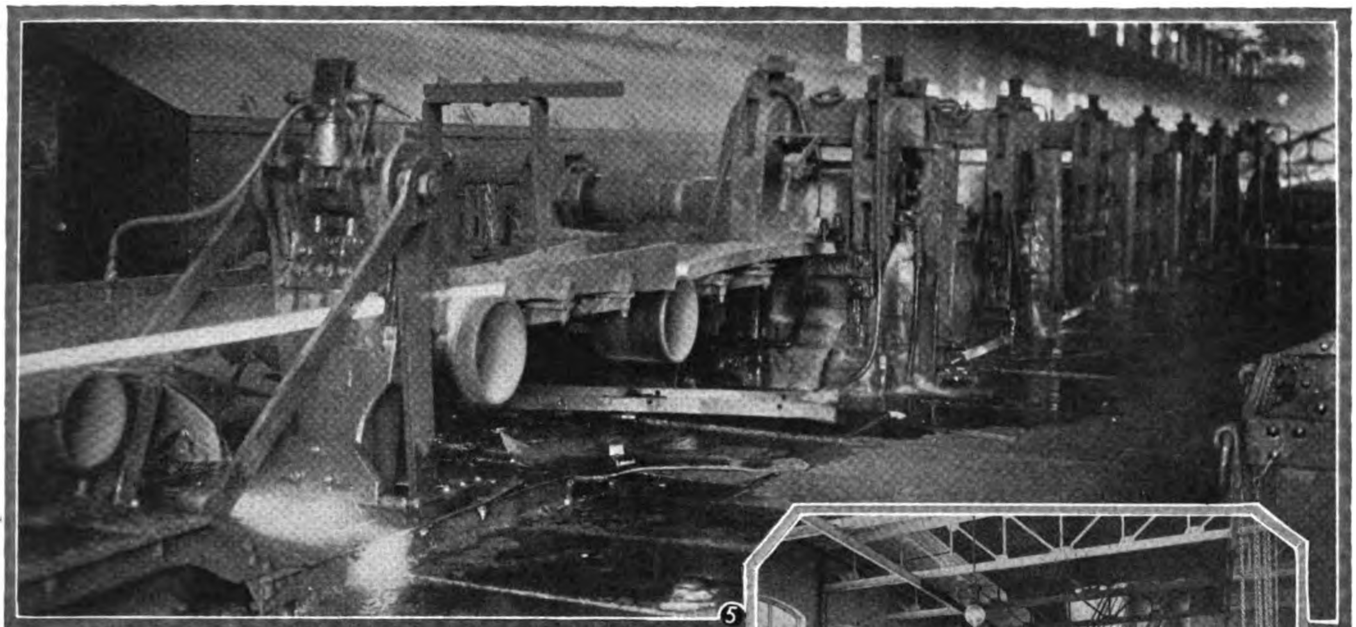


Fig. 5. Maximum production is nowhere more in evidence than in the steel industry. The rolling of red hot bars and billets is but a typical example, where extreme pressures are exerted upon all bearings and gears, and heat, dirt and water are in constant attendance to contaminate the lubricants and hamper their effectiveness. Lubricants must, therefore, be most carefully refined; gear compounds to resist the washing action of hot water and the thinning out action due to heat; bearing lubricants to withstand oxidation and contamination from flying slag, scale, dust, and dirt.

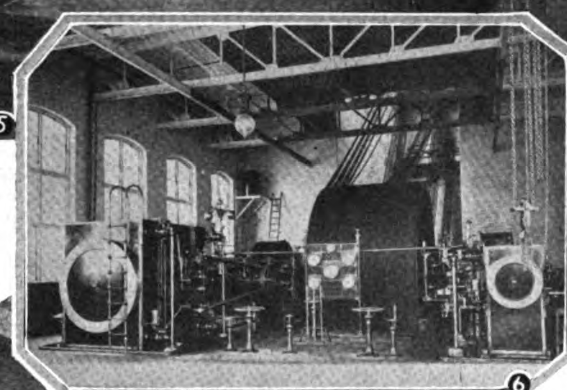


Fig. 6. Here, for example, opposite phases of lubrication are met with, for wire rope is certainly different in its lubrication requirements from the average steam engine. Penetration to the innermost strands of the rope is important, but if the lubricant does not stick tenaciously to the rope there will be possibility of its being thrown off, to contaminate the more carefully refined steam engine lubricants.

nite factors requiring of consideration:—

1. The operating conditions existing.
2. The means of lubrication, or the lubricating equipment at hand, and
3. The grade of lubricant required to meet these conditions.

To a considerable extent these are so closely related that it is often impossible to consider them independent of each other. For this reason none should be overlooked, even though the matter of price is seemingly the governing factor. Difference in operating conditions will always impose different requirements upon lubricants and call for care in their selection. For example, the bearings of a steam turbine will require quite a different lubri-

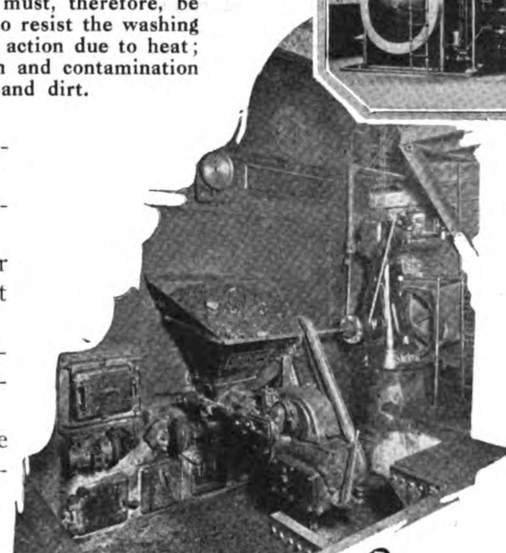


Fig. 7. The dirty conditions which are frequently so prevalent around boiler rooms persist in accompanying the automatic stoker, especially where fuel is fed to the hopper by hand. Bearings are preferably grease lubricated, the use of compression grease cups in particular keeping a sufficient amount of lubricant working its way through clearance spaces to prevent the entry of abrasive foreign matter. Gears and chains require a semi-solid, mineral lubricant with a high adhesive characteristic.

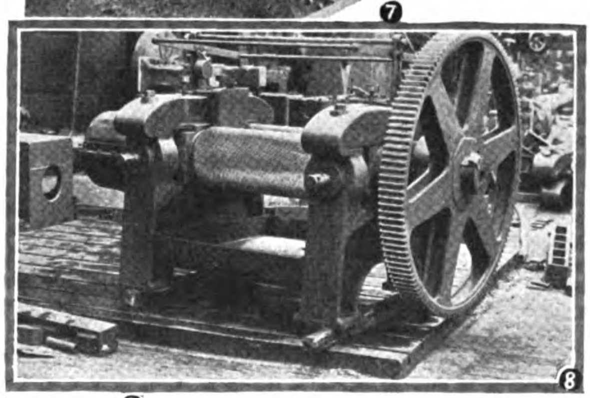


Fig. 8. Gear and bearing lubrication in the rubber industry on the various types of rolls involved is a problem due to the frequent excess of talc, dust and other foreign matter which can gain easy access to the lubricants. Waste machine or engine oil is often preferable for gear lubrication, recommendations being to change it frequently. Bearings, if lubricated by some form of automatic lubricator, will be effectively protected.

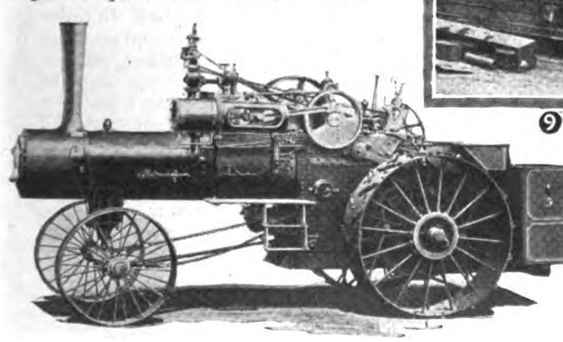


Fig. 9. The steam traction engine so extensively used in many parts of the world has proven one of the most difficult pieces of apparatus to lubricate. Here we select a high grade steam cylinder oil, with a good deal of compound, for the more of the latter the better will it resist the washing action of water.

cant from a set of rough, exposed gears; or a line shaft hangar dangerously located may necessitate the usage of automatic lubricating equipment of far more intricate nature than usual to get away from the dangers of hand lubrication. There are, therefore, any number of intricate problems involved in the lubrication of any industrial plant. Of course many of these are quite alike and can be handled in much the same manner by use of similar grades of lubricants. Other conditions, however, will require exhaustive investigation, especially where intricate process machinery is concerned, if we are to attain the maximum of machine efficiency and keep production up to standard.

In the usage of many grades of lubricants, just as in their manufacture, too little attention is often paid to the probable ultimate operating conditions they will

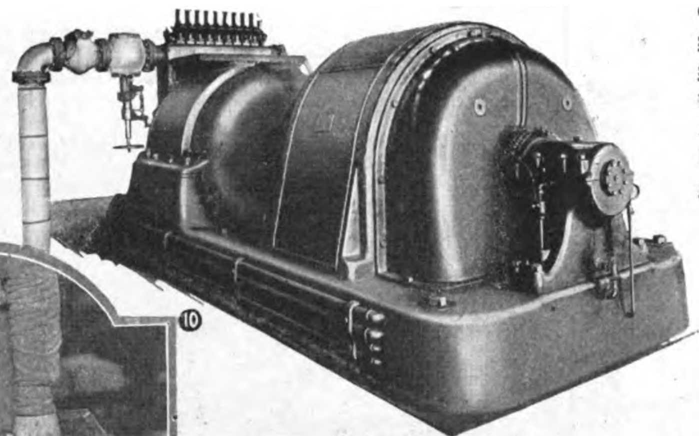


Fig. 10. The steam turbine involves probably more exacting requirements from a lubricating point of view than any other type of power plant equipment. The essence of efficient turbine operation is high rotational speeds and continuous service. Furthermore, bearing clearances are relatively low. The lubricant must, therefore, be capable of functioning perfectly without emulsification or sludging. The actual selection of a steam turbine oil will depend upon the type of lubricating system installed.

Fig. 11. Pneumatic tools operate under relatively low temperatures due to the expansion of the air in passing through them. Unless this air has been sufficiently preheated certain grades of lubricants may, therefore, be cooled to their points of congealment. It is, therefore, always advisable to select a low pour test oil. Naturally heavier tools will require heavier bodied oils; some are even built for grease lubrication.

Fig. 12. The operation of hoisting machinery in the shipyards must be carried out in all sorts of weather conditions. Certain of the equipment requiring lubrication can be housed, and thereby protected. Wire rope, however, must operate exposed. In order to insure the effective penetration of the lubricant, it should be applied hot, preferably by means of some form of split box through which the wire rope can be drawn. The lubricant should be a straight mineral product, semi-solid in nature, with a highly adhesive characteristic, for it must resist the washing action of water and the squeezing out action which occurs when it passes around the sheaves.

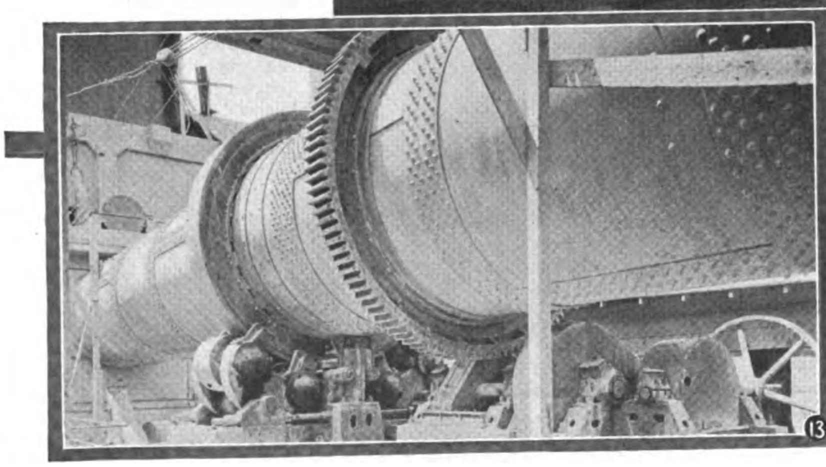


Fig. 13. Another industry where intensive demands are imposed upon the lubricants is the making of cement. Kilns especially involve high pressures, temperatures and oftentimes considerable dust and dirt. It has been found that straight mineral gear compounds, semi-solid in nature, of relatively high viscosity will meet these conditions most effectively. Bearings, on the other hand, may be lubricated with either mineral oils or greases.

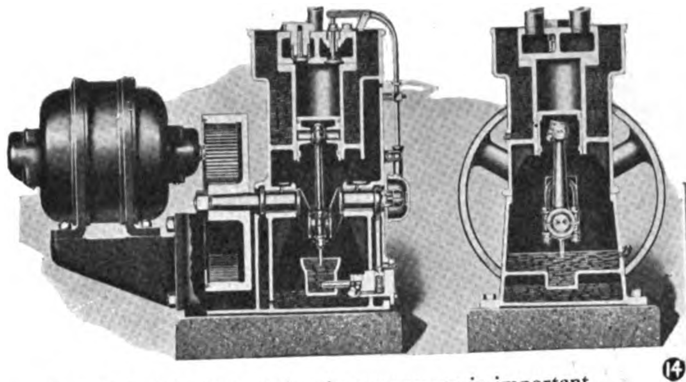
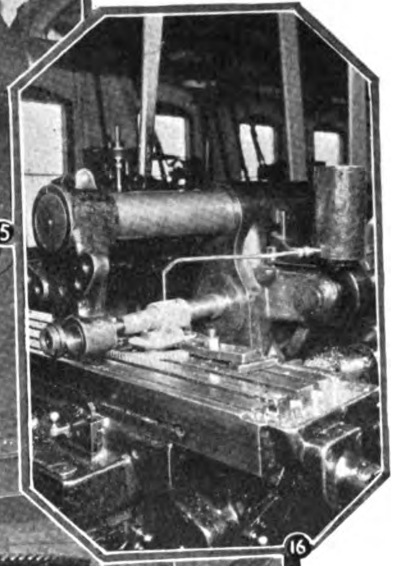


Fig. 14. Lubrication of the air compressor is important due to the possibility of feeding too much oil to the air cylinders, with the ultimate result of carbonaceous deposits occurring in the air lines. Here the rate of feeding is, therefore, a primary factor. On the other hand, the oil must always be a specially refined product which will show as little tendency as possible to throw down carbon. An air cleaner should be used whenever the intake air is not clean. An added precaution is to clean out the system at regular intervals.

Fig. 15. The silent chain is one of the distinctive advancements in the field of power transmission. It is decidedly advantageous for usage where silent operation is a factor, and where the distance between the driving and driven shafts is too short for efficient belting, and yet too great for the use of a gear drive. The manner of lubrication of silent chains will depend to a considerable extent upon the manner of guarding or the provisions for bath oiling. Wherever possible, bath oiling should be used, the lubricant having a viscosity of perhaps a heavy engine oil.

Fig. 16. In the machine shop lubrication plays a most important part due to the accurate work which must be done on practically all the machines. Metallic particles, dust, dirt and sometimes water have to be contended with in many cases.



have to meet. The consumer tends so frequently to regard the matter of price as paramount, in the false belief that "oil is oil," that his machinery is often subjected to far greater depreciation and possibility of breakdowns than necessary. In other words, neglecting to study his lubricating requirements may be the cause of all manner of future operating difficulties. In such instances the oil is certainly not entirely to blame. It may be absolutely unsuited to the operating conditions and lubricating equipment involved, but on the other hand, it may be a perfectly good product which would give eminently satisfactory service when properly used. There is altogether too much value involved in the average machinery installation to run the risk of its dissipation by the use of haphazard lubricating methods. Furthermore, such machinery, if it is

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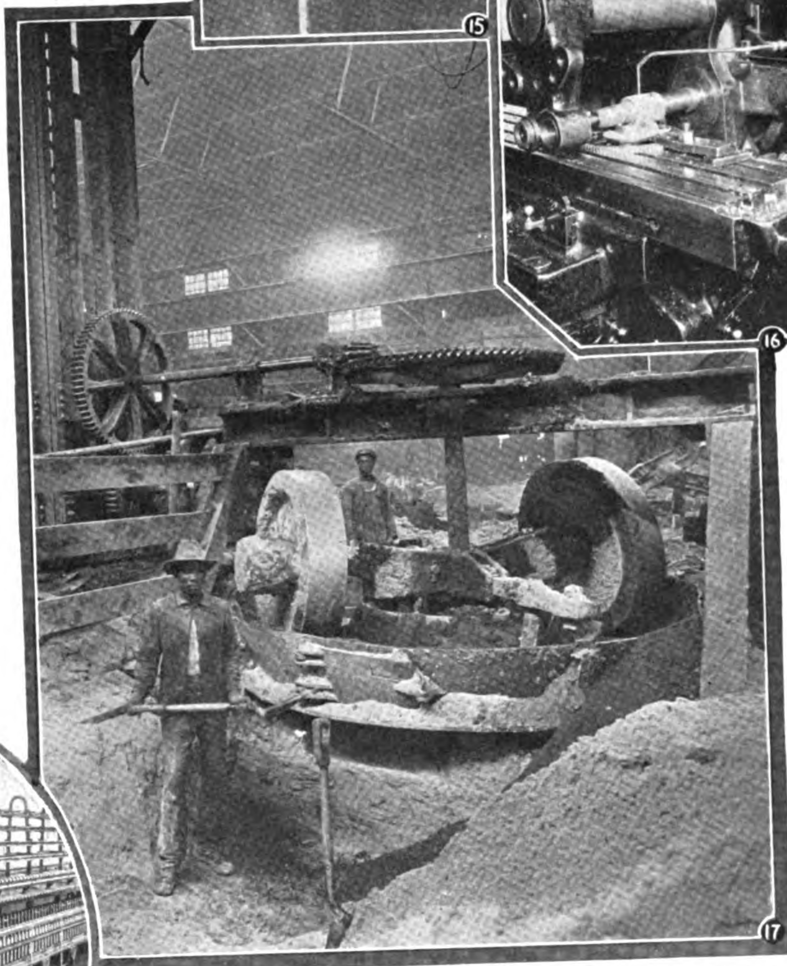

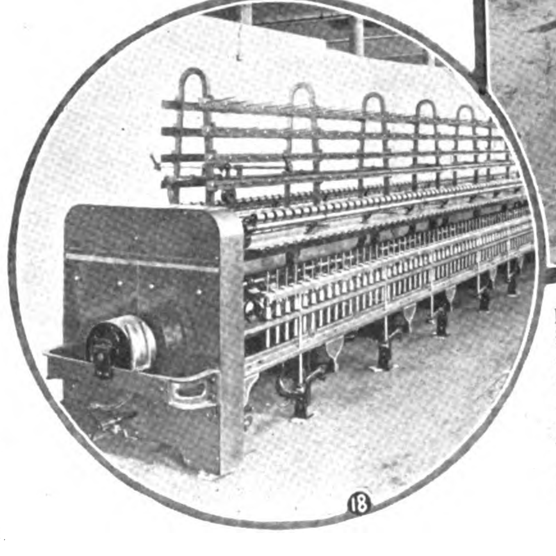

Fig. 18. While protection of the wearing surfaces is, of course, the primary consideration of the textile industry, we must also consider the detrimental effects upon the threads in event of splashed or dripped lubricants. For such lubrication compound mineral oils of very light viscosity which have been refined to a practically water-white state have given best service.

Fig. 17. Grinding mills, as can be seen, are not the cleanest machinery in the world. Naturally, the gears, which are the principal wearing parts of such equipment requiring lubrication, will suffer accordingly. The fact that they cannot be run in a bath of lubricant in many cases makes it necessary to coat them with a gear compound which will adhere to the teeth.

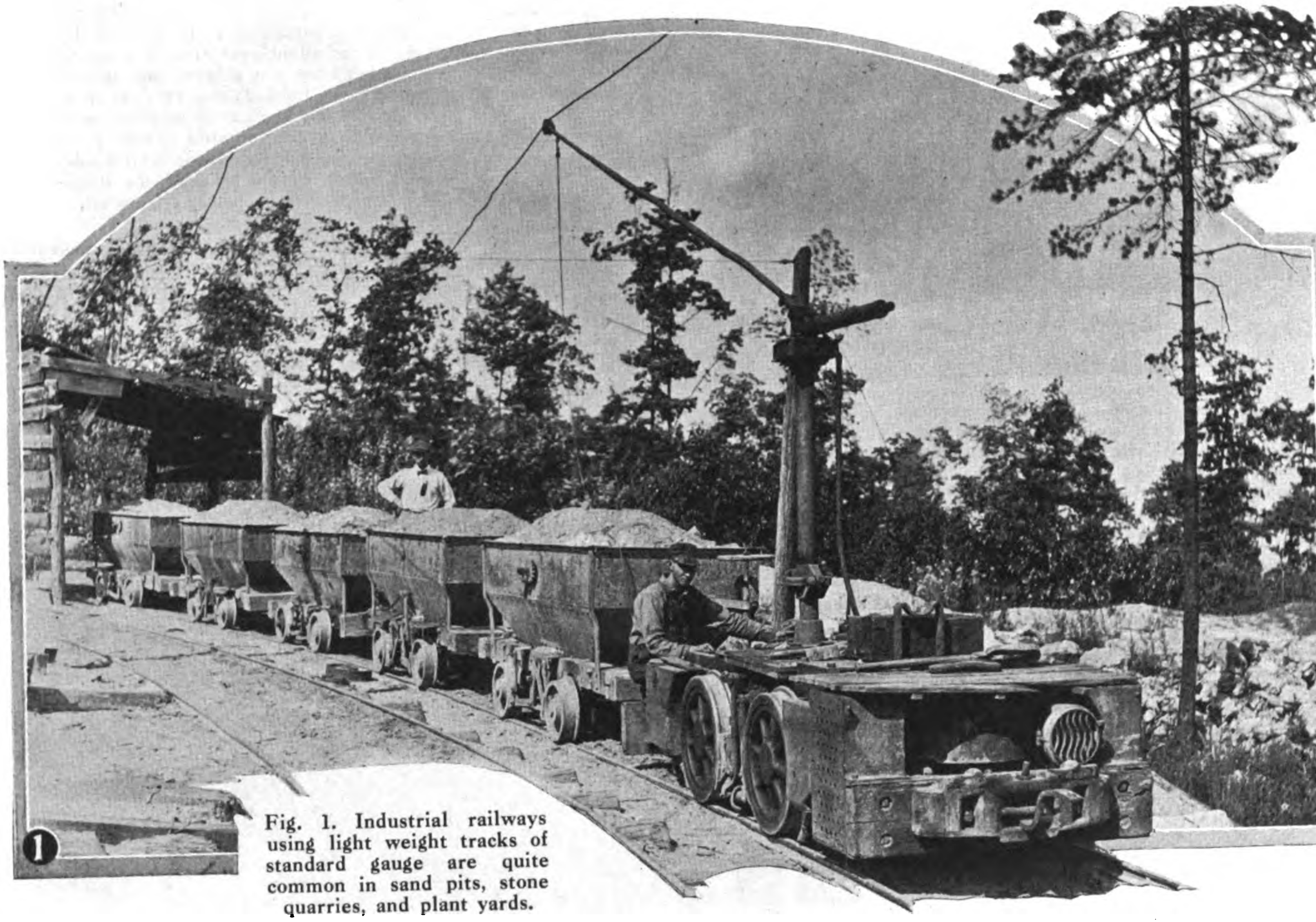

Fig. 1. Industrial railways using light weight tracks of standard gauge are quite common in sand pits, stone quarries, and plant yards.

Industrial Railways

Their Advantages and Limitations

By Matthew W. Potts

MANY industrial plants have discarded their industrial railway systems that required tracks upon which to operate and have installed tractor-trailer methods. Both these means of transportation have their advantages and consideration should be given to all the various points when new installations are contemplated and before present installations are discarded. Some executives have found it necessary to re-install their track systems after having once discarded them due to the fact that they did not study the problem fully before taking action. As these mistakes place an unnecessary expense against industry and do much to retard the use of additional materials handling equipment we are presenting a broad view of industrial railways and their application to numerous industries.

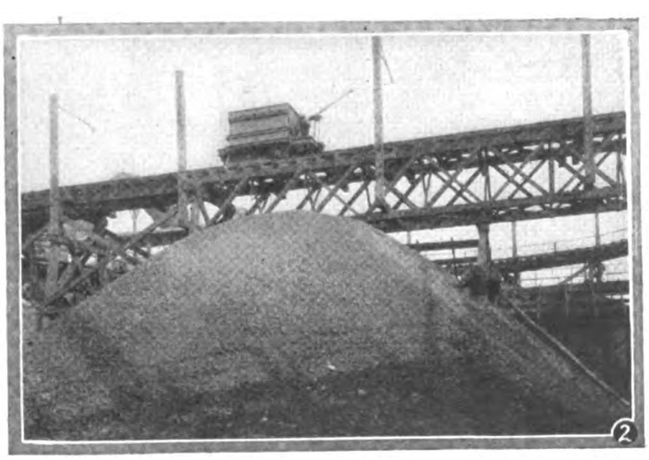

Fig. 2. Unit power driven car operating on trestle over outside storage yard.

The success of any industrial railway system is dependent upon the proper layout, location and installation of the track systems. In addition the matter of proper gauge of track, the location of switches, turntables, transfer cars and other accessories play an important part in the economic operation of the equipment. The matter of locomotion and the type of equipment to be hauled over such railway systems is dependent upon the industry in which they are installed. For instance the brick making or quarry industry employs a different kind of track, car equipment and locomotive equipment than would be required for use in chemical plants, foundries and machine shops.

In cases where the present installations are not operating satisfactorily and also in plants where new systems are under consideration the following factors which enter into the problem of industrial rail transportation should be carefully investigated. One of the most important items is the weight and character of the materials to be moved. Where exceedingly heavy loads, as shown in Figs. 7 and 19 are to be handled an industrial railway system has many advantages. Heavy equipment and loads of this nature do not lend themselves to tractor and trailer systems for the reason that such equipment frequently has difficulty in handling such heavy loads over the ordinary plant yard roads and through buildings where the floors are rough or badly constructed. The installation of rails furnishes a cheap and permanent road bed.

The next point to consider, especially on new installations, is the layout of tracks and the advisability of having the system serve all departments of the plant. Some industries do not lend themselves to a complete industrial railway system but separate unconnected units of this equipment have been found economical for cer-

Fig. 3. Road builders are using this industrial materials handling equipment in the handling of concrete and they have found that it reduces their labor costs.

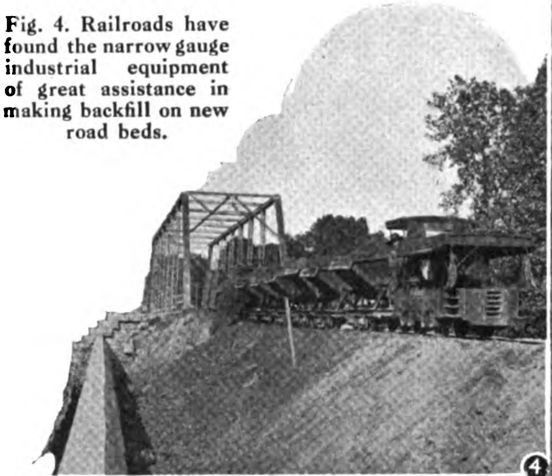

Fig. 4. Railroads have found the narrow gauge industrial equipment of great assistance in making backfill on new road beds.

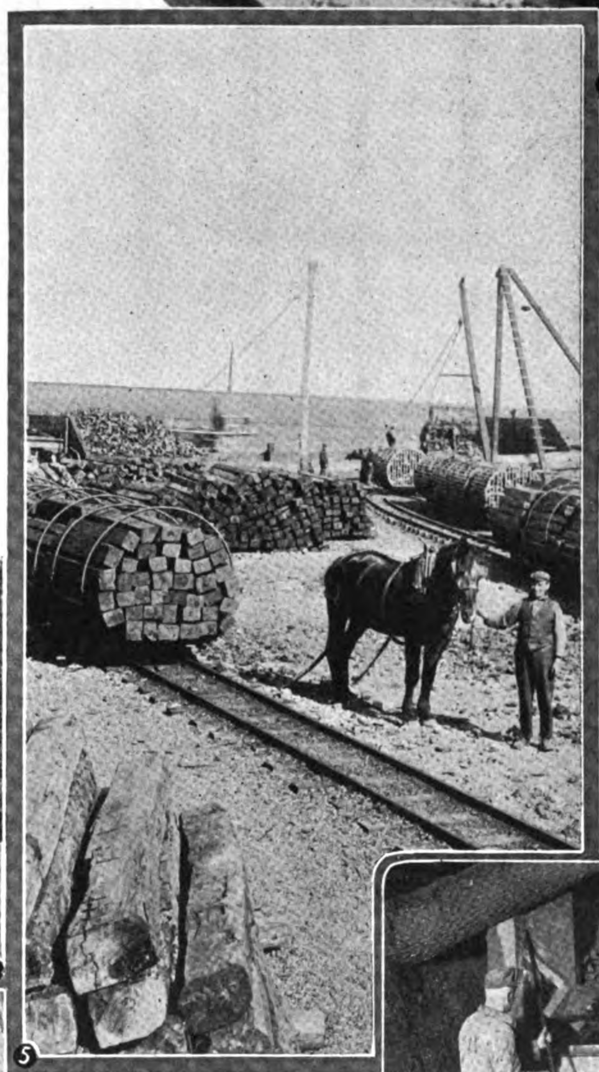

Fig. 5. Industrial railways play an important part in the handling of materials at creosoting plants.

Fig. 6. Coal and iron mines are large users of narrow gauge tracks and industrial railway equipment.

Fig. 7. The Oil Well Supply Company have found the industrial railway a satisfactory method of transporting materials about their plant.

tain departments and certain operations, for instance in foundries. To illustrate a case in point, we will consider the handling of materials from the cupolas to the pouring floor. Here a track system, with turntables and switches, upon which a medium sized ladle car can be operated will reduce the cost of handling hot metal, as a large quantity can be drawn from the cupola at one time and taken directly to the point of use, where it can be poured into smaller ladles, which the men can easily handle to the molds. In chemical plants, coal mines, quarries and other industries, industrial railway systems can be so laid out as to connect several buildings and process departments for the handling of semi-finished products and raw materials during manufacture.

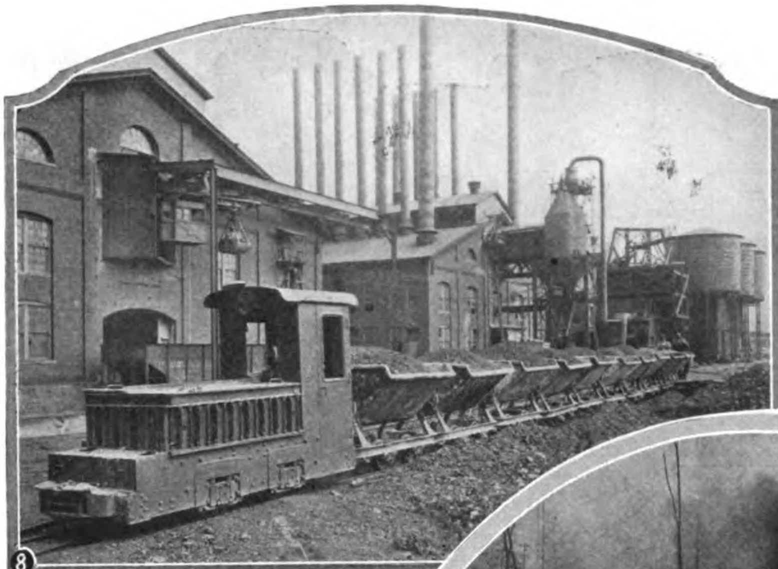

Fig. 8. This electric locomotive and its train of cars is handling refuse material from plant to dump.

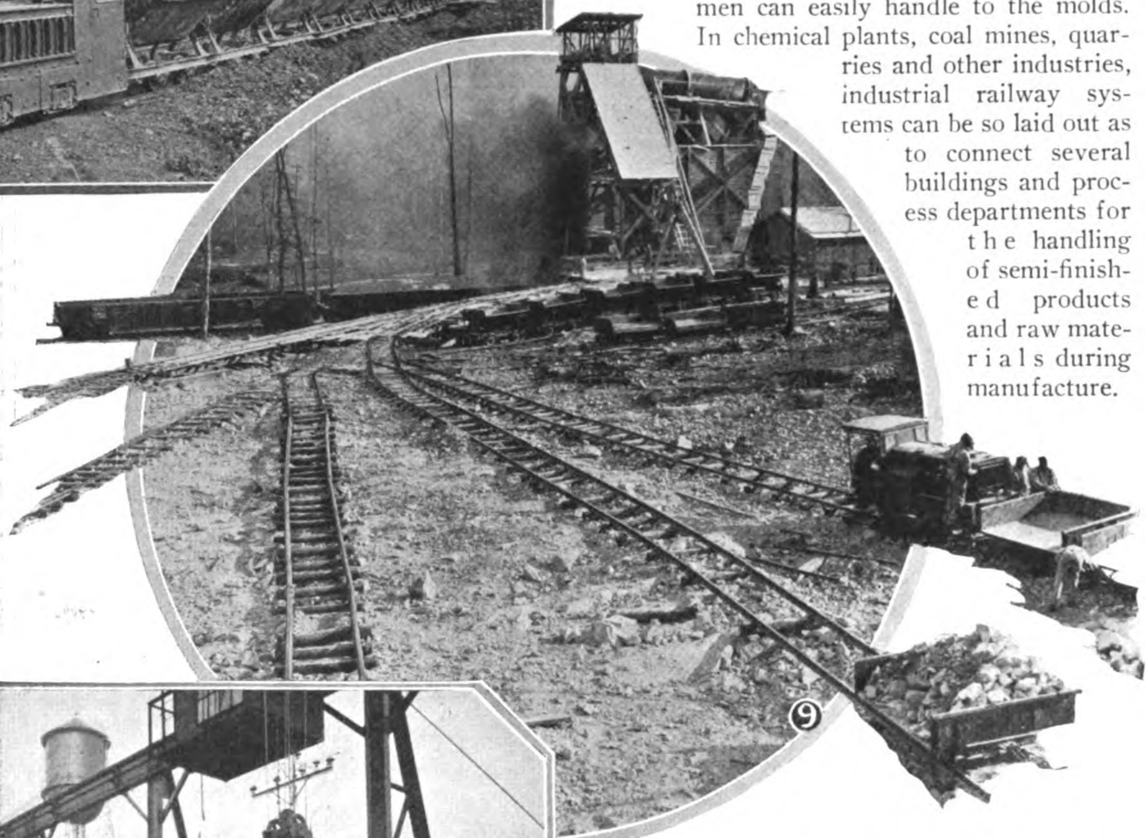

Fig. 9. Here industrial railways are quickly shifted from one location to another. Note the track layout.

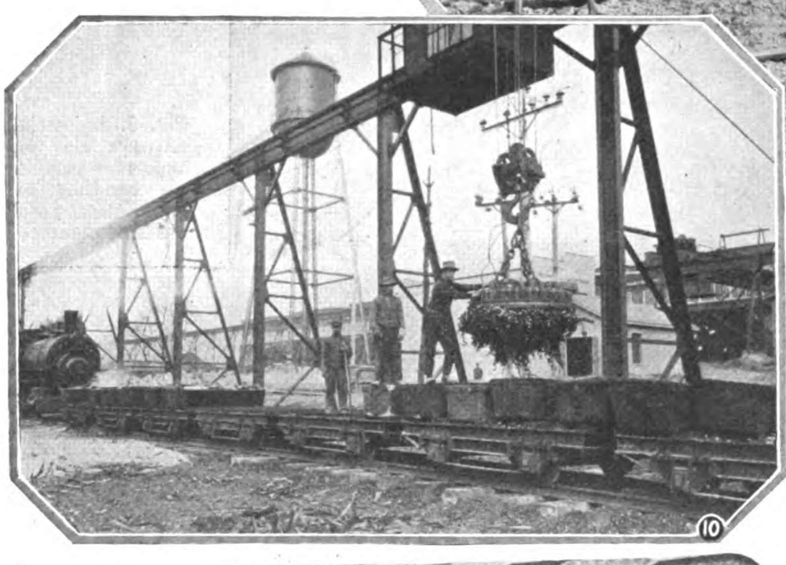

Fig. 10. This shows the coördination of several types of equipment from overhead crane, with lifting magnetic to steam locomotive for hauling open hearth charging cars.

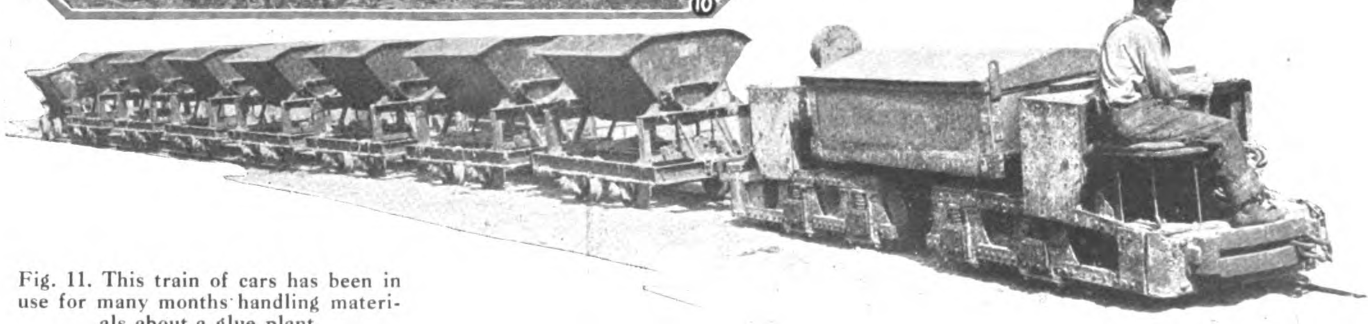

Fig. 11. This train of cars has been in use for many months handling materials about a glue plant.

After the point of application has been settled, the next important step is to determine the type of locomotion to be employed. On short hauls various types of cars pushed by hand have been found most economical. In quarries, sand pits, on plant refuse dumps, in brick works, etc., the use of a horse for pulling trains or cars has proved in many cases to be the cheapest power available. Fig. 15 shows a horse being used in connection with an industrial railway system for the handling of clay in a brick plant. On comparatively short hauls, or under conditions as shown in Fig. 16 small electric locomotives, patterned after the electric storage battery tractor, can be used to advantage because of their compact construction. The equipment shown in this installation is operating at the Consolidated Gas Company's plant in New York City handling various materials over a considerable trackage. Gasoline

Fig. 12. This equipment is operating in a plate glass plant and is handling cars loaded with batch materials.

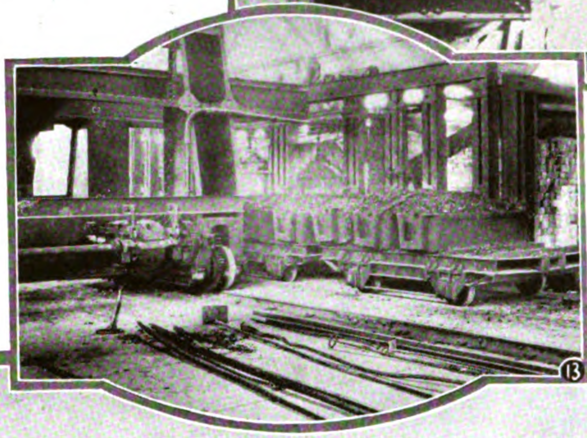

Fig. 13. These are the same cars as shown in Fig. 10 and illustrate the equipment in front of the open hearth furnace, together with a partial view of the charging machine.

Fig. 14. Complete layout of track in limestone quarry where cars are loaded by hand.

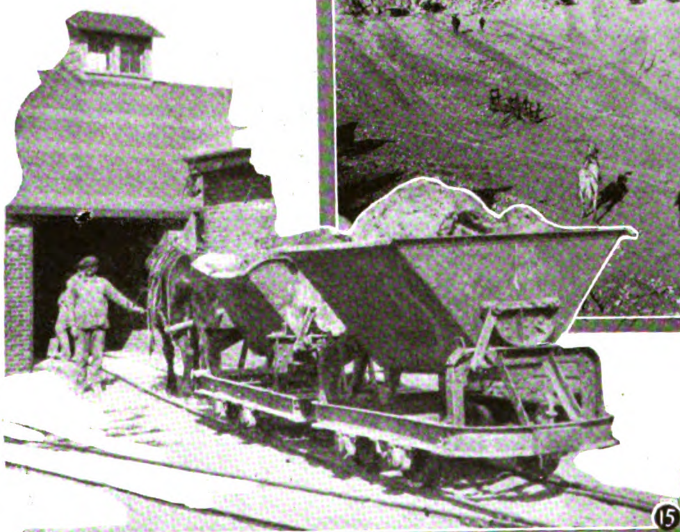

Fig. 15. With track railways the means of locomotion are many. Note the horse.

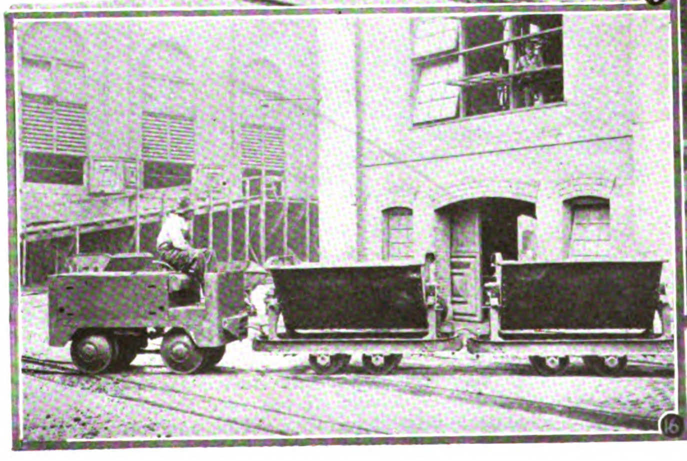

Fig. 16. Small electric locomotives, similar to industrial tractors, are also built to operate on tracks, so as to care for fixed lines of travel.

Fig. 17. Air hoist dumping rock car at crusher plant. Many dumping devices are used in connection with this class of equipment.

tractor manufacturers are adapting their equipment into industrial locomotives as shown in Fig. 24 and such locomotives are now operating on industrial railways in logging camps, on sugar cane plantations, in the construction of roads and about industrial plant yards.

Where heavy loads are to be carried or where the haul is long, large electric locomotives operating on storage batteries or obtaining their power from third rails and trolleys have been found the best means of locomotion. The low type shown in Fig. 19 is now being extensively employed in coal mines and other underground workings, as well as for the handling of heavy loads about the plant yards. On general outside work and inside work various types of electric locomotives, using trolleys will be found operating. Such equipment is shown in Fig. 1 handling sand and also illustrated in Fig. 12 where the cars are loaded with batch materials used in the manufacture of glass. In sand pits, quarries and clay banks where industrial railways have been employed for some time steam locomotives known as donkey engines are used for hauling the cars. Even in these installations, however, storage battery locomotives and the gasoline locomotive are now becoming prominent.

As equipment and layout are closely tied together for the reason that it requires more than one piece of equipment to make up a sys-

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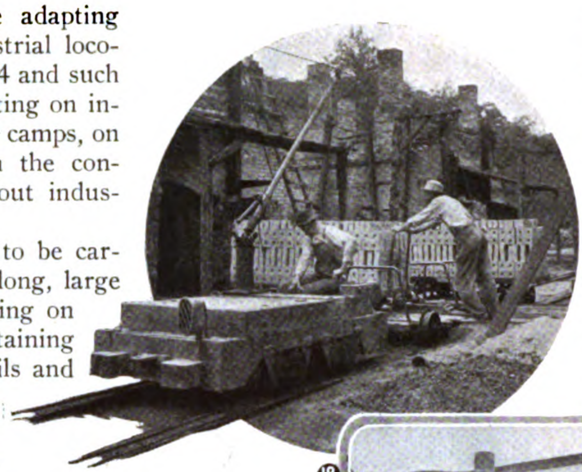

Fig. 18. This electric locomotive obtains its power from a trolley wire instead of storage batteries.

Fig. 19. Heavy loads are hard on plant roads and materials of this nature handle better on tracks.

Fig. 20. This industrial railway handles clay from the clay bank to the plant of the Delaware Clay Mfg. Co.

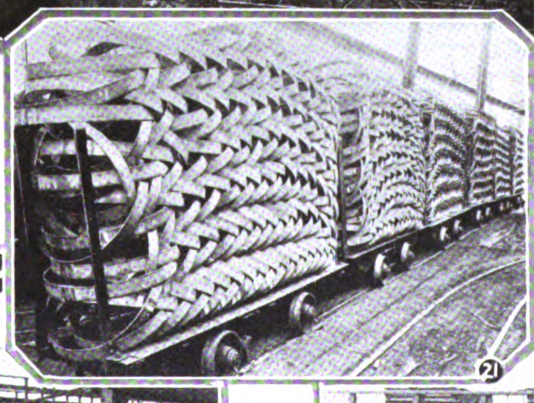

Fig. 21. This special type of car is used by an automobile rim manufacturer for handling his product about the yard.

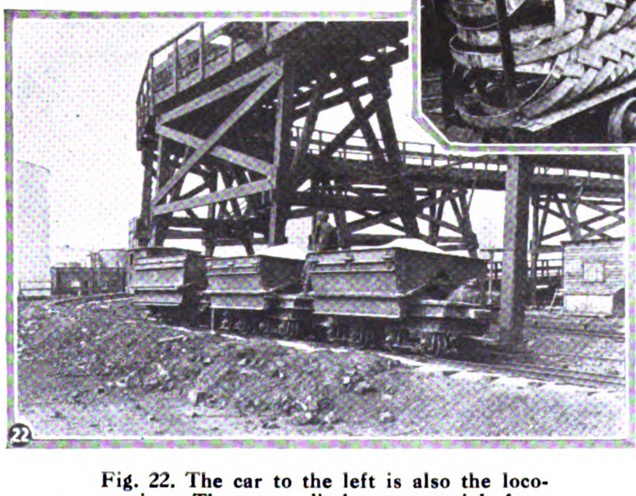

Fig. 22. The car to the left is also the locomotive. These cars discharge materials from both sides.

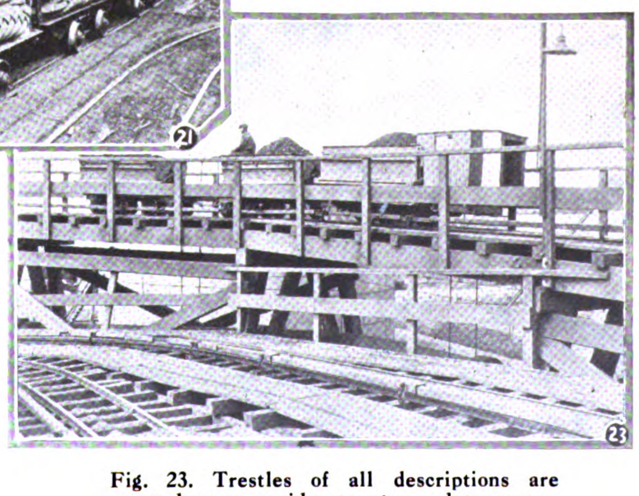

Fig. 23. Trestles of all descriptions are erected over outside storage yard to accommodate industrial railways. This equipment is operated by third rail.

Taking the Rainbow Out of American Industry

By Roy C. Sheeler

THE value of all the standing property in the United States in the year 1922 was about $83,000,000,000—including property of every description. Buildings other than dwellings, taking in railroad properties, industrial plants, hospitals, schools, churches, etc., totaled $41,000,000,000. To this must be added new structures of various types erected since that date, to the tune of many millions of dollars. Based upon the estimate that but twenty-five per cent. of such buildings is kept in proper condition through the use of paint and varnish, you will note that only $10,300,000,000 worth of the valuable property already erected is protected from the ravages of rust and decay. This leaves a property value of enormous proportions left to the good graces of the weather and particularly subject to the destructive agencies of conditions peculiar to many industrial processes,—mostly through failure to recognize the danger that exists in not giving adequate thought to this important matter.

Fig. 1. Paint, alone, would not cure such conditions as this; but it would surely act as a stimulus to better "housekeeping".

Each industrial plant has its own peculiar problems. In some, extremes of moisture, steam and water are present, causing all metal surfaces to rust and corrode with extreme rapidity. These conditions call for a protective coat especially designed to withstand such contact. Other surfaces come in contact with gaseous fumes, weak acid vapors, etc. Much money is wasted and much good paint condemned through the use of the wrong material for the purpose. And it is with the intent of getting away from the haphazard use of paint and varnish in the maintenance of industrial plants that this article is written.

Profits, today, in Amer-

PLANT STANDARDIZATION SYSTEM

COLOR KEY	Interior Surfaces—Office	USE	COLOR KEY		USE
1	WHITE	Walls	M	SCARLET	Fire Equipment, Sprinkler System Fire Doors
2	WHITE	Ceilings	N	YELLOW	Sand Pails
3	LEAF GREEN	Dado	O	OLIVE GREEN	Hand Mark for Doors
4	FRENCH GRAY	Woodwork & Doors	P	WHITE	Wall & Ceiling
5	LIGHT GRAY	Radiators	R	LEAF GREEN	Dado
6	BUFF GRAY	Floors	S	BUFF GRAY	Cement Floors
	Interior Surfaces—Factory			All Exterior Surfaces	
A	RED LEAD PRIMER	Primer for new metal surfaces	10	STONE GRAY	Body for wood buildings
B	OLIVE GREEN	Finish for metal surfaces	11	CHOCOLATE BROWN	Trim " " "
C	LIGHT GREEN	Machinery Guards	12	RED LEAD PRIMER	Primer for new metal surfaces
D	DEEP BLUE	Machinery	13	GREEN	Finish for all metal surfaces, including galv. iron roofs, siding, etc.
E	MAROON	Oil Tanks	14	CHESTNUT BROWN	Finish for doors
F	SKY BLUE	Cold Water Pipes	15	BLACK	Hand Mark for doors
G	GREEN	Gas "	16	WHITE	Oil Tanks
H	YELLOW	Air "	17	OLIVE GREEN	Water Tanks
I	MAROON	Oil "	18	YELLOW	Fire Equipment
J	TAN	Live Steam Pipes (Covered)	19	MAROON	Chassis of Trucks
K	BLACK	Exhaust Steam Pipes	20	GREEN	Body of Trucks
L	BLACK	Heating System			

Fig. 1a. On the original chart (discussed in the text) actual samples of the various paints are pasted in the rectangular spaces.

ican industry depend among other things on production costs. Given two plants making practically the same character of finished product, one of which has standardized their various processes from the receipt of the raw materials to the shipment of the finished product, and the other following the lines of least resistance,—one would find not only a much better product made by the first plant, but one costing considerably less to produce. If standardization is a good thing for the purchase of raw materials, for the various processes of manufacture, is it not also an equal advantage to apply this principle to the maintenance of plant and equipment through the proper use of paint and varnish? No plant manager or superintendent will deny the importance of the consistent use of paint and varnish in maintenance work. But in how many plants are painting methods following a set rule, established beforehand, which will insure reasonable service and satisfaction from the use of the correct product? In many plants today painting methods have not kept pace with standardized practices in other plant activities. Guesswork and haphazard methods are costing these

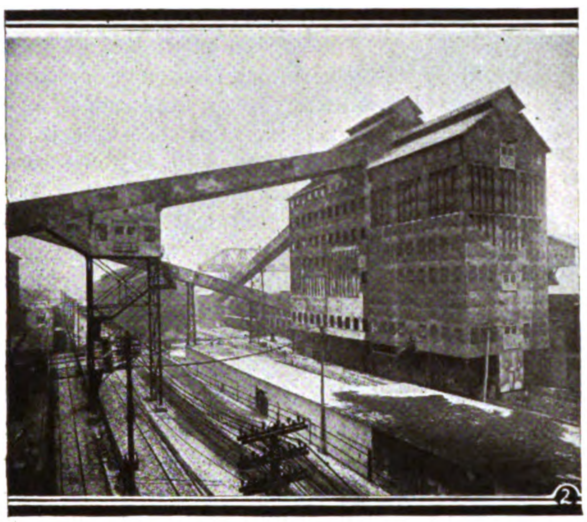

Fig. 2. No building of the immense Ford plant is ever permitted to suffer for want of paint protection.

Fig. 3. Modern boiler rooms admit plenty of light, and the value of paint as insurance against premature decay through rust and corrosion is better appreciated.

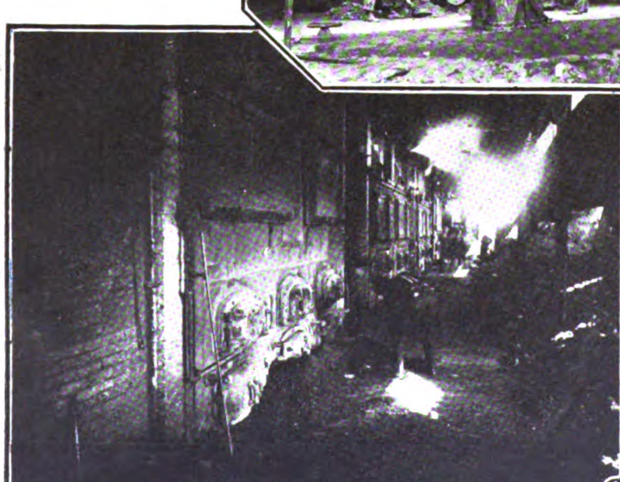

Fig. 4. There still are too many boiler rooms whose dingy atmosphere hides the need for surface protection.

companies many thousands of dollars every year, due to the necessity of much replacement of wood and metal, and the inadequate protection from rust and decay given by the paints they are using.

Standardization of painting methods is responsible for—

Greater attractiveness and unity of the entire plant;

A standard color for each surface;

A ready means of identification in case of trouble;

A finish for each surface of a recognized standard of quality;

Reduction of overhead expense

by the elimination of costly experiments with unknown materials;

The use of the most durable paint possible to obtain for the purpose;

Simplification in ordering material for repainting.

Anyone who has travelled about the country cannot help but note the "rainbow" effect seen in many industrial plants, in which some buildings were painted one color, adjacent surfaces a contrasting shade, with apparently no thought given to the unsightly appearance such a procedure creates. A uniform color adopted after careful consideration of the nature of the plant and the conditions under which it must serve, would not only make for a more attractive appearance, but at the same time bring a lower aggregate maintenance cost. It would reduce the number of colors necessary to carry in stock and thus restrict the total investment in upkeep material. The choice of a standard shade for exterior surfaces, when reduced to the basic consideration of maximum durability, will depend upon the character of the surface as well as general conditions it must meet. For instance, it would be folly to paint buildings white where they would be under constant contact with smoke, soot and the like. But it is not necessary to sacrifice attractiveness by the use of some dull, sombre shade, when a lighter and more lively color might be used.

The selection of standard colors for each surface involves a careful inspection of the entire plant, a tabulation of all the surfaces to be painted,

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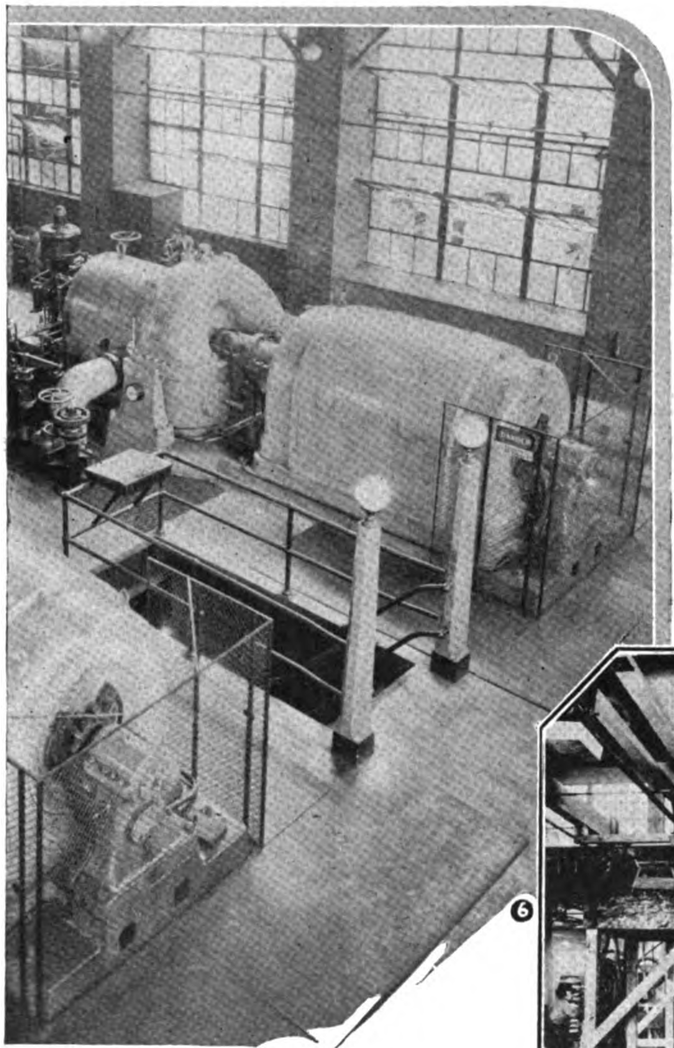

Fig. 6. There is no inherent reason why machinery cannot be made attractive and the reaction on the operating staff is well worth while.

Fig. 5. Where various lines of piping form a more or less intricate network under the ceiling, identifying colors for each class of service is of value in emergencies.

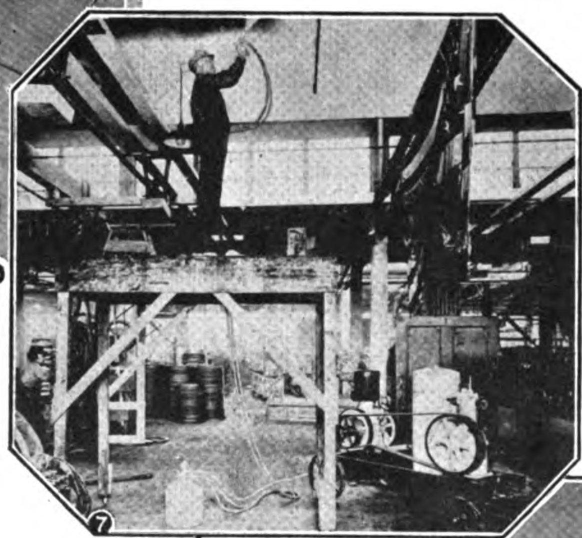

Fig. 7. With modern equipment, painting maintenance involves a minimum of interference with routine production.

Fig. 8. Not only the machinery and the walls and ceiling of this power house are protected by paint, but the concrete floor is covered by an enamel-like coat to prevent dusting.

Industry Chooses Locations to Meet Changing Conditions

By John A. Piquet

Fig. 1. The Shawinigan Falls in the Province of Quebec are typical of Canada's great water-powers, one of the reasons American concerns are establishing branch plants in Canada. Half a million horse-power is wrung from these tumbling waters by the Shawinigan Falls Water and Power Co., the largest hydro-electric plant in North America. (Photo by courtesy of The Canadian Pacific.)

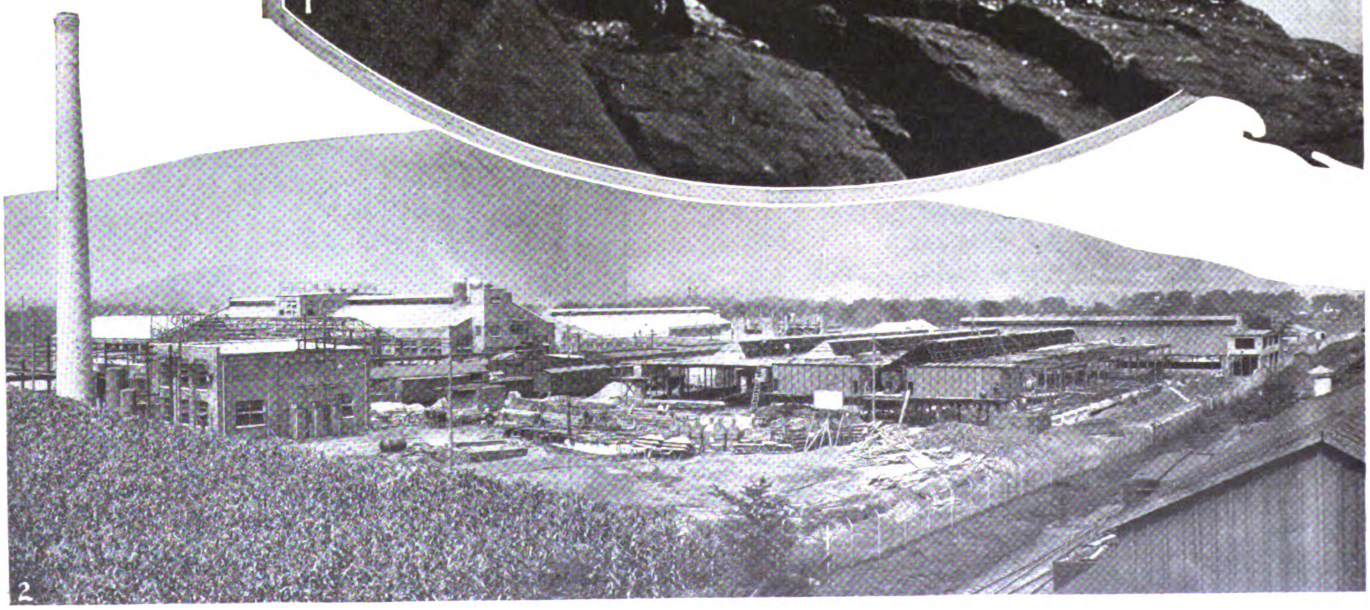

Fig. 2. Bathtubs and sinks made of cast-iron and porcelain clays were manufactured in the North and shipped to Southern markets. The Crane Enamelware Co. located this plant at Chattanooga, Tenn., where iron and clays are near by, and from which several railroads distribute to all parts of the South.

AMERICAN Industry is moving, and it is moving in many different ways. The general staff of the modern manufacturing concern is ever on the alert to cut costs. It has found that the location of the plant is today more important than ever before. The old haphazardly located factory is giving way to a trend toward relocation on the part of successful concerns in every line of industry in their never ceasing search for the best possible manufacturing conditions.

From the birthplace of American manufacturing in the north-east section of the United States, industry is moving and expanding to all points of the compass, propelled by irresistible economic forces.

To the north, 750 American concerns have already located branch plants in Canada to sell in that rich market duty free, and to export to the British Empire and France at the lowest preferential duties. Cheap wood and water-power has also caused American capital to invest heavily in the fast-growing Canadian pulp and paper industry.

Fig. 3. New England's skilled workers and well-balanced communities, the products of long experience, kept the Rumford Press, printers of the Atlantic Monthly and other high-class magazines, in Concord, N. H., when it built this new plant.

Fig. 4. The Union Bleaching and Finishing Cotton mill at Greenville, S. C., is near the cotton, has plenty of hydro-electric power, and can pay low wages because the workers enjoy low living costs. These are three of the reasons why the Southern textile industry is increasing rapidly.

Fig. 5. The Ford plant at Kearny, N. J., a plant for the Eastern market. One of the links in the far-flung chain of Ford factories, and another example of decentralization of industry. Car parts are made in various factories and assembled at the market.

Fig. 6. Textile goods on which much hand labor is used are being made in an increasing quantity in the American possessions, where lower living costs permit low wages, and where there is no tariff into the American market.

Fig. 7. The Procter & Gamble Ivory Soap factory at Hamilton, Ont., where rail and water transportation and the cheapest power in the world has concentrated many American branch plants.

Fig. 8. The woods of the South, which can be reforested four times as fast as those of the North, have built up a large furniture industry in North Carolina, of which this plant of the Carolina Wood Products Co. at Woodfin is an example. These abundant forests are also responsible for the growth of the Southern pulp and paper industry, which promises some day to eclipse the North.

Westward the population and markets of the United States are moving, and industry follows in their train. Copper wire in Montana, iron and steel in Utah, automobile tires from long staple cotton in the Southwest, woolen goods from Oregon sheep folds—factories are locating where both markets and raw materials mean big transportation savings.

The new South, with its raw materials, low living costs, and water-power, is calling many industries from the North. Furniture, cotton and woolen goods, paper and pulp, and iron and clay products are among the many lines whose growth is rapidly turning the South into a well diversified manufacturing area of real importance.

To the East and Far-East, the American possessions of Porto Rico

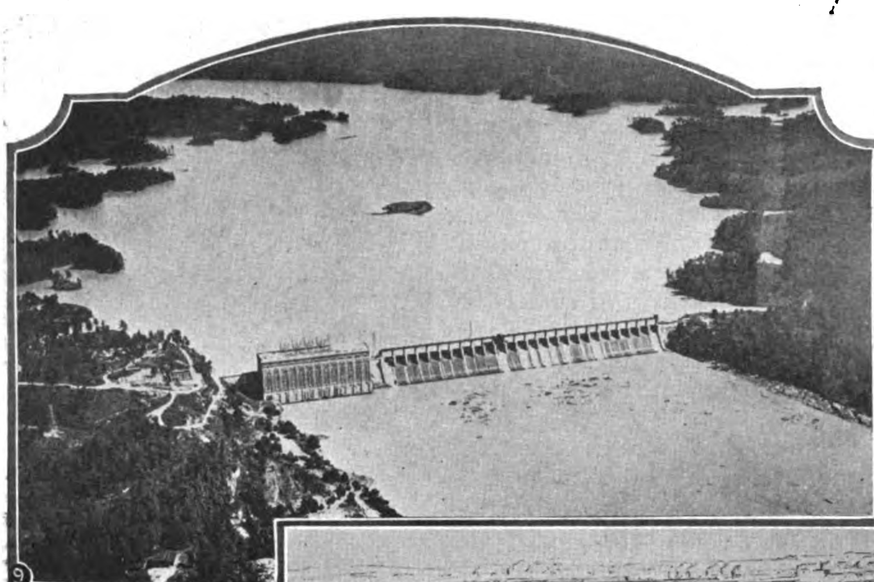

Fig. 9. The Alabama Power Co. unit on the Coosa River is one of many water-power developments in the South now being linked up in a super-power system. This is one of the reasons why industry is moving there in large numbers.

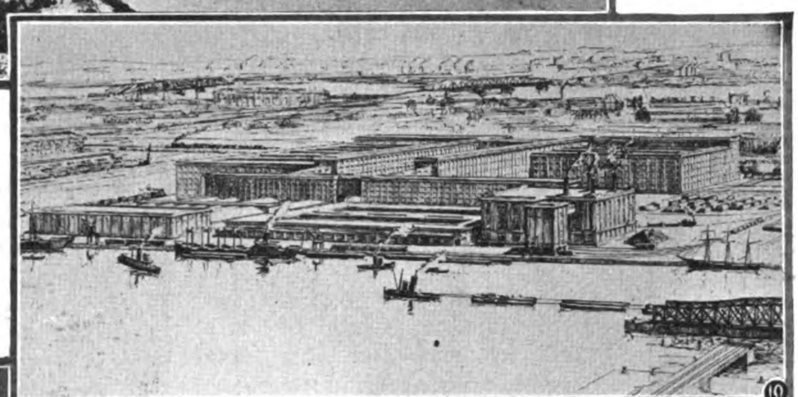

Fig. 10. To supply telephone equipment for the East, the Western Electric Co. is building this enormous plant at Kearny, N. J., between the labor markets of Newark and Jersey City, and on rail and water.

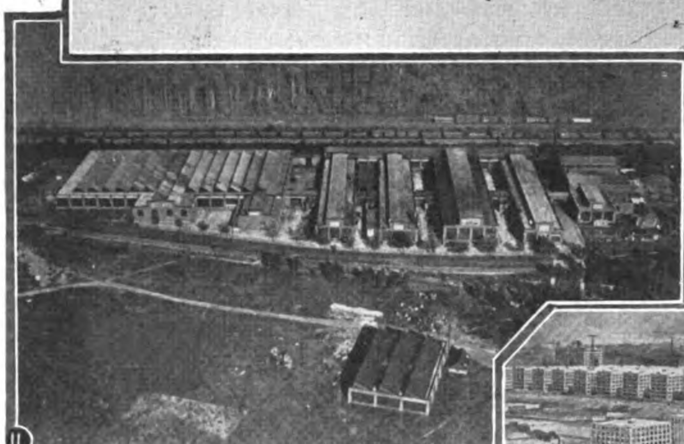

Fig. 11. The Rolls-Royce plant at Springfield, Mass., located there after the East was searched with a fine tooth comb for a city possessing the combination of a steady supply of skilled and intelligent mechanics, low living costs, adequate housing, and nearness to materials and markets.

Fig. 12. The trend toward scientifically planned industrial areas is shown by the growth of the Bush Terminal, situated in Brooklyn on New York Harbor. Here large-scale planning and operation bring to several hundred concerns a combination of advantages impossible for the average individual concern.

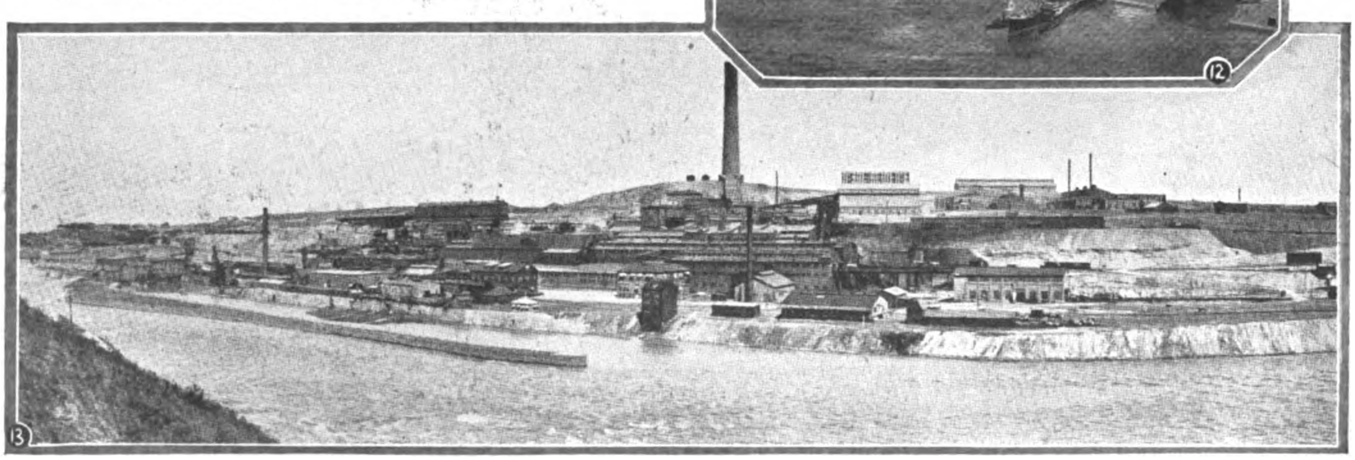

Fig. 13. Great Falls, Montana, has large water-power developments, and is not very far from the great Butte mines and smelters of the Anaconda Copper Company. The West has also become a good-sized consumer of copper wire and products. For these reasons, the Anaconda Company, which does the bulk of its refining and manufacturing near the Eastern markets, built this reduction plant and rolling mill at Great Falls.

and the Philippines are attracting textile and other industries making fine goods requiring much hand labor. There they find low-cost labor and duty free entrance into the United States.

Another movement of American industry is from the congested industrial centers to outlying suburbs and into the country, where plenty of room, a more stable labor situation, and often better transportation facilities are found.

Closely related to this is a third movement, the decentralization of industry from the great central plant to a series of smaller plants, or from the once all-important center of the industry to many other places in addition. An example of the

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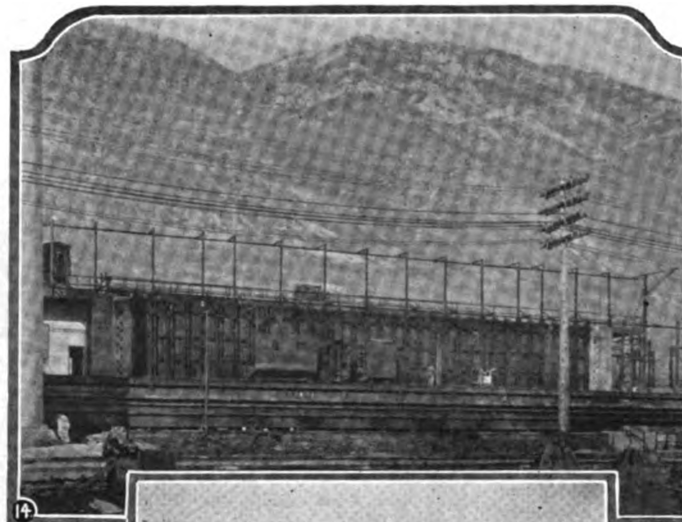


Fig. 14. The by-product coke ovens of the Columbia Steel Co. at Provo, Utah, where iron ore and coal are but ninety miles apart. Iron and steel, starting in New England, moved to New York, Pennsylvania, and Illinois, always following advancing markets because of heavy freight costs. This new plant supplies the Western market at a substantial freight saving.

Fig. 15. The tendency in the clothing industry is to move out of congested cities to smaller towns. This plant at Pottstown, Pa., is one of the fifteen units of the Sweet-Orr Co., which has developed a high grade of labor efficiency.

Fig. 16. A Combined Factory and Marketplace. Industry is getting together to effect economies. The Garment Center Capital in New York is a huge building where ninety garment manufacturers not only obtain first-class working conditions at lower rents, but also attract the country's visiting buyers because of the concentration of garment firms there.

Fig. 17. One of the seventy-three branch plants of the General Cigar Company, which finds better labor and marketing conditions in a scattered system than in one big factory. This typical branch is in a small town in Pennsylvania, where a good class of intelligent workers is obtained, and from which cigars are shipped cheaply and quickly to Pensylvania outlets.

Fig. 18. The overwhelming concentration of tire factories at Akron, Ohio, is giving way, as in other industries, to a decentralizing and expanding movement. This immense plant of the Kelly-Springfield Tire Co., has been built recently in Cumberland, Md.

Reducing the Weight

*Steps in the **Campaign of***

By R. S.

Fig. 1. This sort of treatment is no respecter of package or contents, and it is only one of the many factors which must be considered in designing boxes for long distance shipments. Maximum strength with minimum weight, is the goal; because the freight rate determined by the contents applies also to the weight of the package.

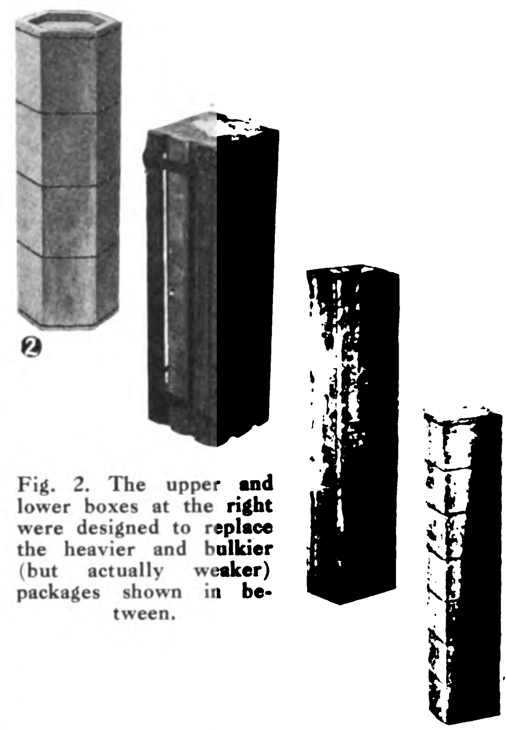


Fig. 2. The upper and lower boxes at the right were designed to replace the heavier and bulkier (but actually weaker) packages shown in between.

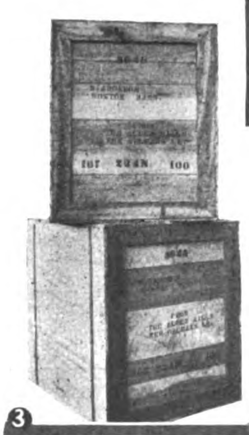
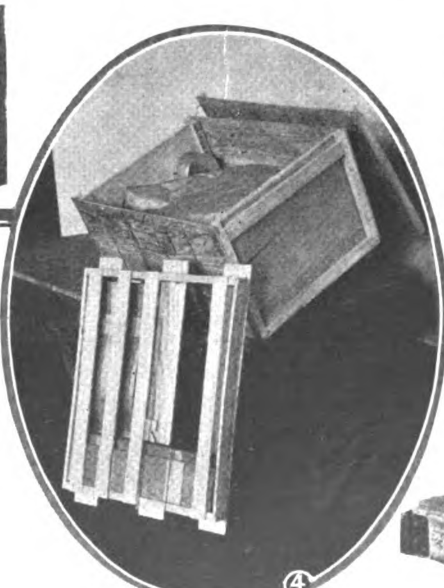


Fig. 3. The heavy boxes shown above are still widely used, but they are gradually giving way to less wasteful containers as shippers learn the economies obtainable.



Figs. 4 and 5. The box at the left, in replacing the one below, carried the same stencil cutter with a total weight of 157 lbs., as compared to the former 171 lbs.

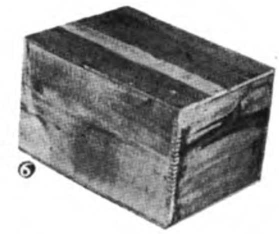
ANOTHER tradition is shattered. This time it is the oft-repeated story that American boxing and packing methods are among the poorest, if not actually the poorest, that may be encountered in the four corners of this old earth of ours.

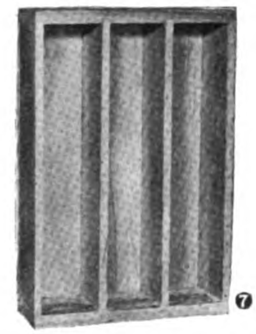
Contradiction of the story now comes from two eminently qualified sources. In a leaflet just published by the United States Bureau of Foreign and Domestic Commerce no less an authority than Julius Klein, Director of the Bureau, is responsible for the statement that modern American packing methods are far ahead of those of the rest of the world. A few short years ago such a remark would not have gone unchallenged. Americans were notoriously poor backers. But as Director Klein points out, "there has been such a notable improvement in recent years that our competitors in the world's markets now openly admit that the United States is far in advance in this important matter. . . . Except in rare instances improvement in

of the Package

the Packing Engineer

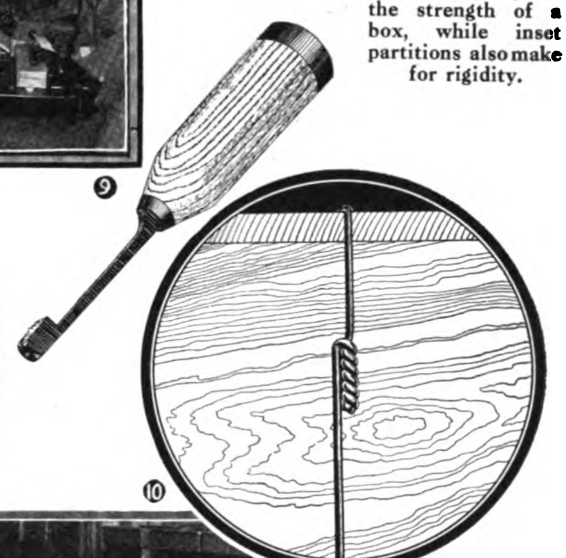
McClure





Figs. 6 and 7. Above—locked corners add materially to the strength of a box, while inset partitions also make for rigidity.

Fig. 8. With the box properly designed, packing the product is almost like packing a trunk.



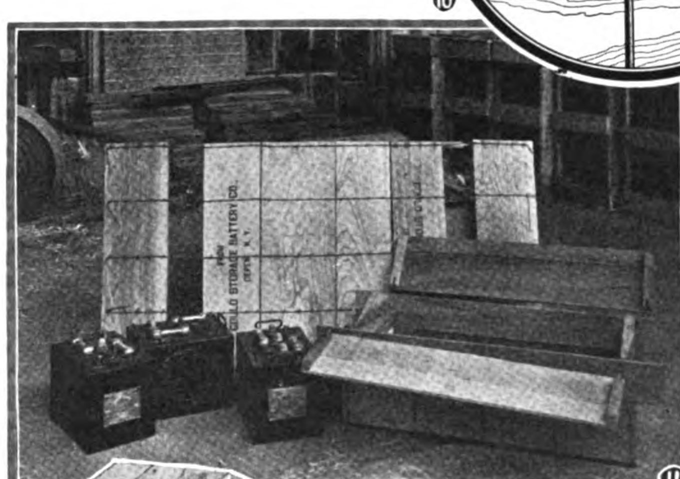
Figs. 9 and 10. The "lock" of the wirebound box, and the simple tool which locks it. These boxes have won their way in many fields by reason of their simplicity and ruggedness.

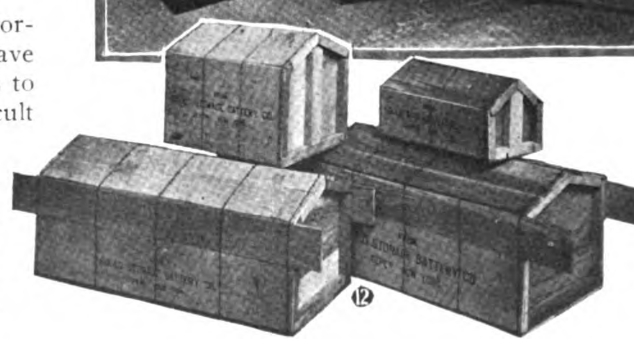
packing methods has kept pace with modern methods of production and distribution, and packing is today regarded as an exact science by experienced exporters."

The other—and this is a generous recognition—appears in the current volume of the Box Makers' Journal (London): "America, of course, is a long way ahead of us in the matter of scientific packing. . . . The experts in that country have realized the important bearing which packing has for both manufacturer and consumer, and they have raised the various processes to a fine art. We, in this country, are following up—but we are still a long way behind."

Statements like the foregoing naturally raise two questions: (1) Wherein lies the superiority and (2) how have the changes been brought about?

Answering them in the reverse order it may be stated that there have been so many contributing factors to this improvement that it is difficult to put your finger on any one outstanding feature. As nearby sources of lumber supply gave out, manufacturers and large shippers who had made up their own boxes and crates found it uneconomical to ship in lumber





Figs. 11 and 12. In many cases, a departure from the traditional rectangular box results in both greater strength and better protection.

in sufficient quantities to carry an adequate stock of box materials to make the different sizes and kinds of boxes. The rapidly rising price of lumber itself further discouraged that procedure.

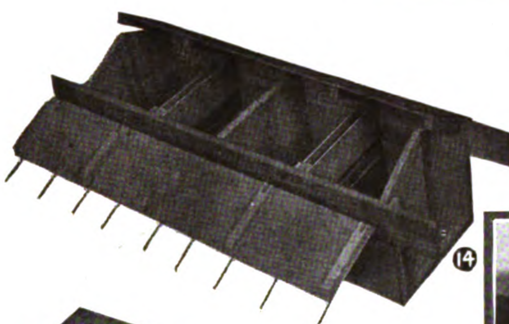
The box manufacturer, however, through his specialization, was finding ways to meet these difficulties. Very early in the study the commercial box manufacturer came to the conclusion that packing means far more than nailing together a box in the shipping room and trusting to the railroad and other transportation agencies to deliver it safely. Good packing includes the solution of any number of problems, most of them beyond the grasp of a shipping room husky. They need the attention of engineering skill, which was and is being generously provided to develop and apply the scientific methods now in use. It has been the application of these methods which has placed American packing—at home as well as abroad—on its present high plane.

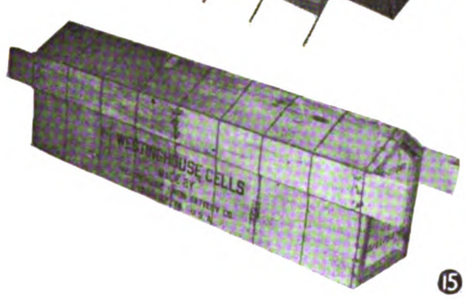
Among the outstanding developments in boxing of recent years, is the use of many kinds of containers of lighter weight or thinner material than that formerly used,—at no sacrifice, if truly suited to the product, in the protective value of the box.

The average weight of shipping containers today is fully fifty per cent. less than it was twenty years

(*Continued on page 45*)

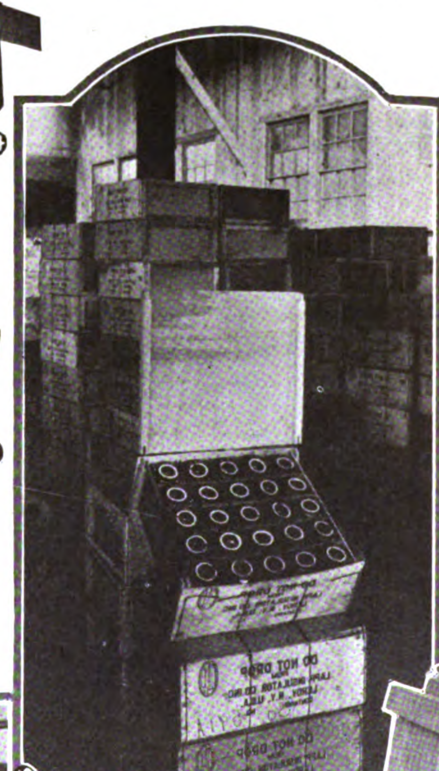
Fig. 13. This shipment to a missionary in far-off India, boxed in a light-weight wirebound box, proved that weight is not an essential factor to strength.

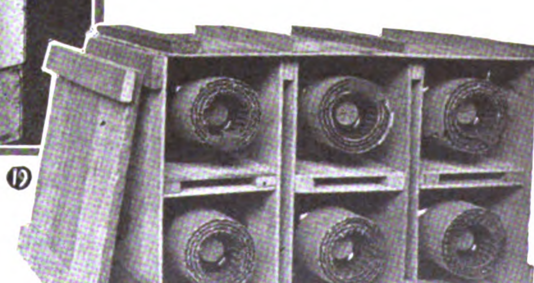




Figs. 14 and 15. Note the light but strong partitions, which add greatly to the strength of these battery shipping boxes.

Figs. 16 and 17. The locked-corner box, of comparatively light wood, as used for the shipment of bottled inks.





Figs. 18 and 19. Light-weight, slightly resilient boxes properly designed are better, in many cases, than rigid heavy containers for breakable shipments.

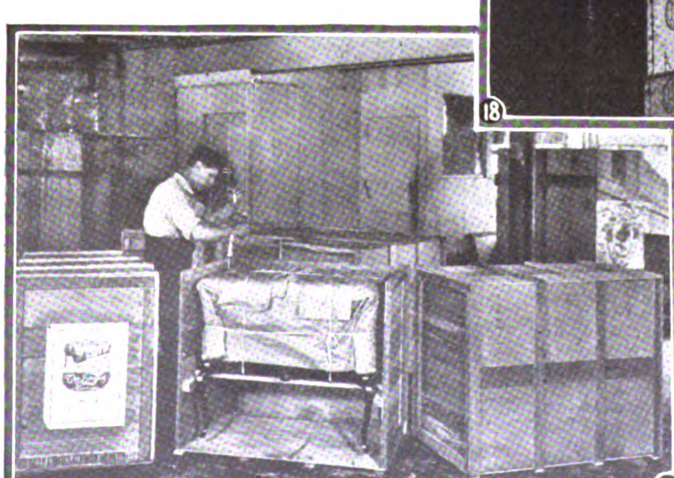
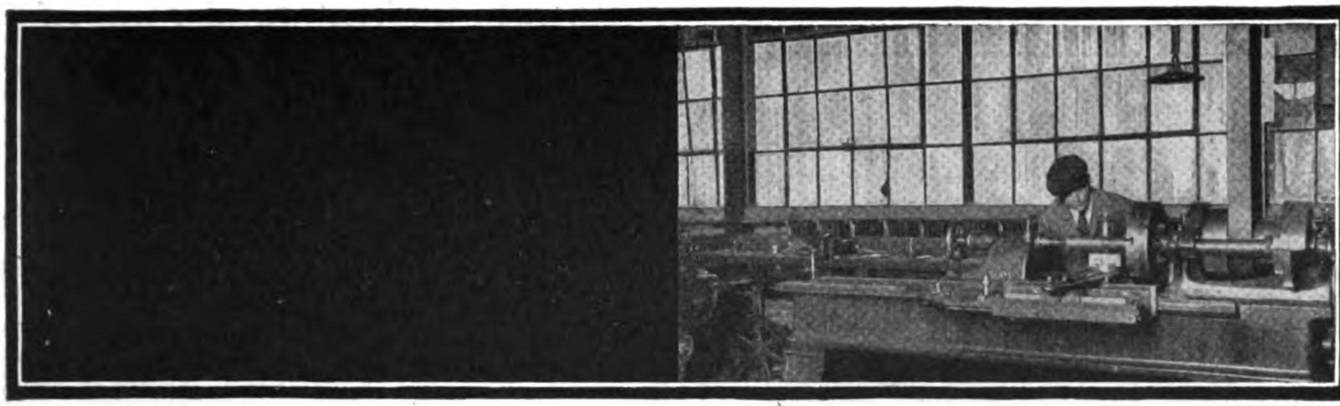


Fig. 20. Securing adequate shipping protection for ranges, by properly designed reinforced panel boxes.



Without glass or artificial light a building would be as pitch dark as a tunnel.

With plenty of clean glass area the interior of a building is flooded with perfect light.

Why Do You Not Use Tin Where You Now Use Glass?

A RIDICULOUS question? Not at all. Of course tin will not let in the daylight. Neither will rust, soot and dirt encrusted glass. You realize that to increase production, decrease spoilage and minimize accidents proper illumination is vital. But are you profiting by it? Are you paying high artificial light bills for a substitute because dirty glass bars out the free daylight?

Perhaps you have not heard how easy and economical it is to clean the worst rust and soot encrusted glass with *Skybryte.* Perhaps you have not heard how thousands of foundries—iron and steel mills—great industrial plants—railroad shops and round houses—now keep glass clean with *Skybryte.*

Cleans Perfectly Where Other Methods Fail

Perhaps you think it is too expensive to clean dirty glass. Perhaps you have tried other methods with unsatisfactory results. Perhaps you are skeptical of *Skybryte.*

Practically all those who now use *Skybryte* regularly felt this way at one time. But they were open to conviction. They were willing to try *Skybryte* at our risk. Now they are enthusiastic in their praise of it. We invite you to make the same test.

Splendid Results with Only Common Labor

Regardless of conditions any ordinary laborer can make your glass like new with *Skybryte.* He simply coats it on the dirty glass. At once the most stubborn crust of rust, soot and carbon scale is loosened. Then he flushes off with water, using either hose or brush. The glass is like new and in pours the profitable daylight.

Harms Dirt Alone

Although *Skybryte* is such an amazing cleaner it is absolutely harmless to paint, putty or sash. We guarantee this fact. Thousands of regular users vouch for it.

Cost Is Trifling

Records over a period of years and under all conditions prove that the average total cost of cleaning glass with *Skybryte* is only a fraction of a cent per square foot. This includes both labor and material. Five gallons of *Skrybryte* clean 4000 square feet of dirty glass. An unskilled laborer easily cleans at least 5000 square feet per day.

Accept This Trial Offer

Skybryte is guaranteed to win your prompt, enthusiastic approval. We want to prove this to you, entirely at our risk. Thus we make you the offer in the coupon below. It puts you under no obligation. It is your opportunity to learn from your own actual experience why thousands now use *Skybryte* regularly.

The SKYBRYTE Company
1100 Keith Building Cleveland, Ohio
Chicago Branch, Tower Building, 6 North Michigan Ave.

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Skybryte CLEANER (LIQUID)

For Plain Transparent Glass Use Skybryte Powder. Free sample on request.

TRIAL OFFER COUPON

The Skybryte Company,
Keith Building, Cleveland, Ohio.

You may ship us five gallons of Skybryte on trial and one regular 75c Skybryte brush FREE. We will use one gallon of Skybryte at your risk. If we are not fully satisfied we will return the balance to you within 30 days, return charges collect and you will cancel invoice. Otherwise we will pay your invoice for five gallons Skybryte at $3.00 per gallon, F. O. B. Cleveland.

Skybryte in bbls. $2.50 per gallon freight allowed

Company ....

Street ....

City ....

Taking the Rainbow Out of American Industry

(*Continued from page 29*)

noting the conditions each must meet, and then making recommendations accordingly. The composition of the paint is of first importance, the color taking second place. Having decided what character of product must be used to satisfactorily withstand the conditions it must meet, it is not a difficult matter to arrive at a suitable color. The accompanying illustration will indicate the extreme flexibility of the plan and how it may be made to meet the exact needs of any industry.

One of the most important parts of this plan is the identification of piping systems in and about the plant. Many industries use in their various processes a wide variety of liquids, vapors and gases, lines conveying which frequently run side by side and intertwine to an amazing degree. Unless there is some sort of an identification mark on these lines, it is the easiest thing in the world to turn off or turn on the wrong valve, to the consequent injury or loss of life or property. To accomplish the desired purpose, it is not necessary to paint the entire length of the pipe, but apply the identifying color to the couplings or valves only, allowing the pipe itself to carry the color of the adjacent surface. This also does away with the "rainbow" effect frequently noticed where the entire piping system carries the selected color throughout its length. In the chart illustrated, the following scheme was used:

Cold Water Pipes	Dark Green
Gas Pipes	Blue
Air Lines	Yellow
Acid Pipes	Black with Vermilion band
Live Steam Pipes (covered)	Brown
Exhaust " "	Maroon

Color identification of fire plugs, fire houses, and other similar equipment is extremely important. Many companies are using a bright shade of yellow for this purpose, due to its high visibility at night. Either a bright vermilion or other bright color may be successfully used for this purpose.

Standardization from a quality standpoint depends first upon a thorough knowledge of the conditions that surfaces in the plant must withstand. Many concerns follow processes of manufacture which are detrimental to the service given by the ordinary paint coat, but which may successfully be met by finishes designed for such a need. One of the greatest causes of complaint with paint usage in industrial plants lies in the application of a paint, which, from a color standpoint is entirely acceptable, but which is not made according to the best formula for satisfactorily meeting the peculiar needs of that particular plant. A certain amount of knowledge and discretion must be exercised by the individual responsible for the maintenance of the plant and equipment. But once a paint manufacturer makes his recommendations, based upon a thorough survey and knowledge of the exact conditions to be overcome, then under most circumstances, satisfactory results are made certain. So, the importance of choosing the paint from a quality standpoint and its suitability for the work to be done, is paramount.

The greatest responsibility on the part of the mainte-

(*Continued on page 40*)

(*Continued from page* 38)

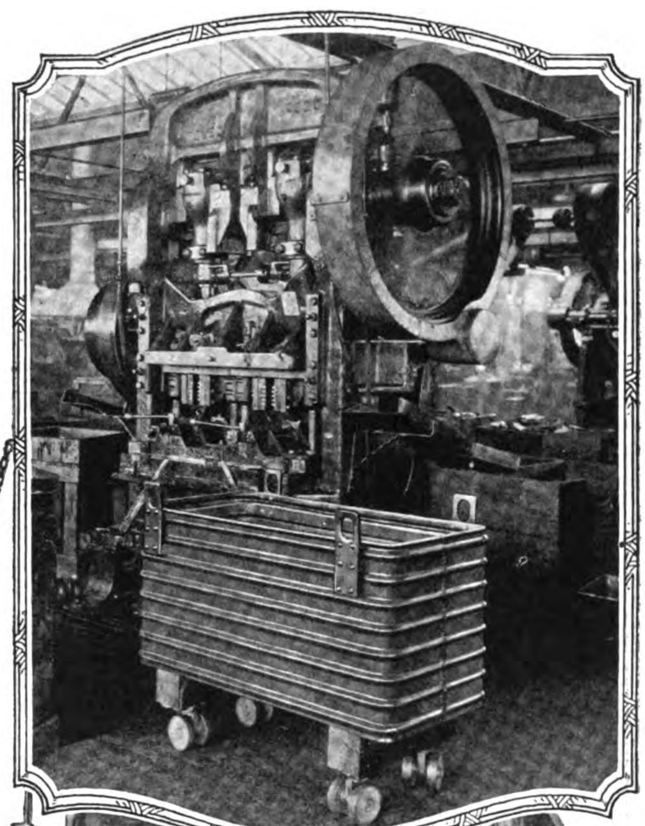
nance engineer or plant superintendent having the upkeep of the plant in charge, is to keep repairs at a minimum and thus reduce the overhead from this particular angle. Many companies still fail to realize the fact that painting is not an expense, but an investment. They do not see that it is far easier and less expensive to *keep* the plant and equipment in good condition than it is to neglect it and suddenly find it necessary to make expensive replacement to keep the plant in running order. On the other hand, those concerns who are far-sighted enough to see the economic value of the frequent use of the right type of paint on their plant and equipment, have found that the benefits of this plan are more far reaching than would be indicated on the surface. No one will contradict the statement that painting is an aid to "good housekeeping"; that it increases efficiency; that it bespeaks prosperity and makes for greater happiness and contentment among the employees. No man likes to work in dingy, depressing surroundings. Even under the most apparently unfavorable surroundings, it is possible to do a great deal toward improving appearances and conserving property values by using the *right* type of paint on many of the surfaces. Boiler rooms and other parts of the plant are frequently sadly neglected in this respect, under the mistaken idea that owing to dirt, soot, etc., it is impossible to do anything with them. Any plant manager who will take the time to look carefully into this matter will find, however, that while white painted walls and ceilings may not be practicable, there are other finishes that may be used acceptably, and which will do a great deal toward making the daily work in these surroundings a little more cheery and wholesome. By standardizing on the proper type of paint to use under all the conditions throughout the plant, and then sticking to recommendations that may come from authoritative sources, much can be done to reduce mortality in wood and metal surfaces in American industrial plants.

The use of standardized methods in paint application brings with it the benefits of simplification in the routine work of ordering material. Everyone all along the line is familiar with the paint requirements of the plant, and when additional supplies are needed, there is no good reason for confusion and mistakes in ordering the proper materials. This also serves to reduce overhead and to eliminate one of the causes of lessened profits. Anything that will help reduce causes of error and clerical mistakes is a very important matter. Simplification of painting practice in the upkeep of the plant certainly has this benefit as a consequence. Those who do the actual painting, whether your own crew or an outside painting contractor, will readily see the many advantages such a plan presents. It will enable them to do more and better work and to derive greater satisfaction in the work which they do. Of course whole-hearted co-operation on the part of everyone interested is requisite for best results; and this will be more readily obtainable when each one is thoroughly sold on the actual benefits derived from such a system.

Increase Your Floor Capacity

Uninterrupted production in the manufacturing plant constantly calls for ample floor capacity to handle goods. Truscon Crane Handling Boxes insure this uninterrupted service because of the ease with which they can be moved from place to place and stacked, to conserve valuable floor space.

Truscon Alloy Steel Boxes here illustrated were made to be handled by a crane.



Truscon Alloy Steel Crane Handling Boxes literally bring the stock room into actual contact with the production line at any point. The boxes may be stacked in tiers increasing the storage capacity per unit of stockroom floor space.

The boxes illustrated were designed for the Ternstedt Manufacturing Company of Detroit. The dimensions are 24″ x 48″ x 24″, weight 231 pounds, capacity 3000 pounds. They may be stacked five high when loaded.

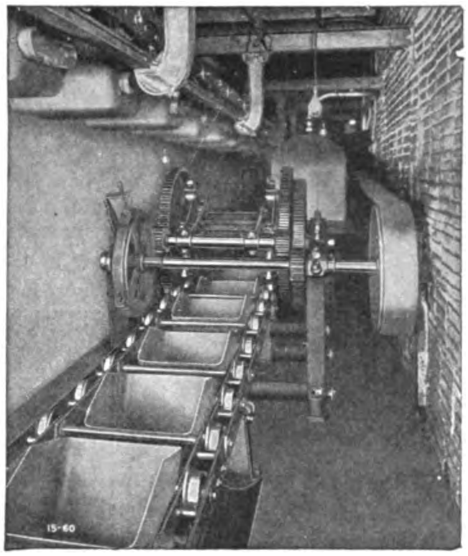
Find out how Truscon Alloy Steel Boxes will fit in with your production plans. Let us send you detailed facts and figures for your particular business.

Truscon Steel Company
YOUNGSTOWN, OHIO

Special representatives for steel boxes and platforms in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis, Cincinnati.

TRUSCON ALLOY STEEL PLATFORMS AND BOXES

What am I going to do about it?



The above illustration shows a Hunt Pivoted Bucket Conveyor handling coal in the power plant of a large manufacturing concern in New York City. An especial feature is the twist of about 30 degrees on the vertical run; made possible only by a pawl-driven chain of which the Hunt is the only type existent. This equipment has been in operation many years and continues to give excellent service.

Hunt Cost Cutting Equipment is noted for ruggedness and reliability, thus insuring long and efficient service, with the maximum of economy and minimum of repairs.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves, or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

This is the question many business executives ask themselves, when they discover their cost of manufacture is running too close to the selling price, and the margin of profit is so thin that it is almost imperceptible.

There is one logical answer to this question; *save on the cost of production.* Facts and figures, if accurately recorded, will give a good working basis on which to begin the saving process. By apportioning each item of expense in production to its proper position in the general cost scheme, the executive would soon find out where the excess expense was eating up profit.

Take the item of power costs, for example. A sub-division of this would be the handling and rehandling of coal and ashes. The method employed in performing this function has a strong bearing on the cost of power, which in turn is reflected in the ultimate cost of production.

Obsolete, worn out machinery, or apparatus unsuitable for the work in hand, cause expensive repairs, frequent shutdowns, and retard production, which demoralizes the whole organization.

Therefore, to obtain low cost power, the storage and rehandling of coal and removal of ashes require equipment that is staunch and rugged. That will stand up to its work for many years. That will perform rapidly, efficiently, and economically.

Hunt Cost-Cutting Equipment has had an enviable reputation for over half a century for handling coal and ashes —and similar bulk material—and can be relied upon to fulfill every requirement for an efficient, long-wearing, economical labor- and time-saving system.

Hunt Engineers will gladly give the benefit of their long and varied experience in planning a coal and ashes handling system for present needs and future expansion.

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc.
431 South Dearborn St., Chicago, Ill.

ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.

Industry Chooses Locations to Meet Changing Conditions

(*Continued from page* 33)

former is Henry Ford and his many manufacturing and assembling plants throughout the country; of the latter, the development of the silk industry from practically a Paterson monopoly to one reaching into many Pennsylvania towns and down to the South.

Still another step, and a most interesting one, is the present trend toward scientifically planned industrial areas, such as the Bush Terminal at New York harbor, the Garment Manufacturers' Center in New York, and various industrial tracts or buildings in various cities. These areas provide common facilities for manufacturers, ranging from land and trackage only to water shipment, power, freight handling, space, and other services.

Political policies are playing an important part in the relocation of industry. Our open immigration of many years allowed millions to enter New York and other Atlantic ports. This vast mass of cheap labor huddled in the large cities of the Northeast, where their languages were spoken, and attracted numerous industries which thrived on this low-paid and, at first, docile labor. New York and other cities grew rapidly industrially in response to this movement of labor.

With the closing of the gates, the differential of cheap labor which these great centers enjoyed is passing, and industries which found it to their advantage to locate there are moving in considerable numbers to other sections. The garment and tobacco industries are conspicuous examples.

Capital always seeks the best bargains in labor, and the increasing movement to the South and to country places for cheaper labor will last only as long as the inevitable unionization does not completely take place. The movement then, in the opinion of the writer, will be not so much to various sections of the country as to particular towns and cities that have developed an industrial civilization where capital restrains its tendency to treat labor solely as an item on the balance sheet, where labor in return produces enough to warrant high wages, and where the community is organized for the welfare of all, and not for some business men's ring or radical labor element.

The tariff is another political factor in relocation. Its ramifications are so numerous that it is difficult to trace its effect. Generally speaking, our high protective tariff policy of the past has had a tendency to delay the scientific location of industry by lessening competition and therefore the incentive to cut costs by locating in the best possible place. Theoretically, a high tariff encourages domestic competition, but practically it tends toward a higher level of prices than before and thus less necessity for scientific production.

On the other hand, tariff policies of our customers are forcing American plants to locate in Canada, England, France, Sweden, and many other countries, and bringing foreign plants here.

The present high tariff is not conducive to extensive relocation to trim costs, but it is offset by the causes of relocation today, congested cities, labor troubles, power and fuel shortages or changes, high freight costs, and the movement of population and markets.

Reducing the Weight of the Package

(*Continued from page 36*)

ago. And yet, due to scientific methods of construction, proper nailing determined scientifically, and adequately reinforcing where necessary, or by the use of an entirely new type such as the wirebound box, the loss and damage claims today are undoubtedly lower than ever before in the history of railroading. When one takes into consideration the increased volume of damage claims in moving goods and the decreased purchasing power of the dollar, it's apparent that they are lower than at any time since such records have been kept.

Take the case of the Southern Railway, one of the very first to establish a claim prevention bureau: we find a very gradual improvement until 1920—generally recognized as the worst in recent years—after which the progress is most pronounced.

On that one road alone the record of the past three years speaks volumes for better packing methods:

Year	*Claims Paid*	*Per Cent. of Tariff*
1921	$3,015,258.40	2.57%
1922	1,559,724.68	1.28%
1923	1,495,039.40	1.00%

Not all of these savings can be attributed to better boxing and crating methods alone—but they have played an important and an ever increasing part.

For example, iron strapping or binding wires have been used for years on the regularly nailed heavy wooden boxes carrying certain commodities. But when it became generally understood that boxes having comparatively thin sides, top and bottom and bound with metal bindings often are more serviceable than those constructed of heavier lumber without such bindings, shippers were quick to apply this information. "In some cases," according to the boxing experts of the U. S. Forest Products Laboratory, "it is possible to reduce the thickness of material 20 per cent. or more and at the same time permit the use of a poorer grade of lumber, when metal bindings are properly used, without any reduction in the serviceability of the container."

In the wirebound box where a relatively high grade of hardwood lumber is used, and where the unique structural advantages apply, the thickness of the sides, tops and bottoms, and frequently of the ends also, may be reduced fully 50 per cent. under that of an unstrapped box designed for the same commodity—and still give a stronger box.

In this type, frequently referred to as the box without nails, there is a framework formed by mortised and tenoned cleats, to which the thin lumber sides, top and bottom are stapled under a series of binding wires. The ends also are stapled in. When packed the lid is lowered, not unlike the top of a trunk, after which the box is securely closed by merely twisting the binding wires. An inexpensive tool especially designed for the purpose is recommended, although a common pair of pliers may be used.

It's the stitching of the binding wires to the outside surface of the box that gives it its exceptional power of resistance, although the framework construction also plays an important part in meeting certain hazards of transportation.

Another type of these new strong, light containers is the panel box. As in the wirebound type, the sides, top and bottom, made in this case of ply-wood, are nailed to cleats or battens at each edge to form the panels which are then nailed together through the cleats to form the box. This construction makes a box of light weight which if properly nailed is tighter and more rigid than a wirebound box.

For some articles—candles for one thing, or a product with a highly finished surface, like a talking-machine—a very rigid box is required. The lock corner box, with or without partitions which add further to the rigidity, is usually chosen. But where a lighter weight box is desired the panel box is ideal. But packing engineers have discovered that this very rigidity may be a decided handicap for other products. In a recent box laboratory test during the process of developing the best container for a glass bottle manufacturer a very strong and rather heavy rigid box made of 13/16" hardwood lumber was made up. In it the bottles were packed, in groups of three, separated from the next group by a strip of corrugated paper. The box when packed and closed was put through the usual laboratory tests of drops and tumbles—far more severe than is usually encountered under the most trying conditions in transit. It was found that forty-two per cent. of the bottles were broken. In a heavy wirebound box—one of about one-half the thickness of the first box tested, packed the same way and subjected to identically the same tests the breakage was reduced to 22 per cent. A third test was made using a light wirebound box—so light that there was an appreciable "give" to it when loaded with the same quantity of bottles, packed the same way. The same severe tests brought only 4 per cent. breakage.

An exporter of terra cotta tiles recently called in a packing engineer to "check up" on his packing and shipping methods. Among the containers worrying him was a certain wirebound box being used for his tile shipments to England.

"What's the matter with it?" asked the engineer. "Are you having complaints of breakages?"

"No complaints," said the manufacturer. "I've been over there and I saw them arrive. The tiles were all right—but the boxes looked so flimsy I couldn't understand how the tiles ever got through."

The engineer explained the principle and recommended the continued use of the wirebound box.

All of which illustrates that the proper approach to a packing problem begins with the article to be shipped and not with the container.

This applies to domestic shipments as well as those for export, although the foreign shipment is more likely to better illustrate the thought. In the case of a machine, or even the parts of a machine, a very heavy, strong and rigid container, heavily reinforced and strapped, such as is illustrated in figure (Plate 3) may be necessary. On the other hand one of the newer lighter containers may prove entirely satisfactory with a great saving in transportation charges. An example of this kind is illustrated in a wirebound box shipped by the Bible school of Bethel Evangelical Church at Evansville, Indiana, to a missionary in Bisrampur, Rapier District, C. P. India. This box was filled with games, clothes, toys, etc., weighing three hundred pounds, for the native children at the mission. During the trip it had very severe treatment, being carried of course by rail, boat, including the usual rope sling

(*Continued on page* 48)

(Continued from page 46)

at the dock, by hand and by pack. From the missionary it was learned that the contents were received in excellent condition. In proof of her statement she sent the kodak picture from which the illustration (Fig. 13) is made.

A solid article which fits snugly without shifting does not generally need as strong a box as one where the type of contents develops stresses and strains in transit. A cylindrical article concentrates the strain on the few points of contact with the box. These must be made stronger or other provision for distributing this strain provided for. One of the popular methods of doing this is by means of a hexagonal box. This type is of particular advantage also in carrying such disc articles as wheels, auto tires, insulators, etc. An article pointed at one end with a heavy broad base at the other, demands another kind of treatment. Another product difficult to handle is one of small units, like bundles of small brass rods, loose monkey wrenches or bars of solder, which have a tendency to wedge endwise or spread sidewise, throwing the heaviest strain, not evenly along the edges or a side, but instead at one point or in the middle of the particular surface under stress. The point is to ascertain where the greatest strain is to occur, then to build a box strong enough to meet that maximum strain at that point, but no stronger elsewhere than the strain there demands with a reasonable factor of safety. To quote the U. S. Forest Products Laboratory again: "When all elements in the construction of a box resist equally the destructive hazards of service, it is balanced in construction. A box may be balanced in construction and yet excessively heavy, too strong, and uneconomical in the use of material. . . . The chief problem in box design is to detail the parts so that balanced construction and proper strength are both obtained, and at minimum cost. Balanced construction and a proper degree of strength can be determined by suitable methods of testing."

Such tests make possible the extent to which economies in boxing costs may be profitably made.

There's a saving in the purchase cost of a lighter over a heavier box, due to the smaller amount of material used.

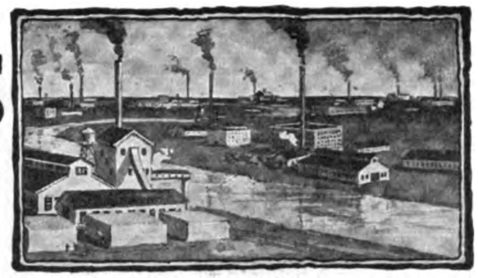
There's a saving in shipping weight—which by the way must be paid on the box weight at the rate for the commodity it carries.

Lastly, there's the economy which comes from a more serviceable container—less likelihood of damage or theft of contents, delivered in marketable condition, and freedom from disappointment to the receiver, with their consequent explanations, delays and claims.

The foregoing illustrations point to but a few of the many packing problems which are being decided daily by packing engineers for the benefit of America's business establishments. No specific mention, aside from the authorities quoted, has been made of the agencies which have blazed the trail or which now are at work in maintaining the ground gained or in making further refinements to the art. But it is due to their efforts that the present recognition comes to America.

Remembering as these forces do, the packing and shipping conditions as they found them less than twenty years ago, such tributes as are here given are by no means an insignificant reward.

Ten Great Mills and Factories



-but *One Room* Houses the Really BIG Feature of Hinde & Dauch Service

IN one section of one of the ten great mills and factories of The Hinde & Dauch Paper Company is the room where a few skilled engineers devise special shipping boxes for manufacturers. Just a stone's throw from where giant machines are turning out thousands of strong, smooth-walled, resilient cases every hour, a little group of packing scientists patiently plan and figure—cut, try and test—and produce by hand, possibly a dozen sample boxes per day. ***And sometimes the head designer will spend weeks in working out one single package.***

H & D Free Box Planning Service

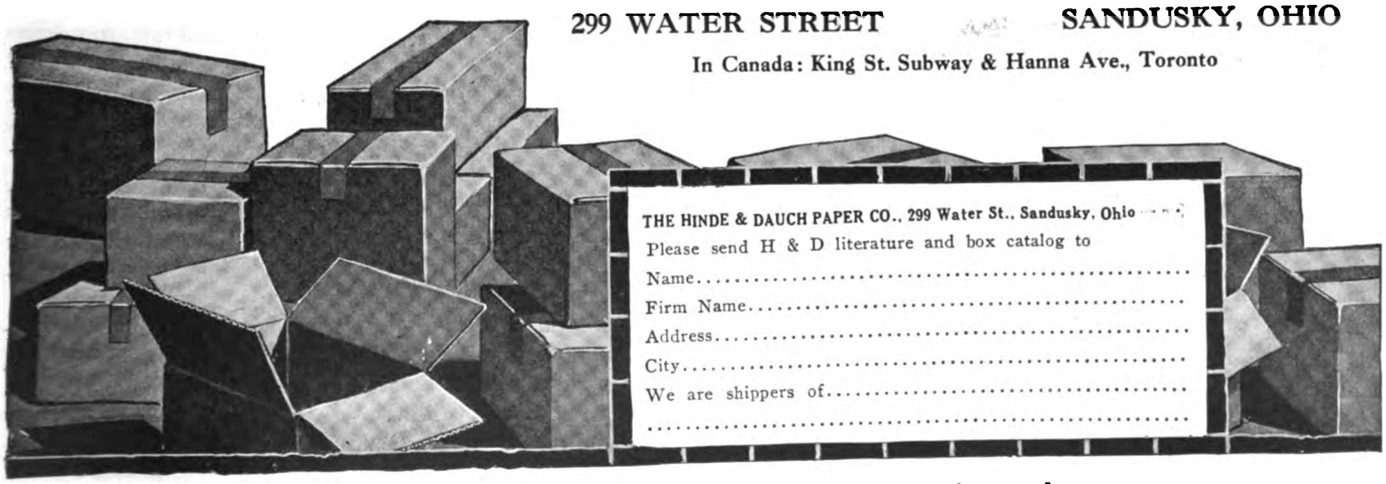
Not one penny is ever received for this highly specialized service. It is free to all shippers who have a packing problem, big or little —regardless of where their box requirements are supplied.

Tell us your problems—or, better still, send us a sample shipment of your goods for experimental packing in an H & D Box. Without cost and without obligation an H & D Shipping Case will be designed and submitted for your inspection and it will be accompanied by our cost figures for the quantity you require. If there is a better way to pack your goods H & D will find it. Send your sample shipment collect—today—to

Last year 3,898 different manufacturers called upon the H & D Service Department for advice and aid in packaging their various products. For these manufacturers 7,591 sample boxes were designed and submitted for their inspection and comparison—ALL FREE OF CHARGE.

Such wide use of a service is indicative of its merit and we are confident that you, too, can find new economies and a better packing method thru this H & D department.

The Hinde & Dauch Paper Company
299 WATER STREET SANDUSKY, OHIO
In Canada: King St. Subway & Hanna Ave., Toronto



Industrial Railways

(*Continued from page 26*)

tem, the subject of industrial rail transportation in its simplest form seems very diversified and complex.

The manufacturers of this equipment add to the difficulties of this situation as their standards vary slightly and for this reason it is sometimes difficult to operate a car purchased from one company over tracks, switches or turntables obtained from another company. A few of the manufacturers have now more or less standardized their track construction and track gauges, but much could be done on the further standardization of their other equipment. As it is necessary to determine a fixed line of travel which cannot easily be changed except in the case of portable railways it is necessary to more or less standardize on a certain size or class of equipment if all parts of the system are to be interchangeable.

The matter of track gauges has always been a difficult one for the writer to understand as there appears to be no good reason for the use of all of the following: 18" gauge, 24" gauge, 30" gauge, 36" gauge, 42" gauge as well as the standard 56½" gauge which is used on our national railways. In addition to the above mentioned, manufacturers' catalogs go so far as to show twenty different gauges, ranging from 16" to 56½". This is a wide assortment and very confusing to the engineer and industrial executive. It is possibly this one point, the lack of standardization, which has retarded the installation of industrial railway equipments in new industrial plants and which has also caused some executives to discard equipment which had already been installed. It seems opportune for a further simplification of the above gauges to be considered, especially if the manufacturers intend to obtain a more extensive use of their equipment in industrial production plants. For general quick movements through buildings, the 24" and 30" gauge equipment seems to be best adapted as it permits short curves, convenient switches and narrow lines of travel. Could not these two gauges and the standard 56½" gauge equipment be the only ones employed?

Along the line of standardization considerable could also be done in the matter of car construction, especially regarding the design of wheels, axles, bearings and the sub-frames. The matter of the superstructure, however, cannot be so easily handled as it will always be necessary to build this portion of the cars to meet the requirements of the industries in which the systems are operating. Industrial railway cars have already been designed and built to meet the different requirements of various industries and a number of these are now considered standard equipment as the design used by each manufacturer is similar. In addition, some manufacturers have developed and built more than 200 different types of special cars to meet certain industrial needs. These cars come under the heading of platform cars, dump cars, hopper cars, scoop cars, charging cars, rack cars and many others and this equipment is now operating under especially severe conditions in coal mines, creosoting plants, chemical plants, steel mills, foundries and other industries.

To obtain an idea of the diversified car equipment the reader should glance at the accompanying illustrations. In Fig. 1 hopper cars which discharge through a gate between the tracks are illustrated. In Fig. 3 we see rocker body dump cars accepted standard designs of which are

(*Continued on page 52*)

CLEVELAND
HAND OR ELECTRIC TRAMRAIL

Branch Offices:
New York City, 30 Church St.
Pittsburgh, 500 Arch St.
Chicago, 557 Ry. Exchange Bldg.
St. Louis, 1309 Pine St.
Pittsburgh, 511 Farmers Bank Bldg.
Detroit, 140 E. Larned St.
Philadelphia, 2401 Chestnut St.
San Francisco 16 California St.
Los Angeles 422 East 3rd St.

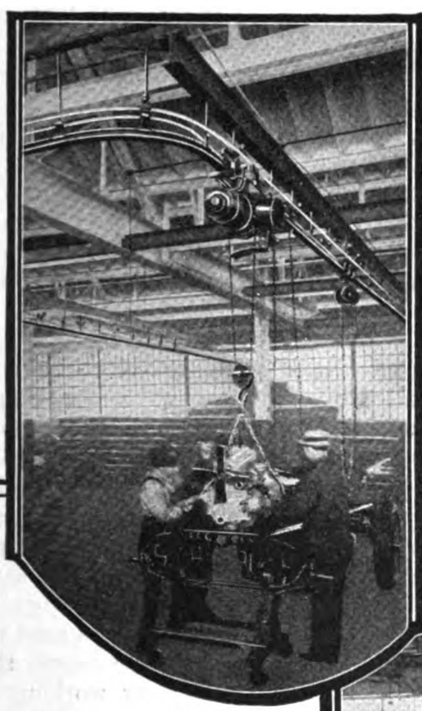
Time and Tonnage Make *Inside* Freight Rates High

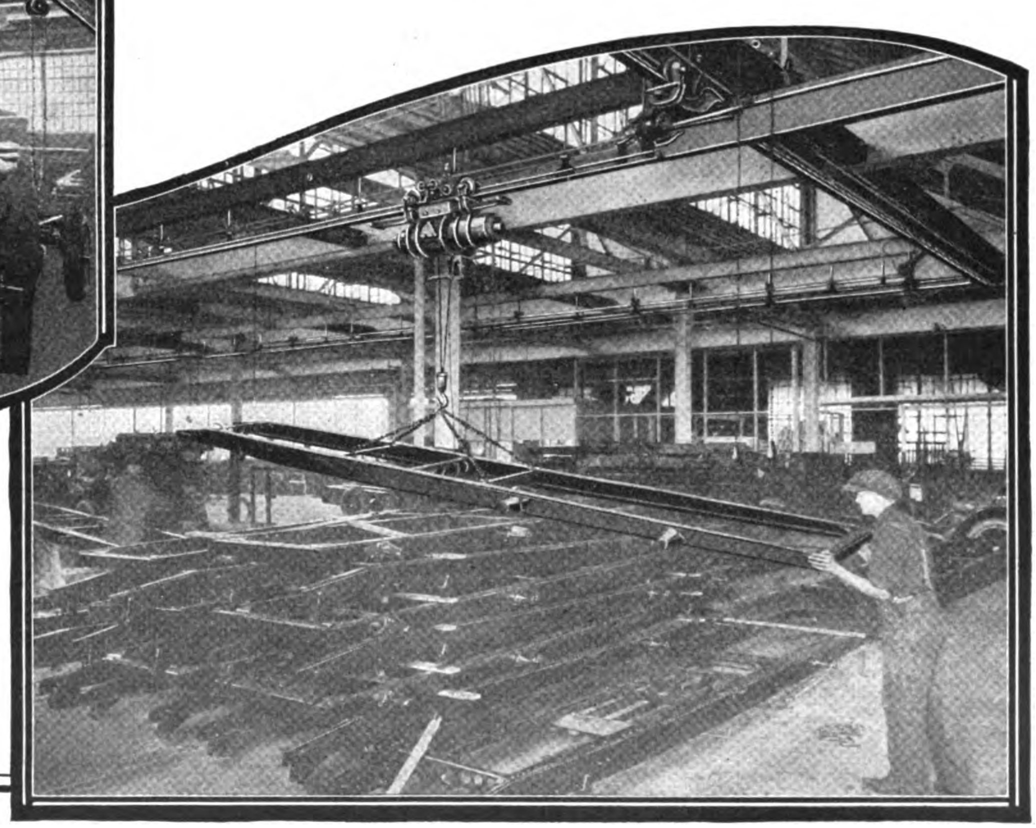
This is especially true where production is retarded by lost time between operations. Few have been as quick to realize the importance of this fact as the automobile and truck manufacturer who also builds and sells "transportation."

The Cleveland Electric Tramrail is an automotive unit for factory service. Its sole object is the reduction of time in the handling of tonnage in all the processes of manufacture.

A Tramrail engineer may offer some valuable suggestions if you will invite one to call and study conditions in your own plant. *Inside* freight rates there are probably subject to great revision downward.

CLEVELAND ELECTRIC TRAMRAIL
DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO.





MOTOR TRUCK ASSEMBLY

A Cleveland Electric Tramrail System plays an important part in the handling of units and assembly of trucks in the Detroit plant illustrated here. More than 750 feet of rail, 9 carriers and one transfer bridge speed up the work.

(*Continued from page* 50)

also illustrated in Figs. 4, 6, 11, 14, 15, 16, 24 and 25, but by looking closely at the construction of the superstructure as well as the sub-frame it will be noted that the details are different in each case. This is for the reason as previously stated that there seems to be no standard for the so-called standard equipment. This matter of construction will be touched on later in this article. In Fig. 5, two types of cars are visible, in the foreground is the type used for handling ties while to the right of the picture will be seen the type for handling small blocks of wood in creosoting plants. Figs. 7 and 19 show two different platform cars, which are different in construction because of the different type of products or materials handled. Fig. 21 shows a special superstructure built by one car manufacturer for operation in a plant where automobile tire rims were produced. Figs. 9 and 17 show the type of cars known as side discharge dump cars and these two illustrations clearly show how such cars are loaded and dumped. Figs. 10 and 13 show a charging box car being loaded with materials, and the same equipment placed in position for feeding the materials to open hearth furnaces. Figs. 22 and 23 show the type known as gable body dump cars and which discharge material on both sides of the track simultaneously. These cars are generally employed where bulk materials are transported over storage piles on trestles or runways, as shown. In Fig. 2 such a car is illustrated but this car is self-propelled, while in Figs. 22 and 23 both types are used in the same train.

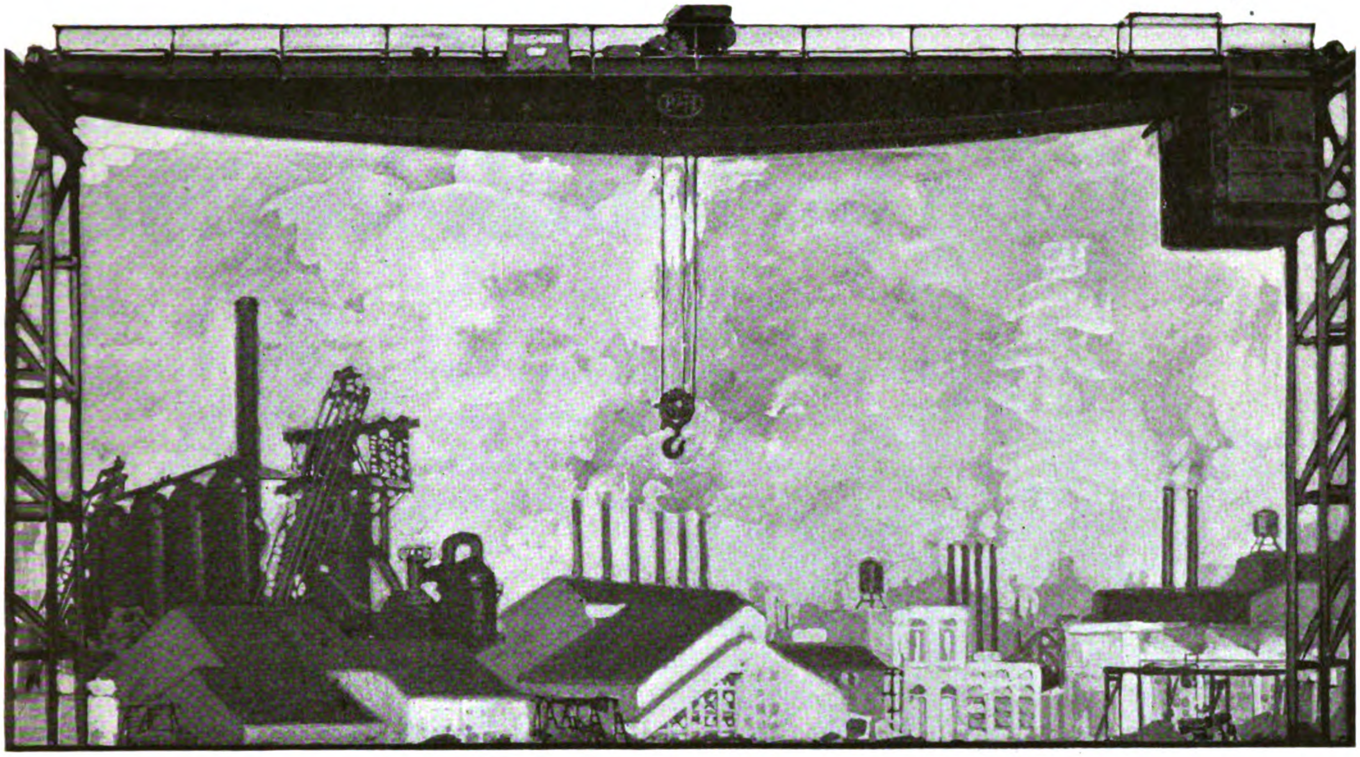
Self-propelled cars are in a sense locomotives equipped with car bodies and for this reason their construction differ considerable, some being trolley driven and others operating from a third rail.

The construction of car bodies is a matter which more or less defies a general standardization but a good many parts could be made interchangeable. The reason why each body should be constructed to meet the needs of the industry in which it will operate is clearly shown by looking at Figs. 6, 8 and 14. The car shown in Fig. 8 can be of a light construction because it is loaded with small loose materials direct from a chute and is simply dumped at the refuse pile. In the case of Fig. 6, however, the car body gets considerable abuse as irregular and heavy chunks of materials fall from varying heights and strike the body with considerable force. It is therefore necessary to reinforce such equipment with angles and plates in order to obtain proper service. The same is true in the case of quarry cars as shown in Figs. 14 and 25, although the equipment shown in Fig. 14 need not be as heavy as that shown in Fig. 6 for the reason that the stone is loaded in this class of quarry working by hand. In the case of the equipment shown in Fig. 25, however, a fairly heavy hopper should be provided for the reason that the shovel bottom in dumping the load frequently strikes the edge of the car.

In order to point out the various industries in which installations have been successful and to show the many uses that can be made of this equipment or method of handling, a brief description of some of the installations illustrated, and their points of use, will be described.

Fig. 2 shows a self-propelled car operating on a trestle and handling coal to outside storage piles. Figs. 22 and 23 show self-propelled cars hauling gable body dump cars over trestle structures. In Fig. 22 we see fine granu-

(*Continued on page* 57)



Low Crane Operating Costs Over Long Period of Years

The extreme care in selection of material, design, and manufacture—means extra time, extra expense,—which we could save and for a time, at least, purchasers of P & H equipment would not know the difference.

But,—it is on this factor of thoroughness (despite the time and cost) that the reputation of Pawling & Harnischfeger Cranes and Hoists has been built. It is due to this that the long life,—low maintenance during that long life,—and the satisfactory performance are possible.

The user gets lower crane service cost per year over a long period of years—something the engineer or industrial man of judgment is seeking.

Then, too,—the conservative rating of all P & H products—and our 40 years in business, designing and building over 7,300 cranes and hoists assure you that the placing of your material handling problems in the hands of P & H engineers will receive intelligent attention.

Partial List of Users of P & H Cranes

Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.
American Brass Co.
Baldwin Locomotive Works
International Harvester Co.
American Locomotive Co.
Ford Motor Co.
Ingersoll-Rand Co.
Worthington Pump and Mach. Corp.
Chicago & Northwestern R. R.
Warner Sugar Refining Co.
Dodge Bros.
Fairbanks, Morse & Co.
Westinghouse Mach. Co.
National Carbon Co.
Calumet & Hecla Mining Co.
Studebaker Corporation.
Bullard Machine Tool Company.
Crane Company.
New Jersey Zinc Co.
Simmons Co.
Standard Oil Company.
Jeffrey Manufacturing Co.
Firestone Tire & Rubber Co.
Gisholt Mach. Co.
Chain Belt Co.
Busch-Sulzer Diesel Eng. Co.
Weyerhaeuser Timber Corporation.
Nordyke & Marmon Co.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

Established in 1884

3850 National Ave., Milwaukee, Wis.

New York Atlanta Detroit Kansas City Chicago Portland Memphis Dallas
Philadelphia Los Angeles Pittsburgh San Francisco Seattle

P&H CRANES and HOISTS

to more productive work Material Handling Equipment

WHEN a workman rolls down his sleeves, lays aside his tools and turns away from some menial back-breaking job to more productive work, it is good for his employer and for him.

Labor assigned to more important work, helps solve the industrial problem of labor shortage, aids the plant in achieving simplified practice and raises standards of living.

Concerns of every size and in every industry, are now adopting Jeffrey Material Handling Equipment, thereby making the most profitable use of their men.

Jeffrey Equipment includes a complete line of Conveyors, Elevators, Portable Loaders and Unloaders, Chains, Coal and Ashes Handling Machinery, Power Transmission Machinery, Crushers, Pulverizers, Mining and Tipple Machinery, Locomotives, etc.

The Jeffrey Mfg. Co.

Columbus, Ohio

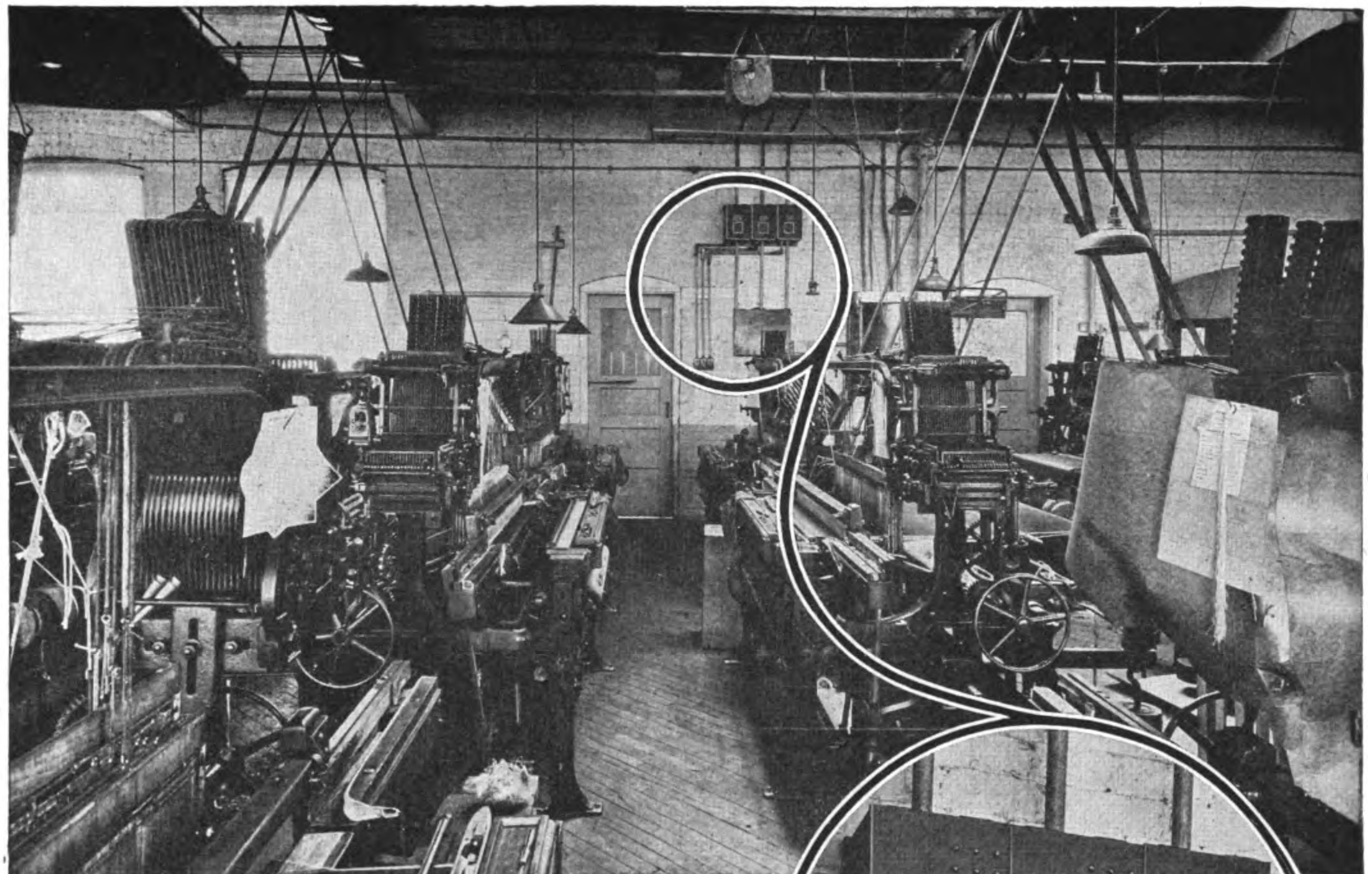
New York	Boston	Chicago	St. Louis
Philadelphia	Cincinnati	Detroit	Denver
Pittsburgh	Charleston, W. Va.	Milwaukee	Los Angeles
Scranton, Pa.	Cleveland		Montreal

THE release of labor from menial tasks to more productive work in the plant through proper material handling equipment, is directly in accord with the educational program conducted by Secretary of Commerce, Herbert Hoover, through the Division of Simplified Practice, Department of Commerce.

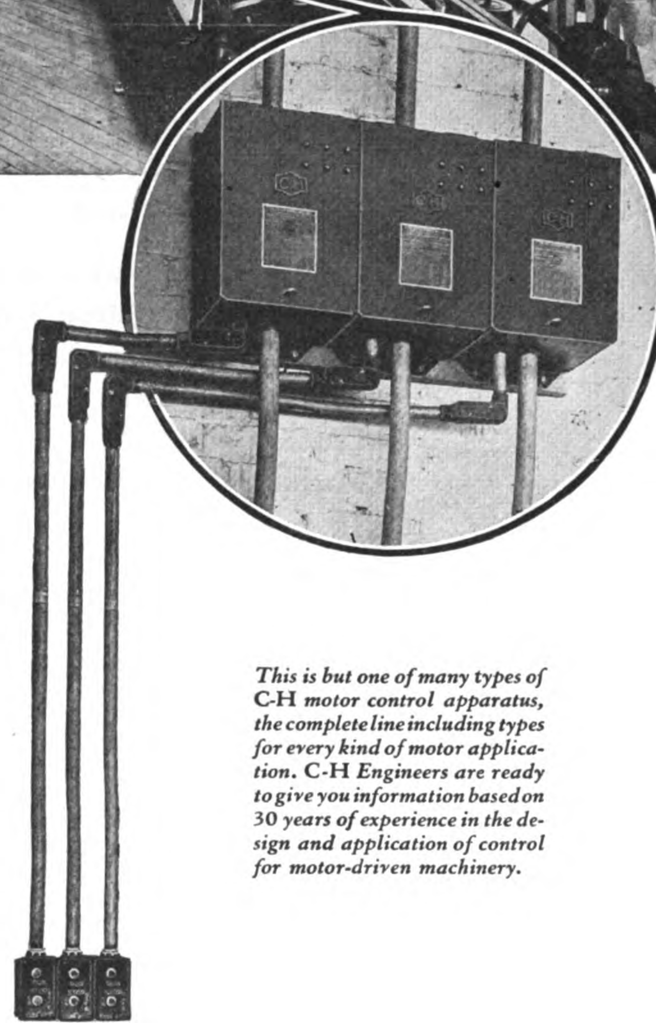
Material Handling Equipment helps secure simplified Practice of Production. It releases labor for the more productive work.

Material Handling EQUIPMENT

7-1-24



Three of the 25 Cutler-Hammer Push Button Type Automatic Starters used with the 5 H. P. motors driving the hundreds of looms in Mill "F" of the Amalgamated Silk Corporation, Allentown, Pa.



Hundreds of Looms—as Easily Controlled as the Lighting Circuits—With C-H Push Button Control

Overhead—out of the way, the Cutler-Hammer Automatic Magnetic Starters are placed—with conveniently located "start" and "stop" push button stations to make it easy for any operator to set the looms running or stop them.

No training is required—buttons are plainly marked—every protection for the motor is provided. If the power is "off," No-Voltage protection comes into play so that if the power comes back there will be no injuries resulting from sudden, unexpected starting. The "start" button must be pressed after an interruption.

If for some reason overloading occurs, protection is similarly afforded and the motor automatically cut from the line, eliminating chance of burning out.

More complete information on the starting and speed control of motor-driven equipment furnished on request.

This is but one of many types of C-H motor control apparatus, the complete line including types for every kind of motor application. C-H Engineers are ready to give you information based on 30 years of experience in the design and application of control for motor-driven machinery.

THE CUTLER-HAMMER MFG. CO.

Motor Control Department

Works: MILWAUKEE *and* NEW YORK

Offices and Agents in Principal Cities

Northern Electric Co., Ltd., Can.

C-H CUTLER-HAMMER **AUTOMATIC STARTERS**

(Continued from page 52)

lar materials being handled and the cars operating at ground level before proceeding up the incline to the trestle, while Fig. 23 shows the same type of equipment handling small and large lump material and clearly illustrates the incline from ground level to the trestle. Many systems of industrial railways using this class of equipment have been installed and are now operating in chemical plants, fertilizer works and numerous industrial plants where large quantities of bulk materials have to be handled over a considerable distance and where straight runs of conveyors are not possible.

Fig. 3 shows how road builders are using industrial railways for handling concrete in the construction of public highways and in Fig. 4 we see a gasoline locomotive hauling similar dump body cars on the backfill of a new railway road-bed. With this equipment a greater amount of material can be handled per day than with wheelbarrows or buggies and the handling of large quantity cuts the labor cost.

The Oil Well Supply Company has found the equipment shown in Fig. 7 very economical in the transfer of various classes of material about their plant. This equipment insures prompt deliveries of the proper quantities of materials required by the different departments and the use of storage battery locomotives for hauling the trains eliminates the danger of accidents from third rails or trolley wires. The reader's attention is directed to the layout of industrial track visible and how it parallels the incoming freight railroad to the center of the plant; also how the track switches into the buildings and crosses the other railroad at a point in the foreground. It is heavy loads of this character which are particularly difficult to handle with any other class of equipment. The same is true in the handling of big castings and other parts, as shown in Fig. 19.

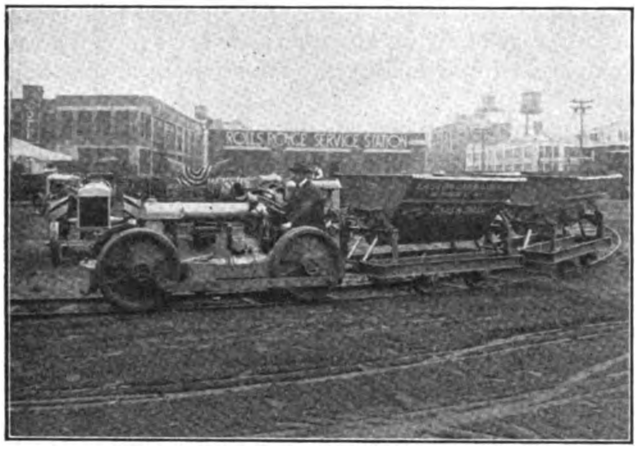


Fig. 24. Gasoline tractors are being adapted into locomotives for use with industrial railways.

The steel industry employs industrial railways of various gauges and on many handling operations. A 56½" gauge track equipment with steam locomotive and flat cars for handling charging boxes to open hearth furnace is shown in Figs. 10 and 13. Fig. 10 illustrates how the overhead crane equipped with a lifting magnet loads scrap metals to the charging boxes. Fig. 13 shows the same equipment in front of an open hearth furnace, together with a partial view of the machine which places the charge in the furnace. It will be seen that this equipment handles heavy loads and receives rough use.

In preparing wood with creosote or other preservatives considerable difficult handling would exist if industrial railways were not employed. The preserving of wood is now an extensive and important business as pieces are treated ranging in size from a paving block to a telegraph pole and for this reason a number of different designs of cars are required to meet the various needs. Two of these, as previously stated, are illustrated in Fig. 5. The construction of these cars is somewhat different than for other purposes as they usually have a steel slat platform with open work superstructures to allow a free circulation of the treating compounds and to permit a quick draining off of the liquids when the cars are withdrawn from the dipping bath. We also wish to point out the faithful horse which is used as a means of locomotion.

Two similar installations, but operating in different industries, are shown in Figs. 8 and 11. That in the first mentioned is the installation of a storage battery locomotive handling a train of cars, which carries refuse material from the production plant to the dump at the Columbia Plate Glass Company, Blairsville, Pa. It is interesting to note in this picture that other materials handling equipment is employed at this plant and above the locomotive, but attached to to the side of the building will be seen a monorail telepher equipped with a grab bucket. Fig. 11 shows how the same class of equipment is employed for handling raw materials in a large glue plant.

In Fig. 12 we see how another glass plant employs industrial railway systems for the handling of batch materials in process from mixers to glass furnaces. In this case the equipment is of a wider gauge and the locomotive operates from trolley wires instead of storage batteries.

In sand pits, clay banks and stone quarries, the matter of track laying is not given the same consideration or care as in the case of industrial plants, as it is frequently necessary to shift these tracks from point to point. Figs. 9 and 17 show two operations in the same quarry, and clearly illustrates how the various lines of track all lead to the central dumping point. In Fig. 9 a general view of the crusher and screen house and the method of loading the cars as well as the gasoline locomotive for hauling the same are clearly visible, while Fig. 17 shows how an air hoist is hooked to the side of the car to facilitate the unloading. Bucket elevators then carry the stone to the sizing screen which distributes it to the various storage bins.

Brick plants use industrial railways on many handling operations from raw materials to finished product. Fig. 18 illustrates three different pieces of equipment and three different gauges of track. The electric locomotive is operating on one gauge while the transfer car, which it is hauling, operates on a wider gauge. This wider gauge was determined upon so as to handle the brick cars at a low elevation. It will be noted that the cars upon which the bricks are loaded are propelled by hand and operate on a narrow gauge track system.

It has already been pointed out that various means of locomotion are employed, the reason for this being the length of haul and the weight of the load. Fig. 15 shows clay being handled in a brick plant on a short haul from clay bank to machinery house and in this case a single horse hauls the cars. At the Delaware Clay Manufacturing Company, Delaware, Ohio, an electric locomotive

(*Continued on page 60*)


NORTHERN CRANE
BAY 15-16
A Standartized
5 Ton Crane built in Large Quantities to Sell at Low Cost
First time in the history of the Industry that a crane has been standardized and built in large quantities to sell at a popular price.
But modern times demand Lower Prices and Better Equipment.
Why Buy a Hoist
(A make shift for a crane) When you can secure a real crane, with all the modern advantages and safety at but a slight difference in cost.
Order them as you would a Ford—for every part of your plant—you can now afford to do so.
Being inexperienced as compared to the ordinary crane you can now solve your lifting and conveying problems by a larger use of such equipment.
Made in one type only but in any length span and travel. Not an ordinary crane but the very last word in crane design.
Write for the full facts.
NORTHERN ENGINEERING WORKS
the people that build all forms of cranes, hoists, tramrail systems, stackers, etc.
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District Office
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Standartized
FIVE-TON
NORTHERN
QUANTITY PRODUCED
CRANE

(*Continued from page 58*)

hauls the cars from clay bank to plant. Fig. 20 shows this locomotive and the long trestle built over a ravine which presented a difficult problem for other types of materials handling equipment. Here it will be noted that the haul is of considerable length.

This installation speaks well for the economies that can be effected by the use of industrial railways over teams of wagons under such conditions, for it is not likely that the above-mentioned company would have invested its money in the building of a trestle as shown, unless they decided beforehand that the reduction in labor costs would shortly return their investment and savings effected.

In addition to the types and systems of industrial railways illustrated in this article we find equipment being operated by cables and cable hauls as well as rack railways which are used in places where steep grades or inclines are encountered. Cable railways will be found handling coal in a number of industrial plants and in these cases cars are moved by being coupled to a constantly running rope and this coupling is either done automatically or by an operator. Other cable railways operate on the principle of gravity and are counter-weighted to return the empty car to the point of loading. This equipment is used extensively for the handling of coal on water fronts, although they have been installed at many other places. In operation of such a system a loaded car is released on an incline of sufficient pitch to carry the material at a high speed to an automatic dumping point. Just prior to reaching this point the car attaches itself to a cable which raises a counter-weight and retards the speed of the car. The energy produced by the fall of the counter-weight causes the empty car to return up the incline to the starting point. Rack railways, as previously stated, are installed under certain conditions and are used when it is impossible to employ a chain haul or cable haul for the equipment. In these installations a rack is placed in the center of the track and the locomotive is equipped with a power driven gear which meshes with this rack and provides the proper grip for raising the load. It will therefore be seen that practically any type of locomotion, other than the horse, can be used with these systems.

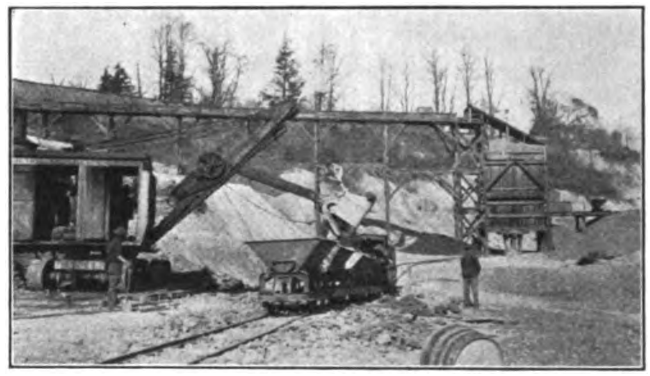


Fig. 25. Brick plants have employed industrial railways for years in the handling of clay.

Industrial railways do not differ from other materials handling equipment insofar as the present progress of their application is concerned for we find that certain industries use this equipment extensively while others have overlooked the possibilities of applying the same principle to their handling operation.

Who's Who in Muscle Shoals?

(Continued from page 17)

Sheffield, Alabama, had been built. This first nitrate plant was not a success and is not in fact located in the actual Muscle Shoals district. The cost was $10,000,000.

Nitrate Plant No. 2 is located at Muscle Shoals. It was completed just about the time the Armistice was signed, and cost somewhat over $60,000,000. Its capacity is 150 tons of nitrogen compound per day. These are the nitrate plants which are figuring in the negotiations and in which it is proposed to produce fertilizers for peace-time consumption, while at the same time maintaining a source of explosives for war purposes (the machinery and processes employed in the production of nitrated explosives and nitrated fertilizers are identical). The cost of plant No. 2 includes the purchase of a limestone quarry in the vicinity as a source of raw materials.

To operate Nitrate Plant No. 2, it was necessary to build the huge Wilson Dam, a part of which is illustrated on our cover. When completed in 1925, this will be the largest dam in the world, a mile long, 137 feet high, and with an ultimate power capacity of 600,000 horsepower. Regardless of the future uses of Muscle Shoals, or its future owners or resources, the government through the Corps of Engineers of the U. S. Army will probably complete this dam. It will cost $51,000,000.

In order to provide for the contingency of insufficient water supply auxiliary steam plants were built by the government at each of the two nitrate plants. These have an aggregate capacity of 120,000 horsepower. One of these is known as the Sheffield Steam Plant. The other, known as the "Warrior" or Gorgas Steam Plant, was sold in 1923 by Secretary of War Weeks to the Alabama Power Company, under the terms of the war-time provision which enabled this company, the original owners of the site, to regain title to the property.

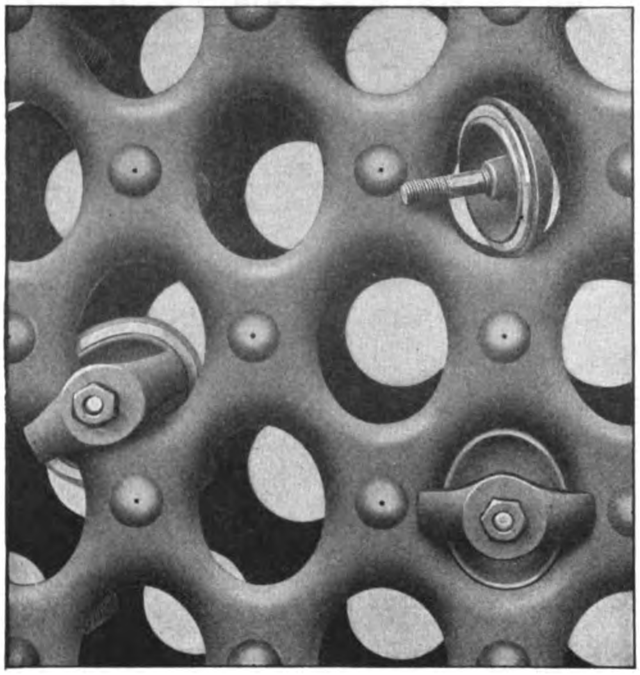
In connection with these various undertakings, the government has also constructed auxiliary buildings, residences, streets, sewers, and town equipment of no small value. At Nitrate Plant No. 1 there are 125 permanent residences, with all modern improvements, paved streets and water-works, four miles of standard gage railroads with necessary locomotives, cars, repair shops, etc. Nitrate Plant No. 2 comprises 2,300 acres of land on which there are 186 permanent residences. There are also a number of auxiliary manufacturing buildings or plants, such as saw mills, blacksmith shops and the like. On this tract there is a completely furnished hotel of 100 rooms, water-works and sewage systems, with twenty miles of sewers. Twenty-four miles of improved roads, cemented sidewalks and streets are also included in this development.

There is also a half-million dollars' worth of platinum belonging to the nitrate plants for use as a catalyst in extracting nitrogen from the air. This valuable material is considered as part of the plant and consequently will go to the purchaser or lessee. There is in addition property of definite fixed value, amounting to some $2,000,000 in the form of building material, lumber and trimmings, tile and fancy brick, typewriters, desks, etc.

In addition to plants and equipment which are either already built or which have been authorized and are under construction, there are a number of additional projects not yet authorized but which have been planned,

(Continued on page 65)

Economy Advantages of THE EDGE MOOR BOILER



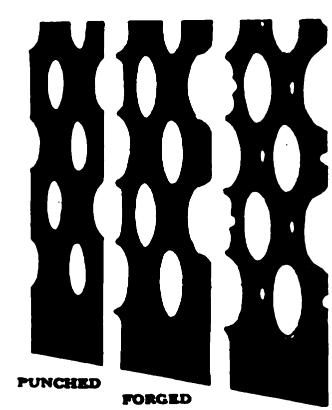
II. The Handhole Plate

BECAUSE it has a considerable bearing on boiler maintenance costs, the handhole plate deserves consideration.

Every handhole in the Edge Moor plate is elliptical, so that it is possible to pass each handhole cover through its own opening. While this construction is somewhat more expensive than the customary method of making most of the handholes round, with an occasional elliptical hole here and there, the added cost is fully justified by the economy effected. Much labor is saved when opening and closing the boiler by eliminating the usual "fishing" for handhole covers.

It will be noticed that the handholes are flanged inward and the turned-in edges machined to a smooth plane surface. This method of flanging forms a reinforcing ring around each handhole, greatly increasing the strength of the plate to resist internal pressure, and insuring that the machined surface remains in a true plane and provides a tight seat for the gasket. Naturally, this construction requires a heavier plate.

Details of this and other unusual construction features of the Edge Moor Boiler are explained in Catalog No. 63, which also contains much useful engineering data. Where shall we send your copy?



PUNCHED FORGED MACHINED

EDGE MOOR IRON COMPANY

Established 1868

EDGE MOOR, DELAWARE

New York Chicago St. Paul Boston Pittsburgh Charlotte Los Angeles

EDGE MOOR Water Tube BOILERS

EDGE MOOR BOILERS EDGE MOOR, DEL. U.S.A.

FOR INCREASED FUEL ECONOMY

(Continued from page 62)

and which, it is assumed in various of the bids will be completed at government expense. A dam at Florence, Alabama, known as dam No. 1, is proposed. It will not supply power, being for navigation purposes only, and will cost approximately $1,400,000.

Eighteen miles above dam No. 2 it is proposed to build dam No. 3 which will supply a maximum of 250,000 additional horsepower and raise the water level forty feet. Its cost will approximate $25,000,000.

A number of minor dams with locks will be required at different locations to provide for satisfactory navigation.

Four offers have been made to the government in connection with Muscle Shoals. They are as follows:

1. Ford offer.
2. Southern Power Companies offer.
3. Union Carbide Company offer.
4. Hooker-Atterbury-White offer.

These various offers have been concisely summarized by Mr. Howard F. Sedgwick, the clerk of the Committee of Military Affairs of the House of Representatives. We can do no better than to quote Mr. Sedgwick's summary:

The Ford Offer

"Mr. Ford will form a corporation with a cash capital of at least $10,000,000 to execute his agreement. The stock and securities of this company are to be owned and controlled by American citizens only.

"The Ford Corporation will lease Dams No. 2 and No. 3 with all necessary appurtenances for 100 years.

"The annual rental for the leases is to be on a basis of 4 per cent. of the actual cost of the construction work, not including the $17,000,000 spent by the Government on Dam No. 2 prior to May 31, 1922.

"The Ford Corporation will buy for $5,000,000 Nitrate Plants No. 1 and 2, the Waco Quarry, and a steam generating plant to be provided by the United States as a substitute for the Gorgas plant (sold to the Alabama Power Co.) at a cost not exceeding $3,472,487.

"The Ford Corporation agrees to manufacture every year commercial fertilizer containing at least 40,000 tons of fixed nitrogen.

"In order that farmers may be supplied with the fertilizer at fair prices, the Ford Corporation agrees that its profit shall not exceed 8 per cent. of the cost of the manufacture.

"To carry out this expressed purpose, a board shall be created, said board to consist of members nominated by the national farm organizations, the President of the United States, and the Ford Company, with a representative of the Department of Agriculture to sit in an advisory capacity, without a vote.

"The Ford Corporation will determine, by research, whether cheaper and better fertilizer can be manufactured, and to reasonably employ improved methods as developed.

The Southern Power Companies Offer

"In a revised offer of the power companies submitted by Mr. Hull in H. R. 6781, a single corporation is to be formed with a capital stock of $15,000,000. Mr. Yates, speaking for the power companies before the Committee on Military Affairs, stated this company would be owned and controlled by American citizens.

"The Corporation is to lease Dams No. 2 and No. 3 for 50 years.

"The average rental for the leases of the dam is to be on the basis of 4 per cent. of the actual cost of construction, except if Dam No. 3 is built by power companies' organization the provisions of the Federal Water Power Act will apply.

"The Corporation is to lease Nitrate Plant No. 1 for $1 a year and is to maintain Nitrate Plant No. 2 in readiness for the production of explosives at the cost of the United States.

"The Corporation will produce annually at Nitrate Plant No. 1 fertilizer with a content of 50,000 tons of fixed nitrogen, as rapidly as there may be commercial demand for same.

"The price is to be the production and sales cost, plus 8 per cent profit.

"A board appointed by the Secretary of Agriculture and the Company is to supervise prices and distribution of the fertilizer.

"A fund of $1,000,000 in ten annual installments is to be paid by the Power Company and expended under the direction of the Government for electro-chemical research in the interest of agriculture and national defense.

"The Corporation is to furnish for fertilizer manufacture a maximum of 140,000 horsepower of electrical energy. It will sell the remaining power to the people of the South.

"The Corporation will operate under the provisions of the Water Power Act."

Union Carbide Company's Offers

Two offers have been made by the Union Carbide Company, the first dated January 21, 1924, and the second, April 28, 1924.

The first offer was concerned only with Nitrate Plant No. 2 and the Waco Quarry, and assumed that the hydro-electric installations would be operated by other parties. Under this offer the Union Carbide Company proposed to lease Nitrate Plant No. 2 and Waco Quarry for fifty years, paying a rental of $150,000 a year for the Nitrate Plant and a royalty of five cents a ton on all stone taken from the quarry. It agreed to produce fertilizer with a nitrogen content of at least 20,000 tons of fixed nitrogen per year and to sell this fertilizer as the government might direct, at a profit not exceeding five per cent and a maximum profit of $2 per ton.

The later offer of the Union Carbide Company, dated April 28, 1924, does not withdraw the first offer but is intended as an additional complete proposal including the entire Muscle Shoals project. It contemplates completion by the government of Dam No. 2, and the leasing by the company of this dam with the power facilities and the nitrate properties for a period of fifty years. As rentals for Dam No. 2 and its hydro-electric facilities, the company proposes to pay rentals as follows: For the first six years of the term, $750,000 per year; for the succeeding four years, $1,500,000 per year, and for each of the remaining forty years a minimum of $2,150,000 per year. For the 60,000 kilowatt steam electric power plant, the company proposes to pay an annual rental of $200,000; for Nitrate Plant No. 2, an annual rental of $150,000; for Nitrate Plant No. 1 an annual rental of $25,000; for the Waco Quarry, a royalty of five cents per ton of stone removed. The total guarantees to the government under this plan amount to $120,000,000 in fifty years. In addition to these sums, it is proposed to set aside after the first ten years one-half of the profits accruing from fertilizer manufacture as an amortization

(*Continued on page 68*)

A Remarkable Development in Ventilation

The New Robertson Ventilator

A new roof ventilator of greater efficiency—a ventilator in which every construction detail is scientifically designed, placed and proportioned to increase its air-moving capacity (see illustration at right).

A more powerful ventilator which actually exhausts *from 50 to 60%* more air than an open pipe of the same diameter.

A more economical ventilator—(1) because, being simple in design and construction, it is moderate in cost and (2) because it has no moving parts to get out of order and require repairs.

A more durable ventilator because it can be made rust, weather and corrosion-proof by the Robertson Process of Metal Protection.

You'll want complete information, of course. Use the coupon.

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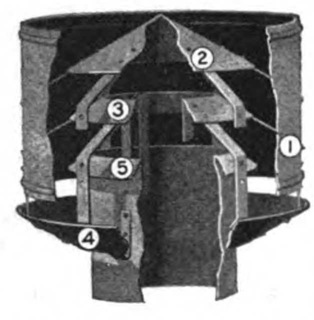
The New Robertson Ventilator



A cross-section view of the New Robertson Ventilator, illustrating the construction features which are responsible for its unusual ventilating efficiency.

(1) *Suction Band*—multiplies the displacement or air-pulling area of the ventilator pipe more than six times.

(2) *Cap and* (3) *Louver Ring*—these details make the ventilator storm-proof and positively exclude downward air currents.

(4) *Wind Baffle and* (5) *Stack Louver*—prevent upward air currents from entering the ventilator and interfering with the outward flow of air.

Don't Fail to Get a Copy of This Book

The complete story of the development and advantages of the New Robertson Ventilator is told in a profusely illustrated book by Dr. J. H. Young, Ph. D., of the Mellon Institute of Industrial Research at Pittsburgh. A copy is yours for the asking. Just fill out and mail the coupon below.

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I would like to have more complete information on the New Robertson Ventilator. Please send me a copy of Dr. Young's book, together with any other descriptive literature you may see fit—with the understanding, of course, that no obligation is involved.

Name.........................

Company.........................

Address.........................

City............State...........

I. I. 7-24

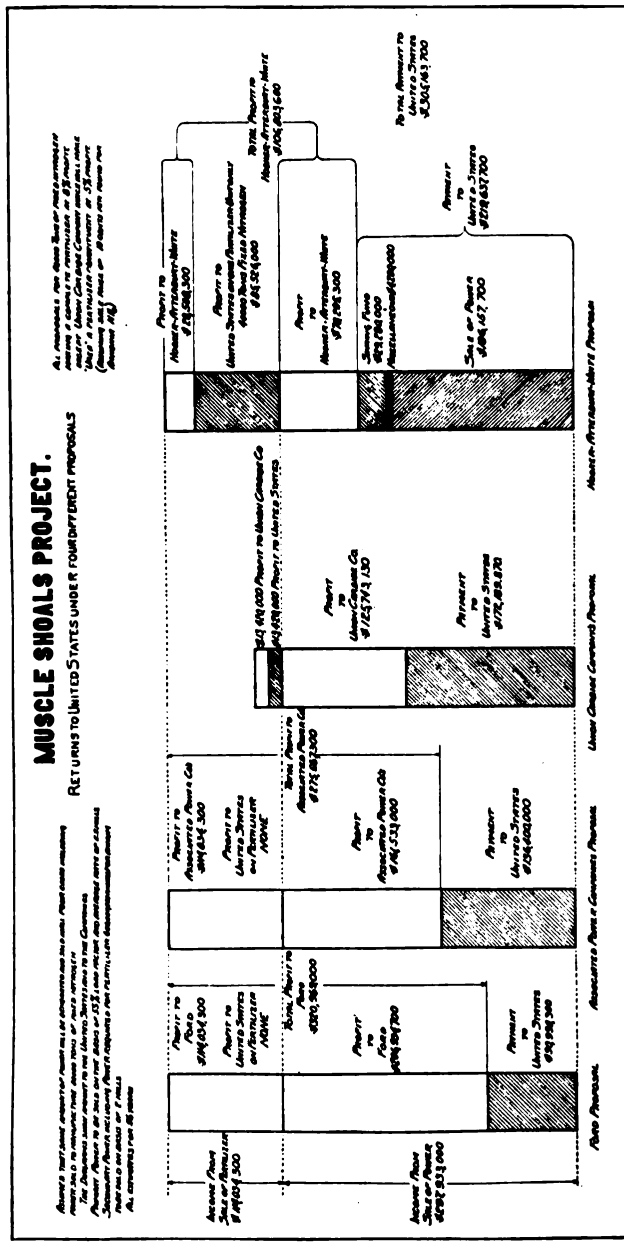
(*Continued from page 66*)

fund to amortize the investment of the United States in the nitrate plants.

Hooker-Atterbury-White Offer

"A corporation with a cash capital stock of at least $1,000,000 is to be formed to lease the nitrate plants and the hydro-electric power plants and to operate these for and at the expense of the United States for a term of fifty years.

"The corporation is to be permitted to earn an annual net profit of 8 per cent. of the current sales price of all



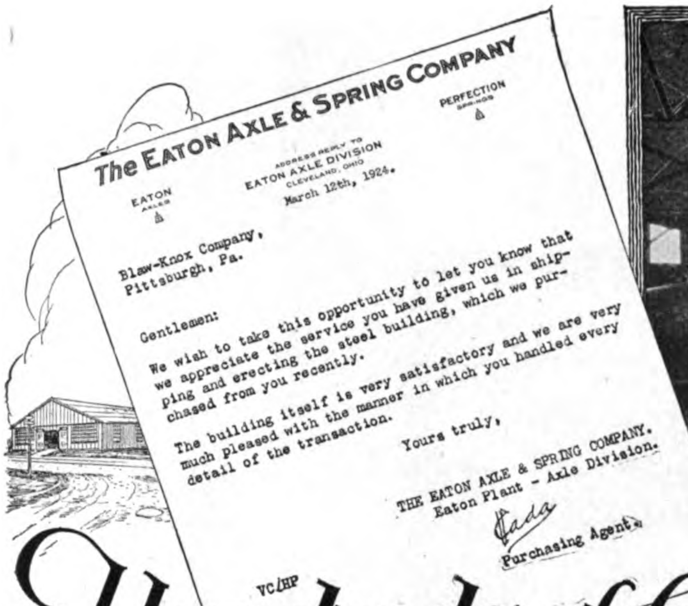
Estimated returns to the government under the various bids.

fertilizers manufactured by the corporation during the year.

"The corporation agrees to continue and extend fertilizer production and to sell surplus power.

"From the annual net earnings of the corporation derived from the operation of the power plants shall be paid interest on preferred stock, a fund for research and betterment work, a fund to amortize cost of dams, et cetera, the remaining profits to be divided between the United States and the common stock holders as follows:

"For the first ten years, the United States will receive



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Eaton Axles

Address reply to Eaton Axle Division, Cleveland, Ohio

Perfection Springs

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Blaw-Knox Company,
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Gentlemen:

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The building itself is very satisfactory and we are very much pleased with the manner in which you handled every detail of the transaction.

Yours truly,

THE EATON AXLE & SPRING COMPANY.
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Storage Building 60 ft. x 280 ft.—The Eaton Axle & Spring Co., Cleveland

Hundreds of Good Companies Verify Your Choice

SATISFACTION with every detail is evidenced by this letter from The Eaton Axle & Spring Co., Cleveland.

While they can well afford *any* kind of structure, they quickly recognized the practical economy, flexibility and immediate use of Blaw-Knox Better Buildings. Decreased investment, with long service, is welcomed by Eaton Axle and by all successful companies.

Whether you need a small shop, warehouse, or complete plant—you *save* the Blaw-Knox way. Hundreds of satisfied users will verify your choice.

Exclusive features of Blaw-Knox Better Buildings make them preferred.

Leakproof skylights are obtainable only in Blaw-Knox Buildings. They are so built into the roof sheets that water *can't* come thru.

Steel sash is used at will.

An unbroken galvanized coating protects the copper-bearing steel sheets from rust and assures years of service.

You profit by: Low first cost. Quick delivery. Easy erection. Economically expanded or sub-divided. Moved without waste. Rust proof. Leakproof.

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A small cash payment—the balance as you earn. Only Blaw-Knox offers this convenience in financing buildings.

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"The General Manager Solves the Building Problem" is an interesting recital of the practical application of Blaw-Knox Better Buildings. "The Blaw-Knox Building Finance Plan" discusses finance as it relates to buildings. Tell us about the buildings you need—and for what purpose you need them.

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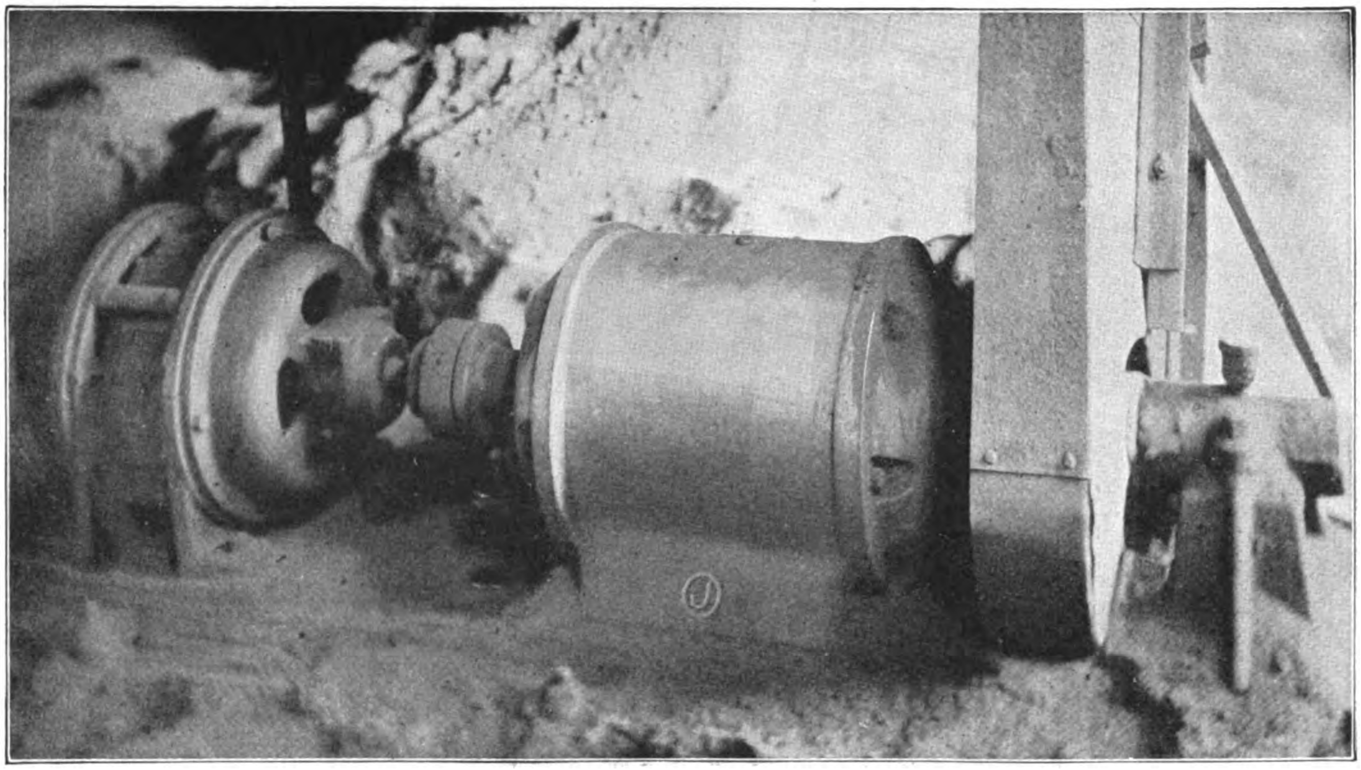
30 East 42nd Street	Lincoln Building	Peoples Gas Building	1511 American Trust Building	Bayard and Warner Streets	622 Genesee Building

BLAW-KNOX Better BUILDINGS



Jones Speed Reducer driving Measuring Machine in Coal Briquetting Plant. Motor speed 855 R.P.M.—Ratio 28.5 to 1—Final speed 30 R.P.M.

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In this Coal Briquetting Plant Jones Speed Reducers are giving continuous satisfactory service. They are unaffected by abrasive dust and dirt so ruinous to exposed appliances formerly used to reduce speed.

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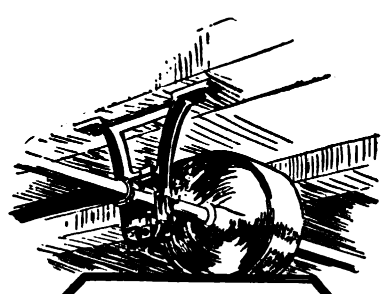
When once installed you can forget the Jones Speed Reducer. The enclosed gears operate in an oil bath. The only attention required is occasional lubrication.

Adverse conditions only emphasize the advantages ot Jones Speed Reducers. They are used in many industries—for many different purposes.

We will be glad to send you a book on speed reduction. It may suggest a solution of some bothersome problem. Simply ask for Book No. 26.



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Church and Murray Sts.	Union Trust Bldg.	226 Superior Ave., N.W.	184 Main St.	425 E. Water St.

Jones Speed Reducers

and Power Transmitting Machinery

two-thirds of all profits resulting from the sale of fertilizer and power, and thereafter three-quarters of the profits.

"Out of its profits, the corporation will amortize the cost of Dam No. 2 (excepting the navigation facilities), the cost of the steam plants, and the cost of Dam No. 3.

"An advisory committee of three, two to be appointed by the Corporation and one by the Secretary of War, is to have advisory powers in all matters connected with properties and the sale of the products."

Since the property is to be disposed of only by legislative action separate bills have been introduced in Congress incorporating the four offers. The Ford proposal, which was the first offer, and which has received the most publicity and attention, has been accepted by the House of Representatives, on March 10th of this year. It has, however, met adverse action recently by the Senate Agricultural Committee. This, however, will not prevent its consideration by the Senate.

A table of estimated returns to the government under the various bids is shown on page 68. It must not be considered, however, that the money return is necessarily the deciding factor. The big question which must be determined by our legislators is that of public benefit.

Two of the plans or proposals, that of the Union Carbide Company and the Hooker-Atterbury-White Corporation center about the production of fertilizers. The public interest primarily involved in these two plans is (aside from the monetary return to the government) the maintenance of highly equipped nitrate plants for war emergency and the production of cheaper and better fertilizers. Agriculturally, this is of great importance, and it is of course recognized that agriculture is the basis of our national wealth.

The Southern Power Companies' proposal centers about the development of power. This corporation is comprised of a number of southeastern power companies having interconnecting transmission lines. The center of public interest in this offer is the extension of our national super-power plan. Under this plan fertilizer production would be a secondary issue.

The public interest in the Ford plan lies in the industrial development of this section of the country which would probably occur under the management of Henry Ford. It is quite likely that he would establish here an enormous chain of industries. It is unlikely that he would have much power to dispose of beyond that required by his own industries. His adherents point to the remarkable development of the city of Detroit, which has jumped to fourth place in population during the past ten years, and of which one-third of the people at least are supported by Ford's operations.

It is a difficult problem that our legislators have to solve in the disposal of Muscle Shoals. Fortunately for them and for us, however, all of the men back of all of the plans are of the calibre and reputation which guarantee success in whatever they undertake.

(*Continued from page* 21)

modern, has been designed for adequate lubrication. Why not give it its due? Then again, the additional expense entailed will only be a fraction of the loss of the average repair item, for these latter have quite outgrown the negligible stage.

Where lubricants for industrial plant service are to be selected suitable investigation should be planned and carried out in accordance with the nature of the service which the former are called upon to meet. There will in general be two primary conditions which should be taken into account, i. e., (1) The mechanical or constructional details of the equipment, and (2) the operating features which are involved. Of course, these should be further differentiated for the purpose of detailed consideration; inasmuch as there are any number of specific factors which, dependent upon one another, will materially influence both the selection of suitable grades

(*Continued on page* 75)

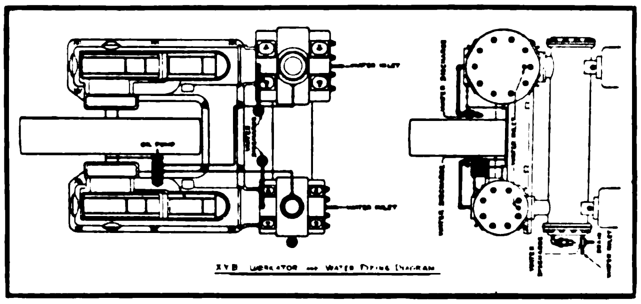


Fig. 19. In planning the layout of a lubricating system, the general arrangement of piping frequently becomes quite a problem. The accompanying illustration will, therefore, be of decided interest, showing as it does the lubricating oil and cooling water piping necessary in a two-stage air compressor installation. Effective lubrication is really a comparatively simple matter if the layout of the lubricating system is properly planned.

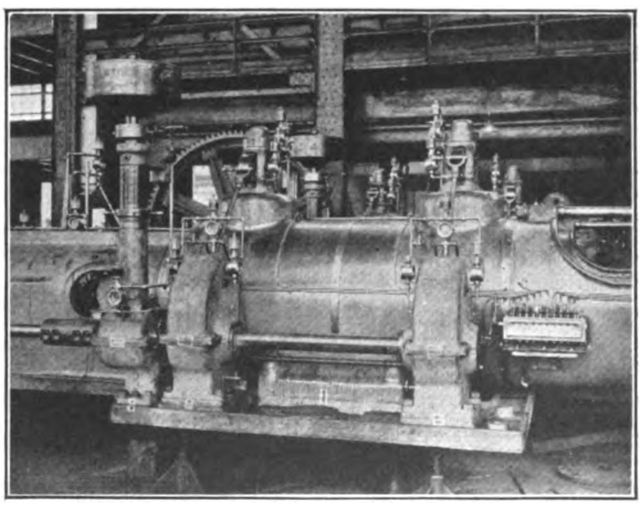


Fig. 20. The selection of suitable oils for the lubrication of the steam cylinder of una-flow engines in general involves chiefly the matters of viscosity and compound. Just what the viscosity should be will naturally depend upon the steam pressure and temperatures involved. The general idea should be to select the oil which will give effective lubrication at the minimum viscosity. The question of compound or the use of mineral oils which contain certain percentages of animal oils depends upon moisture conditions in the steam. An important point to remember is that initial condensation in the una-flow engine is practically eliminated, therefore, the washing action of excessively wet steam requires far less consideration than in a counter-flow reciprocating steam engine. The extensive use of lubricating equipment for both steam cylinders and external mechanisms is clearly shown in the accompanying photograph.

CHICAGO AUTOMATIC BUCKET TYPE CONVEYOR, stationary, in use at Illinois Electric Plant. Coal is dropped from dump car onto conveyor which places it directly into boiler room.

CHICAGO AUTOMATIC CONVEYORS SAVE MONEY

MT. CARMEL PUBLIC UTILITY & SERVICE CO.
MT. CARMEL, ILL.

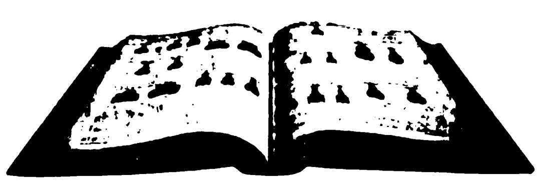
Chicago Automatic Conveyor Co.
Chicago, Ill.
Gentlemen:

Replying to your letter of Nov. 2nd, it costs us on the average of about $1.75 to unload a car of coal. Sometimes this cost is a little high, depending upon the railroad equipment, but a high hopper self cleaning car could be unloaded for $1.25.

We have now had our conveyor for several years and feel it has entirely paid for itself. We do not see how we could possibly get along without it.

Yours very truly,
P. BARNHARD, Mgr.

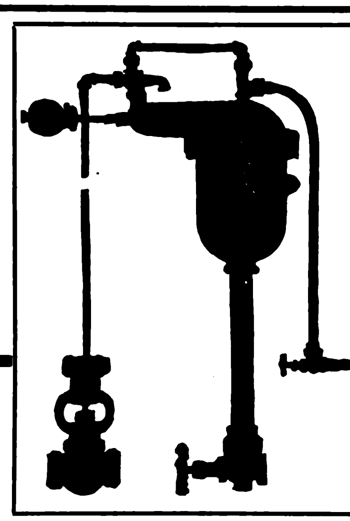
CHICAGO AUTOMATIC CONVEYOR CO.
982 OLD COLONY BLDG.,
CHICAGO ILLINOIS



For the buying facts regarding

Industrial and Power Plant Materials and Equipment

See Sweet's Engineering Catalogue



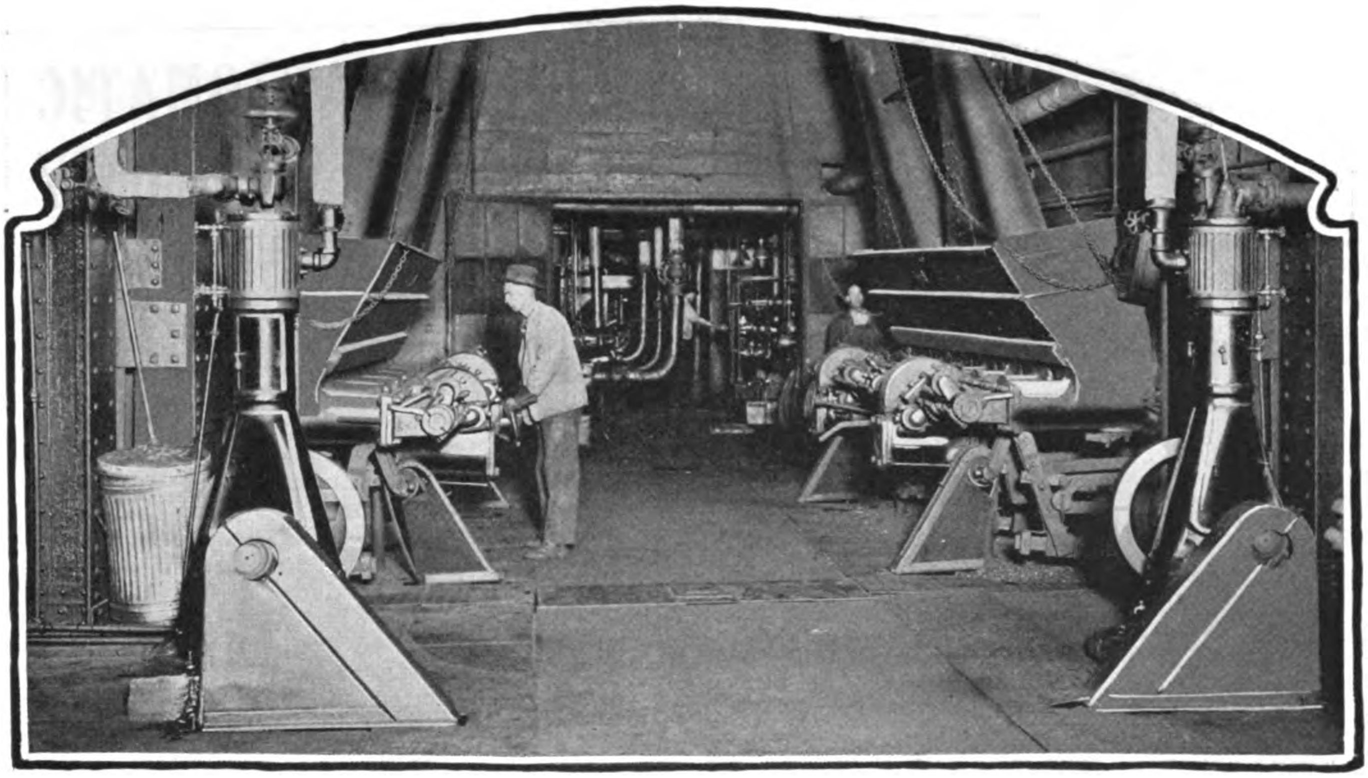
Trouble Proof

There are no floats, tubes or diaphragms in the Vigilant Feed Water Regulator, nothing that can get out of order.

Its action is entirely automatic, being operated by gravity and fixing the proper water level at all times, under all loads and under all conditions. Its use eliminates entirely the uncertain human factor; you need no longer worry about boiler explosions—there can be none while the Vigilant is on the job.

Why not consult with our engineers?

The Chaplin-Fulton Mfg. Co.
28-36 Penn Ave., Pittsburgh



(*Continued from page 72*)

of lubricants, and their manner of application to attain proper lubrication. For example, mechanical conditions will include bearing pressures, steam pressures, size of

(*Continued on page 77*)

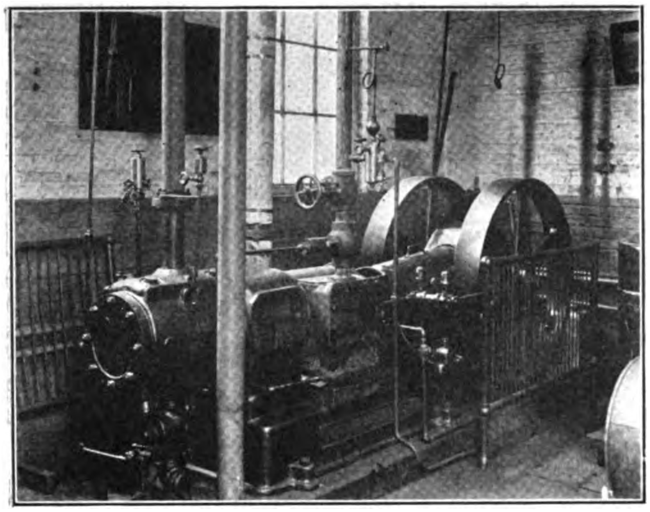


Fig. 21. The single stage air compressor when operating under relatively high pressures may involve temperatures so high as to seriously hamper effective lubrication; this will be especially true where the machines are overloaded beyond their capacity. The utmost care is therefore necessary in selecting air compressor cylinder oils which have been so carefully refined as to insure their complete vaporization and passage over to the after cooler along with compressed air. Unless this occurs the possibility of excessive carbon accumulations in the system will be present, with the resultant danger of breakdown, explosions, or faulty valve action. Usually low or medium viscosity, filtered mineral oils, are preferable for such machines. They should be used carefully and sparingly, for an air compressor oil will lubricate far more effectively than a steam cylinder oil; nevertheless, many operators still labor under the impression that they must feed the same amount of oil to each.

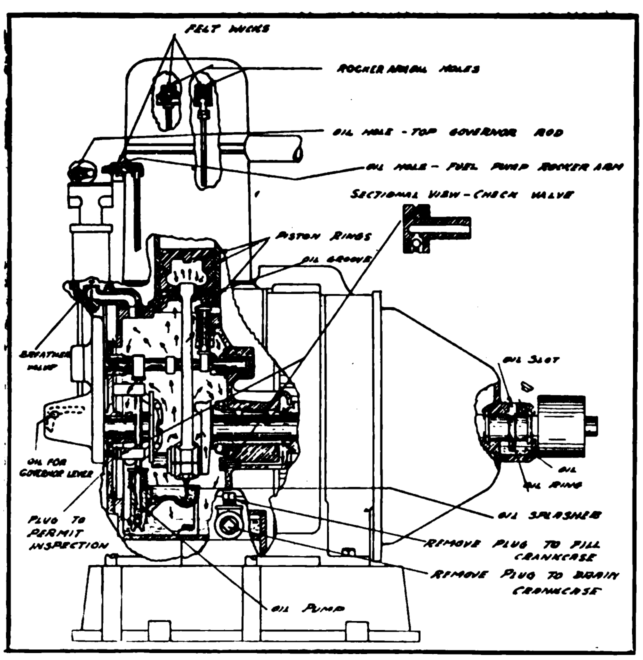
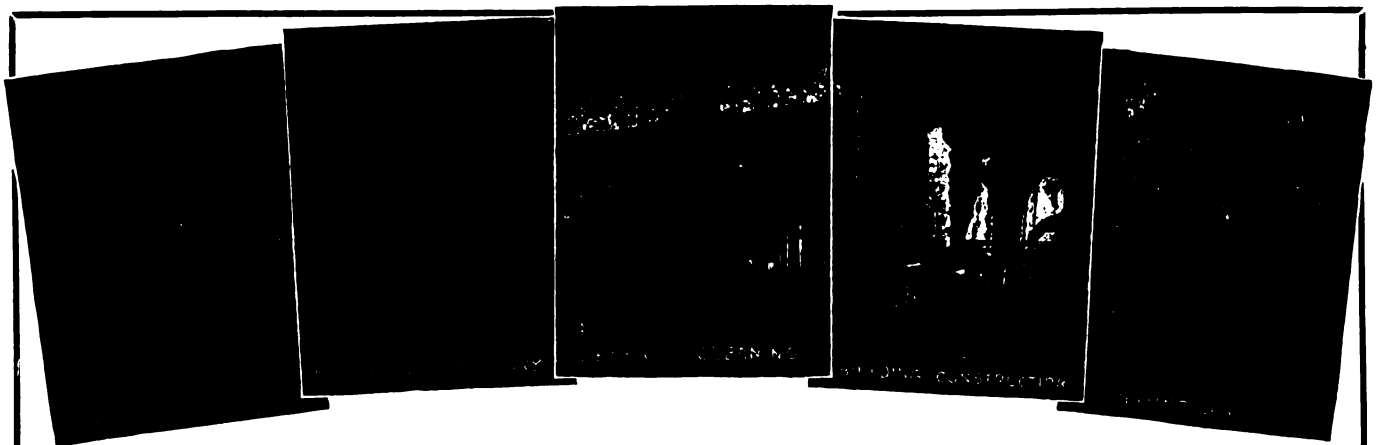


Fig. 22. Details of a splash feed oiling system as applied to a single cylinder gasoline engine. The various working mechanisms of this system are indicated as shown on the drawing. Lubrication by such a method is economical and satisfactory. The oil, however, must be changed periodically just as in the automobile engine, due to the possibility of contamination and dilution. At the right of the picture is shown the details of a ring oiled bearing. Normally there is no interconnection between these two systems in such an installation.



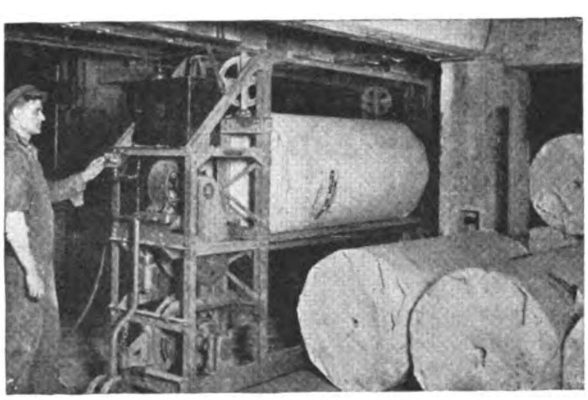
What Lifting Jobs Have You to Do?

AN Economy Portable Elevator is ready for any and all kinds of lifting, including stacking, although their primary usefulness is broader than that. You'll quickly see from the pictures on this page that they can be used for practically every conceivable kind of a lifting operation.

With the Telescoping Feature they can be used in confined portions of your plant, down among the pipe lines or up among the rafters. They handle any kind of material—paper rolls, boxes, bundles, bags, barrels, odd shaped pieces, almost anything that's liftable.

Economy Elevators are portable or stationary, power or hand operated. One of the many models is suitable for you.

Write now—to-day—for a descriptive booklet which contains many suggestions, some of which may put money in your pocket.



HANDLING NEWSPRINT ROLLS

LOADING CARS

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ECONOMY LIFTERS

(Continued from page 75)

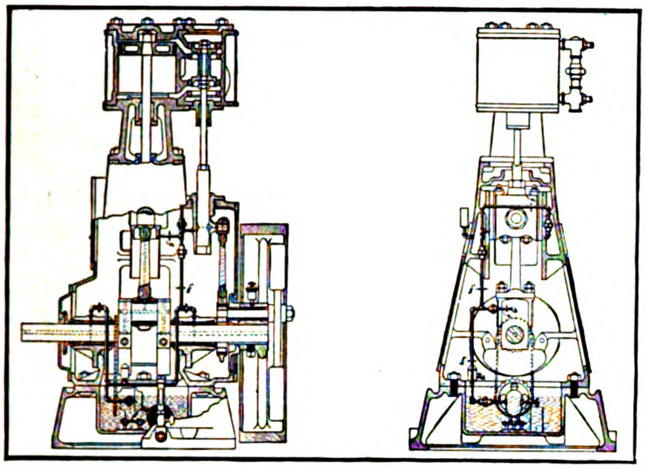


Fig. 23. Sectional illustration of a type of oiling system applicable to a vertical, reciprocating steam engine where the oil is forced directly to the bearings and guides by a chain driven oil pump which is located in the base of the engine. The principles of force feed lubrication are embodied here, wherein flood lubrication is attained, the oil being used over and over again. It is advisable to use high grade engine oils in such equipments in order to insure positive operation and obtain the greatest economy in lubrication over the long run.

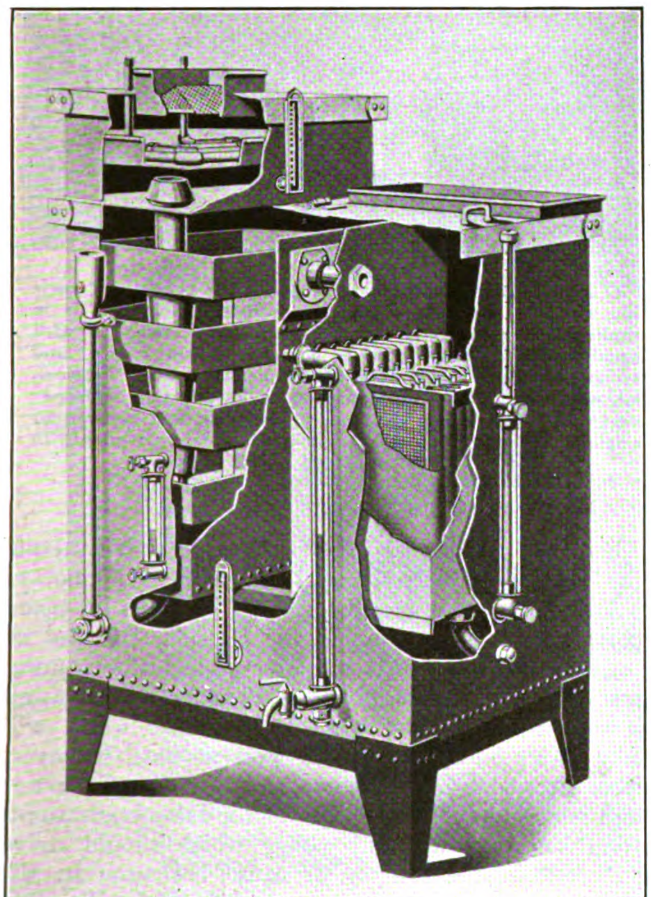


Fig. 24. Purification of lubricating oils is quite as important a matter as their original selection to meet operating conditions. Unless lubricants in certain types of service such as the steam turbine, for example, are kept in a proper state of purity, serious consequences may result. Especially where there is possibility of water entering the system is it necessary to install some form of oil purifier. Water is the forerunner of sludge and emulsification where the oil is used over and over again and subjected to a certain amount of churning. The oil filter as shown in this illustration is admirable in that it adequately removes both water and foreign solid matter from the oil by means of sedimentation and filtration. The settling pans are shown at the left, the filters at the right. The oil flows first over the former and then through the latter.

journals, shafting or cylinders, grades of bearing metal, bearing clearances, nature of the rubbing or wearing surfaces, the way in which operating pressures are applied to the bearing surface, and the operating speeds or the rate at which the rubbing surfaces pass over one another. Operating or manufacturing conditions on the other hand will be relatively far more varied, according to the class of machinery, and product involved, they may be said to broadly cover the questions of temperature changes which the lubricants must meet; their possibility of contact with steam, water, acids, alkali or deteriorating gases; the possibility of the lubricants contaminating the products being manufactured; and the extent to which contamination of the lubricants (in turn) by foreign matter may occur.

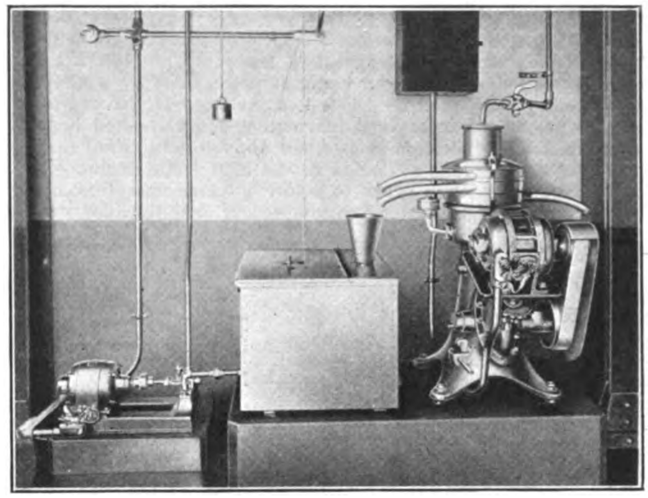
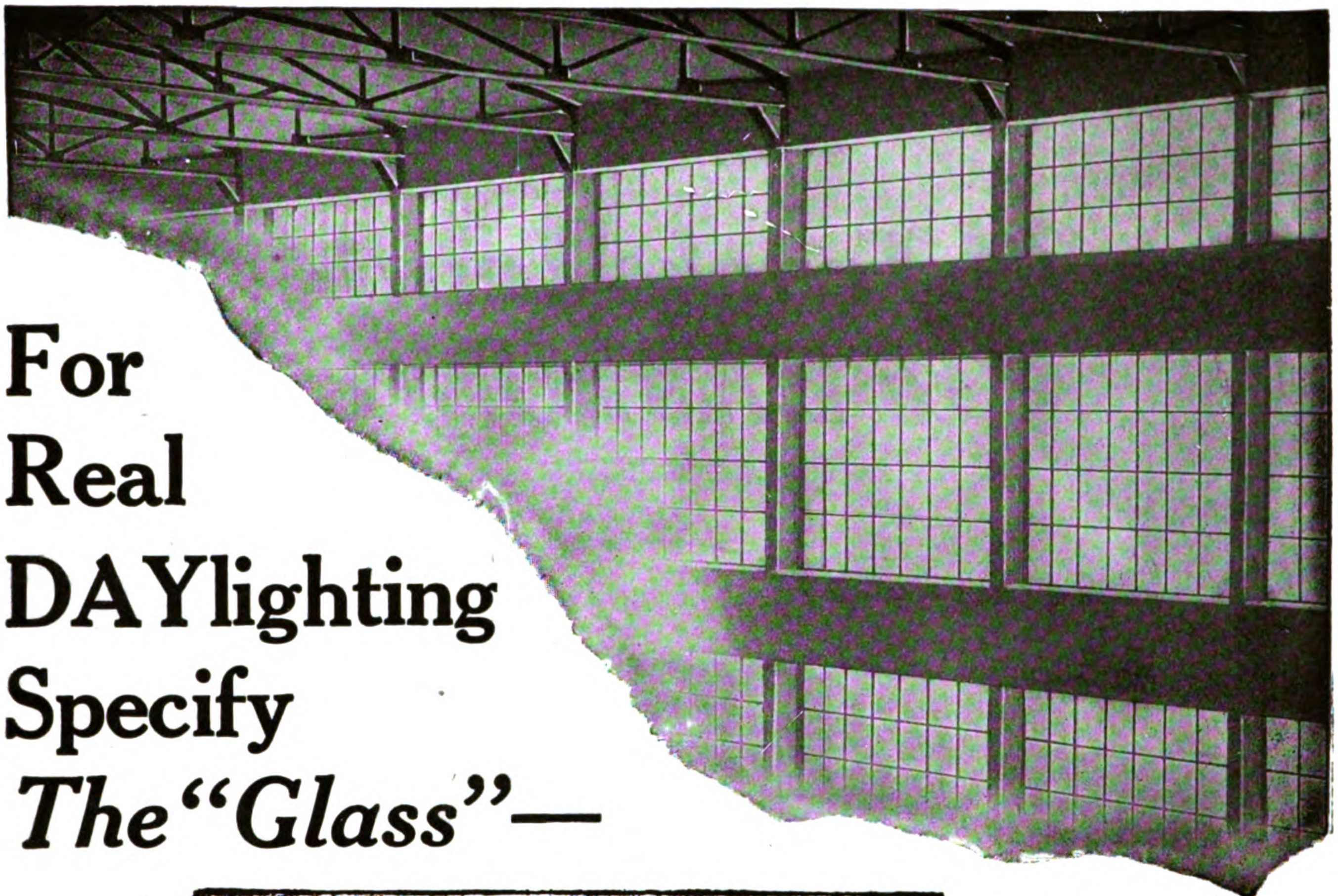


Fig. 25. The centrifugal separator is another type of oil purifier which is extensively used in industrial practice. It is applicable to practically every phase of oil reclamation with equal success. Usually it is a motor-driven device, and brings into play the difference in specific gravity between oil, water and solid foreign matter, in the effecting of proper separation. It is compact, easily installed, and capable of efficient operation by the average class of labor available in the industrial plant.

There is a traditional belief that trade activity tends to be lessened by a Presidential campaign. This notion has little support in fact, but in 1924 writers of trade reports persist in mentioning the Presidential year as an adverse influence. As a matter of logical reasoning there is no ground for giving a Presidential campaign any weight unless there are issues at stake which will vitally affect business. At the present time, however, neither President Coolidge, nor Mr. McAdoo, Governor Smith nor any other candidate for the Democratic nomination has suggested any policy which should drive money out of the country or cause hesitation in the investment of capital. In the actual field of politics in 1924, therefore, we see no reason for expecting the Presidential campaign to influence the volume of purchasing power in the United States in any determining degree.

In the history of the past 100 years, moreover, we find no evidence to support the notion that Presidential campaigns influence the trend of business appreciably. What we do find in studying a period of 100 years is that the trend of the business cycle follows its own natural course in Presidential years with rare exceptions.—*Alexander Hamilton Institute.*



For Real DAYlighting Specify *The "Glass"*—

FACTROLITE

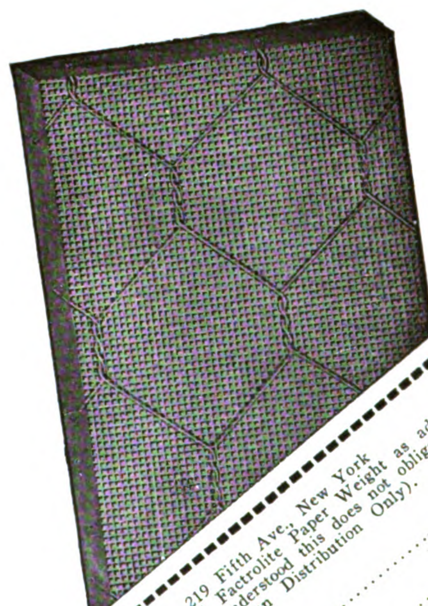
By **reflection** from the plane surface of ordinary glass a great deal of daylight is lost. The prismatic surface of FACTROLITE **GATHERS** these daylight rays that are ordinarily lost (particularly in confined locations where light strikes the panes **at a narrow angle**) and **diffuses** them indoors.

When direct sunshine strikes on windows glazed with "FACTROLITE," the workers do not have to work in a blinding glare or to hang blankets or shades to check the sunlight. FACTROLITE gives perfect diffusion that eases eye strain on the workers nearest the glass and gives those deep in the building interior a clear **diffused** daylight to work in.

The U. S. Government recently used over 100,000 square feet of "FACTROLITE" for daylighting a huge building 300 ft. x 700 ft. The engineers tell us that you cannot see a shadow in any part of the big structure.

FACTROLITE is made both in plain and wire glass. Test FACTROLITE in your own laboratory.

A free sample will be sent to engineers who use the coupon.



Mississippi Wire Glass Company

219 Fifth Avenue, New York

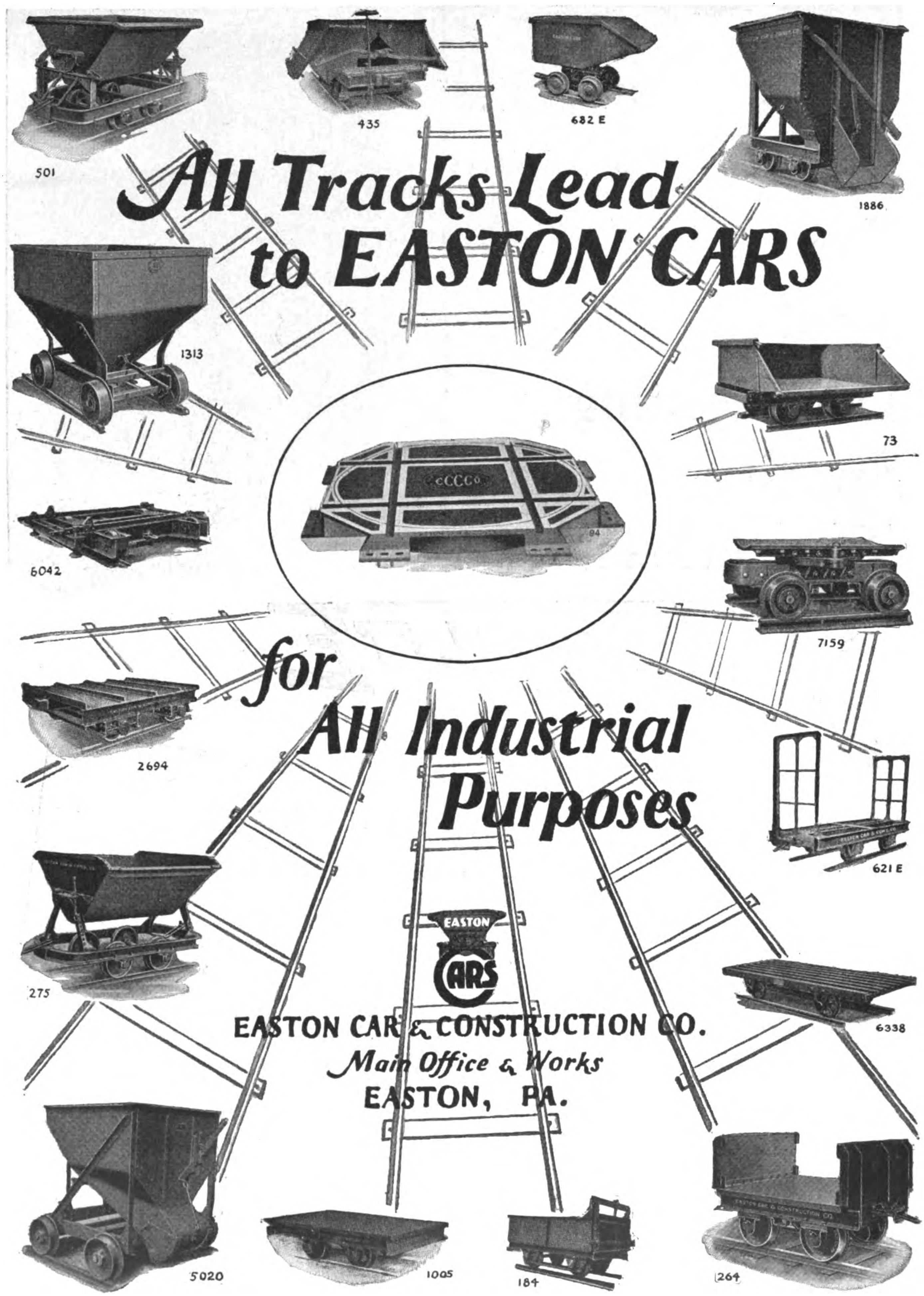
CHICAGO **ST. LOUIS**

Mississippi Wire Glass Co., 219 Fifth Ave., New York

Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way. (For American Distribution Only).

Name..

Address..



All Tracks Lead to EASTON CARS
for All Industrial Purposes
501
435
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73
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7159
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5020
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EASTON CAR & CONSTRUCTION CO.
Main Office & Works
EASTON, PA.

Is Labor Shortage an Excuse or a Fact?

By Thomas I. Leyden

WHAT we have just passed through was not a Labor Shortage but was really a shortage of workers. With many production managers during the past year it was a good "alibi," with more it was a condition forced upon them by the "alibi" makers.

This scarcity of help, caused in part by misleading "Help Wanted" advertisements, inefficient labor scouts, the snowballing of wages, and the wail of the "alibi" makers, soon becomes a front page Labor Shortage. Another important cause may be a boom such as we experienced last year in the building trade.

The law of supply and demand governs the labor market. But the demand may be a false one easily created by misleading "Help Wanted" ads or by inexperienced and unethical labor scouts.

Labor shortage is very profitable to newspapers. It sells many inches in the "Help Wanted" column. But these misleading "ads" hurt the workers because it tells them of opportunities that do not exist.

I do not accuse the newspapers of being directly responsible for these false ads but I am reproducing one which appeared in one of the most dependable and most widely read New York City morning papers.

LABORERS WANTED.
1,000 STREET LABORERS;
STEADY WORK;
OVERTIME, 50c AN HOUR;
REPORT READY
FOR WORK.

Ads similarly worded have appeared quite often this year. The responsibility rests with the employment manager who has it inserted and the paper for accepting it.

Can anyone imagine an operation or a department that needs 1,000 men? Then why should the laborers be told so? Is it not unfair to them?

An "ad" similar to the above appeared this June calling for laborers to work on building operations in the Bronx (New York City). I stopped around to look over the "returns" and found as many white collar men as I did laborers. Why so many white collar applicants? Well, if 1,000 laborers were needed surely there must be a need of many clerks and checkers. That ad cost our white collar crowd about $1,000.

Why were there not enough laborers there? The class of labor needed for this type of work is "Newspaper Wise." They do not waste time or money on such "ads." But a newspaper ad is like a spoken word—it goes on until it wears itself out. How many unwise workers will take a day off to investigate such ads? It causes them to lose not only their day's wage but also quite often they lose their positions. When these inflated ads reach the small town and farms does it tend to keep the boys at home?

On the other hand when the worker sees many such misleading ads does it not create a false independence in him? Why should he worry? Men are needed everywhere. Surely there must be a labor shortage. Do not the newspapers proclaim it throughout the land?

Is there a remedy? Yes, if the employment managers and classified "Help Wanted" managers get together and eliminate inflated or misleading "Help Wanted" ads.

The part played by inexperienced labor scouts does almost as much harm as the newspapers by misrepresenting the jobs and conditions. They bring workers into a community who are no good as producers and who tend to decrease the morale of the present contented worker. The transportation of these men about the country, usually at the expense of the employer, naturally backs up newspaper ads that workers are scarce.

Most labor scouts think of the number of men, not the quality of them. If they are sent out for twenty and return with forty they believe their trip was successful.

The World War created a class of wandering workers who resemble the "hobo" of the 1892-'96 period. The difference is that the "hobo" took chances on freight trains while the war-made tourist rides first class passage.

Invariably the new labor scout will bring in four out of five men of this class. The reason is that as soon as a labor scout enters a large city the word is passed around among this element and they are usually the first to apply when the doors are open. I believe it takes three of this class to keep a position filled: one coming, one working and one leaving. It is rarely that one stays on the payroll longer than one pay period. Their best is three working days out of six. If they should happen to work one full week their next week is the wandering week.

Does this class give production in ratio to their cost? Is it possible to eliminate this wandering worker whose sole aim is to see America first? Can we not arrive at a system to change their 50-50 (work a day—bum a day) method? If we do we can bring about 100,000 men into the regular producing class.

This is possible if employment managers will coöperate and think in terms of the greatest good to the many and not their own department needs. I have yet to meet the employment manager who does not want this class reduced. But when they are pinched for help they forget their promise to coöperate.

Does it pay to hire this type? Consider your office cost, time department cost, paymaster cost and his ability to shirk work (or production cost) plus the cost of replacing him in one week. Is he worth it?

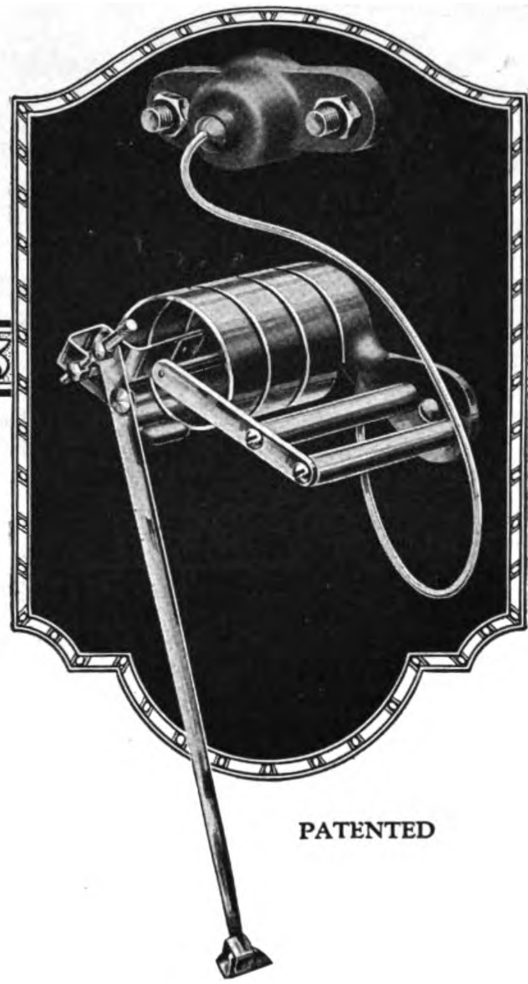
I do not have a panacea for all employment ills but I feel sure that we can reduce the wandering workers class by "honest to God" coöperation.

Let us all have "Length of Service" cards printed on which we shall have Name, Height, Weight, Color of Hair and Eyes, date entered our employ and date terminated. If employment managers of a metropolitan district will give to each departing employee a card and will insist on seeing one from each applicant, or a good reason must be given for lack of it, and if he gives the better jobs to the men holding the better service card, will not the man with short service or no service card do his best to get a good card? He thereby erases himself from the wandering class. This method would assist the labor scout in separating the "Good" from the "Tourist."

Snowballing of wages is being better understood by the workers. They know that such conditions only apply to jobs that have no permanency. It is only applicable to mechanics. They know how harmful it is. The rates caused by snowballing travel to all parts of the country, creating the belief that there is a great demand for that craft. Whereas the real cause is that gambling contractors do not care how much damage

(Continued on page 87)

Like a tree top in a tempest



PATENTED

HERE'S a good question to ask yourself if recording instrument accuracy means anything to you.

"Will the pen arm of the Recorder I purchase accurately follow the time arc of the chart?"

Accuracy of pen arm travel depends upon a *fixed* axis of rotation.

If not controlled, the motion of the pen arm is as erratic as a friendly Towser's tail or a tree-top in a tempest.

The motion of the Foxboro Improved Helical Tube is transmitted to a shaft which forms a perfect fixed axis of rotation for the pen arm.

No adjustments or multiplying devices are introduced to cause friction or lost motion.

The pen of a Foxboro Recorder always follows the time arc of the chart.

The Controlled Motion of the Pen Arm, coupled with the fact that the Foxboro Improved Helical Tube is permanent in calibration, enables us to—

Guarantee an accuracy within less than 1% of total chart range.

Make sure that your records have the accuracy and dependability that only the Foxboro Improved Helical Tube Movement can give.

Write for Bulletin 154-A..

THE FOXBORO CO., INC.

Neponset Avenue, Foxboro, Mass., U. S. A.

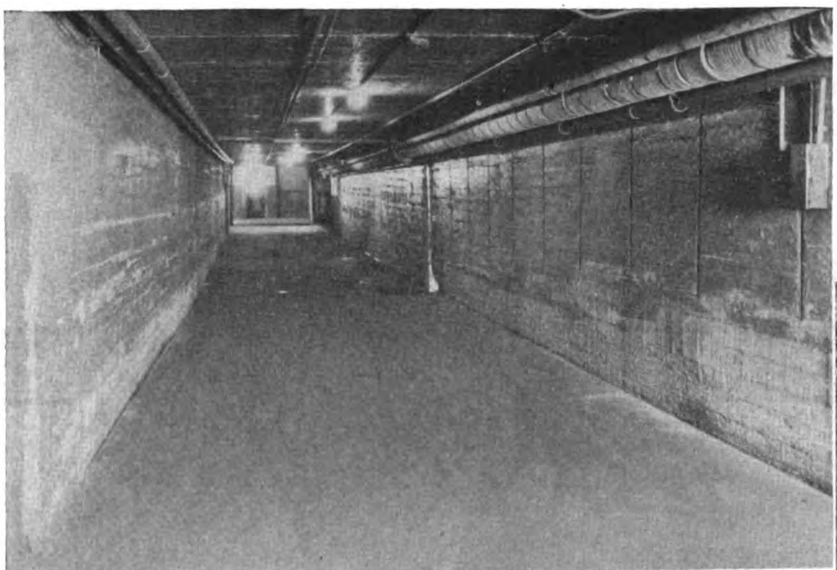
New York Chicago Boston Philadelphia Pittsburgh Cleveland Rochester
Birmingham Tulsa Los Angeles San Francisco Portland, Ore.

Peacock Brothers, Limited, 179 Delorimier Avenue
Montreal, Canada

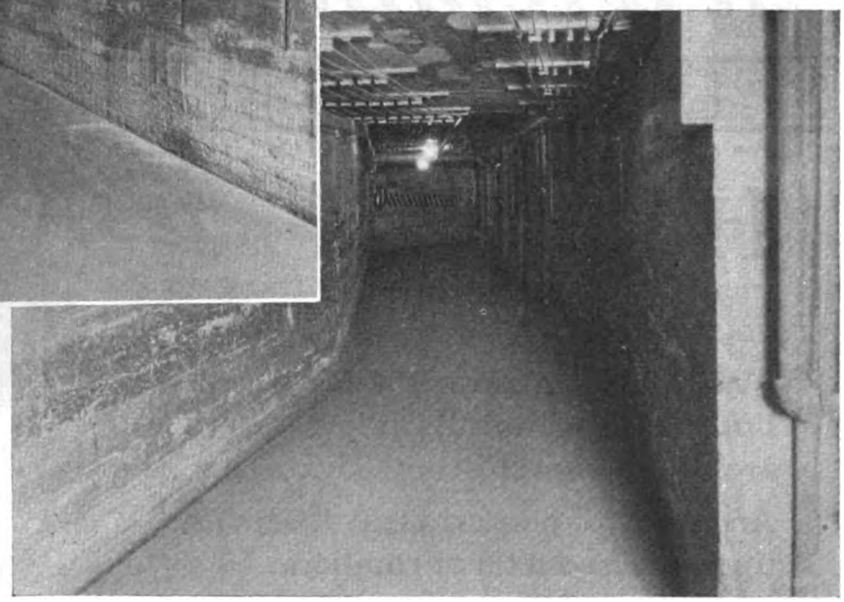
FOXBORO

REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

6704



NORTON FLOORS



A Floor That Will Stand Up Under Heavy Trucking

Heavily loaded factory trucks wear out floors rapidly. In one of the tunnels illustrated here trial sections were laid using different floor materials. After a four years' test the other tunnel was floored with the winning product — concrete with Alundum Aggregates imbedded in the surface.

Five years finds the trial section still in excellent condition and good for many more years while the newer section shows no indication of wear after eight months' hard service.

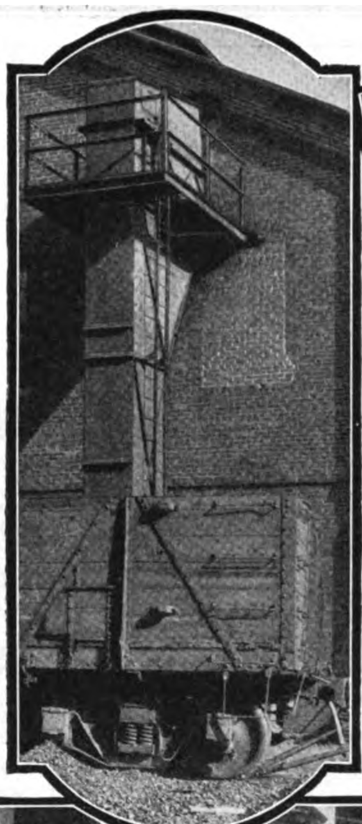
Alundum Aggregates imbedded in the surface of concrete form a floor that is well adapted for rough and heavy industrial service. Alundum abrasive is the hard, tough material used in the well-known Norton Grinding Wheels. Now employed in Norton tiles and aggregates this abrasive has resulted in the most wear-resisting floor material known and one that is practically slip-proof. Water, oil and grease do not lessen the slip-proof effectiveness.

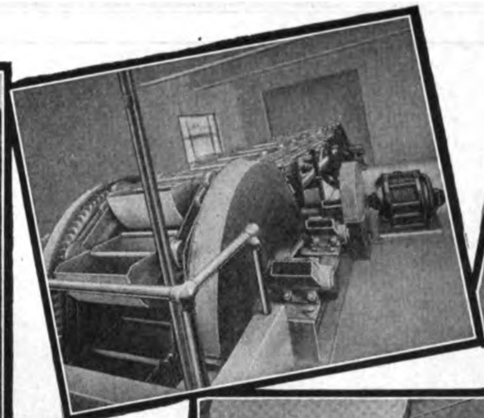
There are other types of Norton Floors suitable for office buildings, hospitals, schools and the finest of hotels and public buildings.

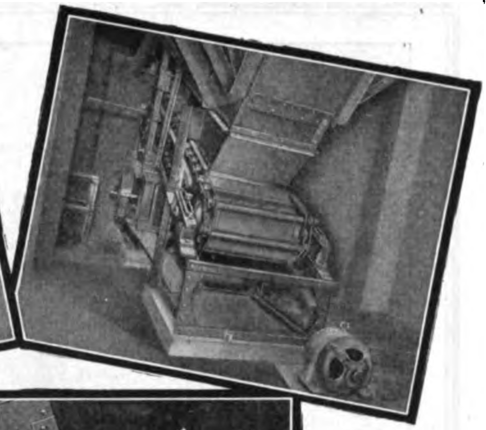
NORTON COMPANY - - Worcester, Mass.

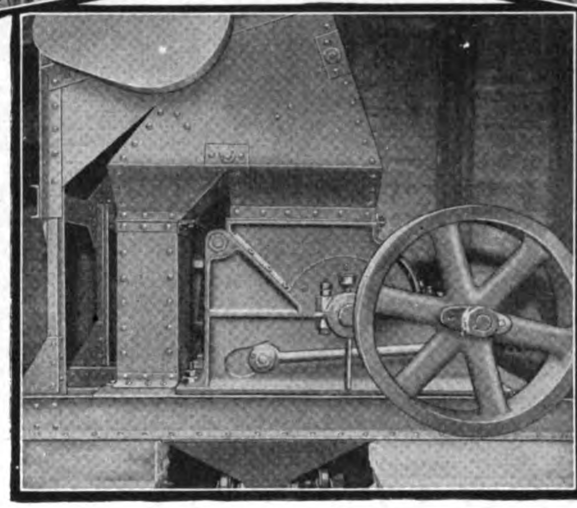
New York Chicago Detroit Philadelphia
Hamilton, Ontario

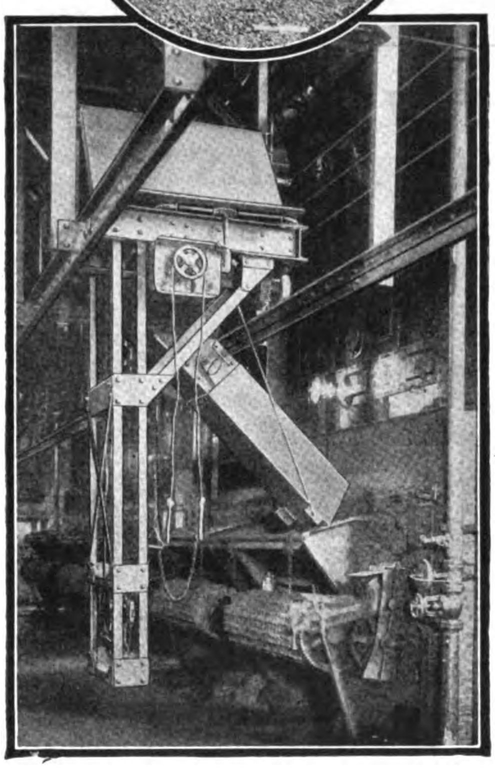
T-105











Meeting the Needs for Suitable Equipment for Power Plants

WEBSTER equipment fulfills the requirements of every power plant operator and owner who appreciates the best methods as expressed in coal and ashes handling machinery. The big reason for the 100% service which it gives is because each installation is exactly fitted to the work required.

Webster equipment for large or small power plants is the culmination of years of experience in building and designing machinery for this work. During this time Webster engineers have thoroughly studied the correct handling of coal and ashes in power plants, and can ably assist in specifying suitable equipment to meet all needs. Check up on your coal and ashes handling equipment with a Webster engineer!

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

Branch Offices

BOSTON......................902 Oliver Bldg.
BUFFALO..................572 Ellicott Square
CINCINNATI.........1914 Union Central Bldg.
CLEVELAND..............509 Swetland Bldg.
NEW YORK...................90 West Street
PHILADELPHIA ..719 Commercial Trust Bldg.

Factories

CHICAGO, ILLINOIS TIFFIN, OHIO

Agencies and Representatives

Atlanta, Ga.........Fulton Supply Co., 70 Nelson St.
Baltimore, Md..H. W. Faunt LeRoy, 523 Calvert Bldg.
Birmingham, Ala...G. R. Mueller, Brown-Marx Bldg.
Denver, Colo........C. L. Dean, 1718 California Ave.
Detroit, Mich., Palmer-Bee Co.,2778-2794 E.Grand Blvd
Knoxville, Tenn...Webster & Co., Holston Bank Bldg.
Louisville, Ky...E. D. Morton & Co., 516 W. Main St.
Memphis, Tenn..E. C. Atkins & Co., Maine & Butler Sts.
Milwaukee, Wis....W. Clasmann Co., 620 Wells Bldg.
New Orleans, La., Globe Supply & Machinery Company, 625-627 S. Peters Street.
Pittsburgh, Pa...Dempcy-Degener Co., 708 Penn Ave.
Salt Lake City, Utah, L. W. Mendenhall, 517 McIntyre Building.
Salt Lake City, Utah........Galigher Machinery Co.
Seattle, Wash., The Brinkley Company, 651 Alaska St.
Vancouver, B. C...B. C. Equipment Company, Ltd., 613 Bank of Nova Scotia Bldg.

Canadian Factory-Sales Office: WEBSTER-INGLIS, LIMITED, 14 Strachan Ave., Toronto, Ont.

(*Continued from page 82*)

they do the business or the bad effect their method has upon the workers. Their only thought is to win on their contract.

Snowballing is frowned upon by reputable contractors and sensible workers. Therefore it is only a matter of a short time until it eliminates itself. Booms in any industry usually create a false labor demand.

Last year a representative of the Scotch Brotherhood of Carpenters toured United States and Canada. The object of his visit was to inform his fellow workers in Scotland what their prospects were of obtaining work at their trade on "this side." One letter stated that more than 500 extra carpenters were needed to work on the Centennial buildings in Philadelphia. About that time Philadelphia newspapers were pretty well filled with Centennial talk. His ill-advised Scotch carpenters found, after traveling 3,000 miles, that the Centennial was still in abeyance and at present writing it is very doubtful if any celebration will be held.

In September, 1922, I met two young Scotch joiners who, after walking the streets of New York City for one month, were forced to pawn their tools and due to their condition I only could offer them a carpenter's helper job. No doubt many of our own young country workers have had the same experience due to unnecessary newspaper publicity given to booms.

I do not blame the press entirely for all our employment ills but I feel sure that a closer coöperation with employment managers of their district would prove beneficial to all concerned.

1924 looks like a good business year. So why not get together to lay plans whereby the many shall receive the most benefit.

THE movement of business as a whole is steadily forward, although not so fast, partly because we are now "between seasons," waiting on the harvest. This is the breathing time in the business world. But there is a little of the kind of "toil and trouble" just ahead that has marked some of our presidential campaigns in past years, for the political caldron is vigorously bubbling over—mostly din and clamor and nothing more. But this year, as in other presidential years, the sober-minded, commonsensed many will vote as they think, and then we shall go on smoothly, with some problems settled and many difficulties out of the way.

Meanwhile, even though many are very cautious and conservative in their commitments, there is little real concern about the future and practically no apprehension. Although an ebbing tide of production is evident in many important lines, in other lines, mainly those immediately connected with building and construction, we are still ahead of the boom of 1923, and we are head and shoulders over 1922 in nearly all important industries and lines of business; for it is misleading to compare everything with 1923, which was an abnormally good year as a whole, notwithstanding the reaction in the late spring and summer months.

The enormous credit fund available for all business purposes has removed that former annual recurring problem of getting sufficient funds to move the crops, and it looks now as if we will have the crops to move, for soil and weather conditions have seldom been more generally favorable.—*La Salle University Business Bulletin.*

Americanization Through Self-Expression

By Fred H. Rindge, Jr.

WE have recently returned from twenty-three countries of Europe from which 3,000,000 people annually venture forth as emigrants to other lands. We have traveled through their beautiful mountains and valleys; talked with them in their neat, little, straw-thatched cottages; admired their beautiful architecture; spent delightful hours in their museums and art galleries; enjoyed their wonderful operas and dramas; revelled in their great libraries; worshipped in their magnificent cathedrals—and we are better Americans for the experience! Who can doubt that these people bring with them to the new world great traditions, history and ideals; deep appreciation of art, literature and music; splendid capacity for courage, adventure and faith which should be *expressed* rather than *repressed?*

We continue, however, to receive them with scant hospitality and refuse to clean house for our guests. We offer meagre protection when they arrive, and practically say to the grafting cabmen, hotel runners, interpreters, employment agencies, blackmailers, radical agitators, dishonest bankers, "Here is your prey, gentlemen, several hundred thousand per year!" Having thus impressed our newcomers with the glories of the Land of the Free, we proceed to offer them our dirtiest jobs, our most unsanitary tenements and our vilest amusements. We call them "Wops" and "Polaks" and ask they why they came. Then we curtly inform them that they must become American citizens or suffer the consequences!

This may seem exaggerated, but in the main, it is all too true. Even if we treated our guests with courtesy and consideration, we would still be far from the solution of our problem, for one cannot deny that it *is* a problem. The trouble is, we have never realized our full responsibility as *host*. An ideal host never monopolizes the conversation, nor consumes the whole evening playing on his own fiddle, nor insists upon repeated expressions of gratitude from his guests. He tactfully discusses their interests, urges them to describe their own experiences and perhaps invites them to entertain with music. *Have we ever seriously endeavored to practice the same principle in dealing with our immigrants from other lands?*

They bring rare gifts. Do we afford them a chance to present these gifts? They come with great potentialities. Are we offering a real opportunity to develop them? They can play and sing and dance as they did in the old country. Do we invite them to entertain us? They produce rare art and handicrafts. How much do we appreciate their work? They cherish great traditions and the memory of noble heroes. Do we encourage and understand their own holiday celebrations? They dreamed of the ideals of Washington and Lincoln years before they left home. Have we disappointed them? They arrived, many of them at least, eager to give their best to America and to become citizens. Have we stifled their desires by unkind and unjust treatment? They are still longing to express themselves as best they may. Shall we encourage or repress their efforts?

(*Continued on page 92*)

$270 for This Electric Hoist!

[For A Limited Period Only]

Lift anything up to 1000 pounds.

Anyone can operate it.

Working parts easily accessible.

Low maintenance cost.

Low head room.

Maximum safety.

Reduce handling costs.

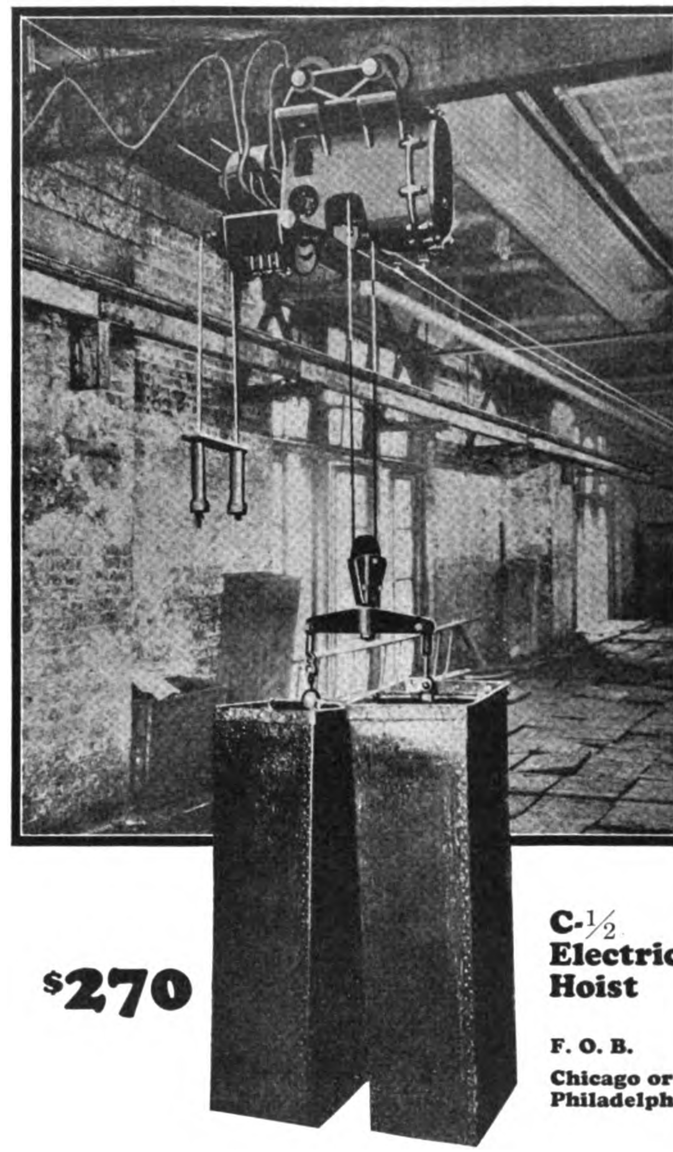
Here is a sturdy, rugged, and economical hoist that will bring you many savings at the low price of $270. (F. O. B. Chicago or Philadelphia.)

With it you can utilize overhead space. You can move materials anywhere—from bench to bench, across driveways or railroad tracks, from building to building, from shipping room to truck—anywhere of a hundred different places. You can entirely eliminate handling confusion. You can release truckers for more productive work.

Low first cost, low maintenance, low head room and long life are the features of this hoist. All shafts are high carbon steel. Bearings are bronze bushed and renewable. Steel driving gears and pinions. The whole drive is contained in the one housing and runs in oil.

It will lift 1 pound to 1000 pounds; lift it easily—lift it safely—move and deposit it quickly with minimum effort and minimum cost. And anyone can operate it.

Why not find out how the Link-Belt C½ hoist might be applied to your work? Let us show you the savings that others are making. Send the coupon today.



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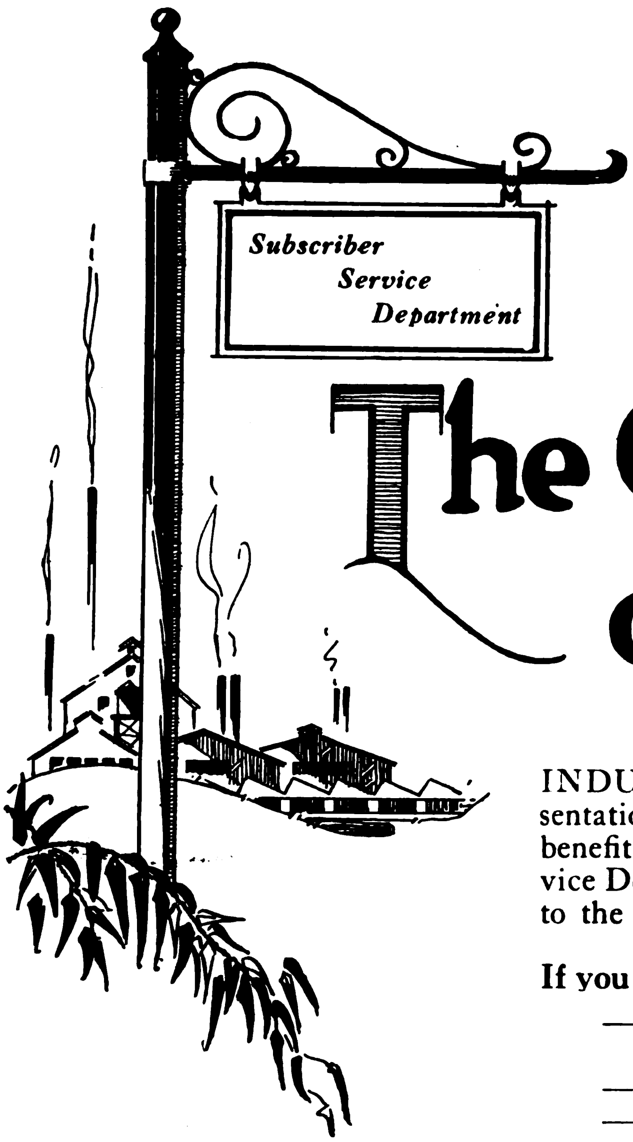

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The Trackless Train

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The wheel is extremely sturdy—cast steel—10″ diameter—3″ crown face.

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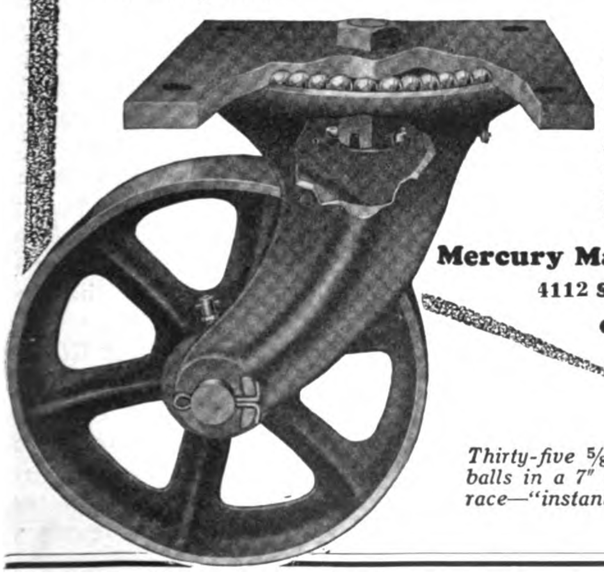

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(*Continued from page* 88)

These are the fundamental questions to answer in any program of Americanization. And, we would do well to begin by finding a better name for the process. The term Americanization smacks of paternalism and compulsion—the very things we should seek to avoid. If we square our treatment of the foreigner with our best ideals, our citizenship will become so attractive that we shall not need to make it, in any sense, compulsory.

We did not hesitate to urge our alien guests to fight for us in the Great War. That opportunity for self-expression enlisted thousands of many nationalities under the same flag. They fought and died with descendants of the Pilgrim Fathers. Other thousands purchased an inconceivable number of Liberty Bonds and proved their loyalty to their adopted country. In the Fourth Liberty Loan, the foreign-born and their children subscribed 16 per cent. of the loan and 46 per cent. of the total number of subscriptions.

Shall we afford less opportunity for self-expression in times of peace? During the war, we so little understood the history and loyalties of foreigners in our army, that we frequently branded as "alien enemies" those who had formerly been subjects of Austria-Hungary, but who had been endeavoring to throw off the yoke of oppression for centuries! No wonder they became bitter and lost their spirit of sacrifice and service! Out of just such people has been formed the splendid republic of Czecho-Slovakia, whose Declaration of Independence we are proud to have had signed in Independence Hall in Philadelphia! Strange that it is so much easier to recognize the worth of peoples in Czecho-Slovakia and other new countries of Europe, than when they live in our midst!

But our horizon is enlarging. We are beginning to realize the importance of large numbers of racial groups and societies scattered throughout the country. We are endeavoring to shake off our provincialism and encourage patriotic celebration of foreign as well as American holidays. Who can forget the impressive scene of 40,000 Poles gathered around Kosciuszko's Monument in Chicago, celebrating the anniversary of the adoption of Poland's early constitution? Any suppression of such celebrations develops a feeling of bitterness which it will require years to eradicate. How futile it is to expect our newcomers to completely forget the lands of their birth! We should provide every opportunity for the learning of English and citizenship without attempting "forcible feeding" or suppression of their own languages. Latvia, Esthonia, Lithuania, Poland, Jugo-Slavia and Czecho-Slovakia are independent nations today, largely because Russia and Austria-Hungary tried to suppress their native languages, until they rose in wrath and smote their oppressors! Let us be ideal hosts and neighbors; let us spread mutual understanding and good-will; *live* our ideals rather than merely prattle about our Constitution; give the immigrant our hand rather than a bundle of tracts; develop the best there is in him and encourage his best contribution to our national life—then we need not worry about his Americanization.

After all, what is meant by Americanization? One of our State Universities defines it as "Any measure that improves the standard of living of native and foreign-born, gives them better ideals of citizenship, promotes mutual understanding, and preserves the best elements

(*Continued on page* 94)

(Continued from page 92)

of American civilization. Americanization should imply a program not fundamentally different for native and foreign-born; it should embrace for both a more conscious effort to understand American life, and to foster a special culture embodying the best contributions of foreign stocks."

Allen T. Burns who directed the immigration study of the Carnegie Foundation says: "Americanization is the uniting of new with native-born Americans in fuller common understanding and appreciation, to secure by means of self-government the highest welfare of all. Such Americanization should perpetuate no unchangeable political, domestic, and economic régime delivered once for all to the fathers, but a growing and broadening national life, inclusive of the best wherever found. With all our rich heritages, Americanism will develop best through a mutual giving and taking of contributions from both newer and older Americans in the interest of the common weal."

Professor Zueblin remarks: "I understand by Americanization the persuading of people to work at the task of being Americans. I think that must apply to natives as well as immigrants. A large part of our trouble with the immigrant comes from his observation of the inadequacy of the citizenship of natives, and our indifference to his education in Americanization." If this be true, it is not surprising that there has arisen a demand for the Americanizing of the American and of America itself!

There are over 14,000,000 foreign-born, speaking more than fifty different languages in the United States! Approximately half of these are citizens. There are 22,000,000 more of foreign parentage. Our Restriction Law permits 357,803 immigrants to enter during the fiscal year. These facts indicate the problem in a nutshell. It must be dealt with by wise and constructive legislation in state and nation. As a *human* rather than a statistical problem, it must be solved in our 3,000 independent communities each of which includes 100 or more foreign people. Every one of these communities should increasingly live up to its noblest ideals, practice the principles of friendship and justice, and encourage the best kind of self-expression. There should be provided the maximum opportunity for learning English and citizenship, for obtaining justice before the courts, securing decent living conditions and owning homes, enjoying health and wholesome recreation, multiplying the right kind of social contacts, and for worshipping God, each man in his own way. Then we shall have traveled a long distance on the road to Americanization and have given a demonstration of real Americanism.

R. M. Little has well said: "Americanism is a word of at least four dimensions, signifying equality, liberty, opportunity and justice. Human life, human interests, human rights, human justice, human relations, human activities, human aspirations, human hope and human faith are the central ideas in Americanism. This nation was founded on this principle—not that we believe all men are created equal as to their talents, but that they are equal as to their *rights,* particularly their rights in relation to government, the economic order, the social order, education and religion."

Our immigrants must believe in these principles if they are to become truly American. And they arrive

(Continued on page 97)

An All-Purpose Truck

The electrically operated elevating truck is by all odds the most useful of labor-saving equipment.

Going right into a freight car it picks up a skid loaded with incoming material and carries it to stock or direct to the job.

In the plant it transports material in process up steep ramps, down narrow aisles, and around sharp corners with a decided saving in time, expense and man-power.

Write for a copy of our complete catalog, or ask a Baker engineer to investigate your problems and recommend the particular type of tractor or truck that will prove most valuable in your plant.

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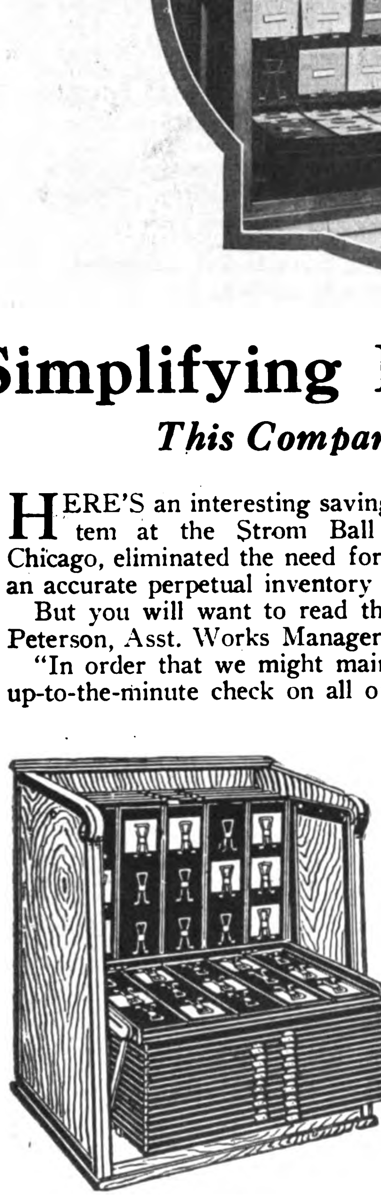
This Company would not be without a McCaskey System

HERE'S an interesting saving. A McCaskey System at the Strom Ball Bearing Mfg. Co., Chicago, eliminated the need for two clerks and made an accurate perpetual inventory possible.

But you will want to read the letter from Mr. L. Peterson, Asst. Works Manager:

"In order that we might maintain an accurate and up-to-the-minute check on all of our finished stock," writes Mr. Peterson, "we installed six McCaskey Registers—three in our stockroom and three in our sales department—a little over a year ago.



A Perpetual Inventory Saves Time

"Before we used the registers, our stock records were kept in ledgers. This system led to mistakes in postings because tags used to inform us of the receipt or shipment of finished stock were easily lost or misplaced. The One Writing McCaskey system does away with this chance for error because the tags are replaced by the carbon backed forms which are placed directly into the registers and which, when stock shipped is subtracted, or stock received is added, give us a perpetual inventory. Moreover, time is gained in that a duplicate copy is sent directly to the sales department to be filed in their registers. Formerly they had to come to the stockroom—and then the information was not always correct because postings were only made in the ledger every morning.

Reduced Payroll $2400 Per Year

"In the payroll department one McCaskey double register is effecting a saving of two clerks' time—$2400 yearly in salaries—by eliminating a great deal of detail copying. Before the slips made out by the foremen showing workman's name and time had to be extended and then the information transferred to another recapitulation sheet for each man. Now the totals are simply forwarded on each slip and filed in the register. At paytime all that is necessary now is to take off the total on the last slip.

"Would not be without them"

"For accuracy, time saving and labor saving we have found our two applications of McCaskey registers as near 100% efficiency as possible. We have given them a thorough tryout and have obtained excellent results. We would not be without them."

Would It Save in Your Plant?

Perhaps your needs are different. But here are many striking examples of savings in plants approximating yours. Plants where McCaskey systems are checking tool losses, keeping production, cost and delivery records, etc. We will be glad to show them to you. There is no obligation. Write us.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division ***Alliance — Ohio***

CANADIAN PLANT **GALT, ONTARIO**

(*Continued from page 94*)

here more prepared to accept them than most of us admit. If they had lacked faith in America, they would not have left their old country homes and risked innumerable hardships and merciless exploitation to begin life in the new world. Many would never have come, had they realized all they would experience! If we expect them to believe in *America,* we must, by the same argument, *believe in them.* The number of Bolshevists among foreigners is comparatively few and our radicals are not all aliens by any means! It is largely for us to determine whether we shall breed Bolshevism by repression or dissipate radical ideas by encouraging self-expression.

In spite of many opinions to the contrary, the number of foreigners who became citizens during 1922 was approximately 30 per cent. larger than the number in the previous year. More than 7,000,000 foreign-born have not yet secured American citizenship. The percentages of the unnaturalized are as follows: 15.73 Italian, 11.85 Polish, 11.34 British, 11.16 Russian, 6.92 German, 6.68 Canadian, 5.14 Austrian, 3.94 Hungarian, 2.89 Swedish, 2.82 Czecho-Slovak, 2.12 Greek, 1.86 Jugo Slav, 1.76 Norwegian and 15.79 per cent from other countries. These are significant figures!

The Cable Act signed by the President September 22, 1922, makes it necessary for alien women married since that date, to secure independent citizenship. The wife cannot assume the citizenship of her American husband, but at least she may herself become naturalized even though her husband fails to do so. This Act greatly increases our responsibility to assist the more than 2,000,000 alien white women in the United States to understand the fundamental principles of our government. The foreign woman, especially the mother, is confined to her home, burdened with many cares, necessarily limited in her contact with American people and ideals, and inevitably narrow in her vision. As she can seldom attend school, American women must go to her with a program of service which will include English, home economics and friendship.

It is encouraging to note that an increasing number of cities and organizations are furnishing more adequate instruction in naturalization, and are making the awarding of "final papers" an affair of dignity and importance. The mayor or governor may well take time to address a meeting of these new citizens and help them to understand their newly-acquired rights and duties! We must find a way to simplify and make more efficient our whole naturalization process. Statistics indicate that the average applicant resides here over six years before he even applies for "first papers," and generally waits five years more before attempting to secure "second papers." This is a reflection not so much on the immigrant as upon our difficult and complicated methods of naturalization. Every applicant who is able to pass a standard test and satisfy residence, character, and allegiance requitements ought to be permitted to take his examination regardless of race or color. This is not now the case. The applicant should be allowed to present the same sort of evidence that he would submit before a court for any other purpose, and not be penalized because he cannot always provide "the same two witnesses." If one witness has been unkind enough to die before his second appearance, the poor immigrant is in sad plight. The number of naturalization officials at

Washington and throughout the country should be increased, and ought to be the highest type of men obtainable. Standards and procedure should be simplified and more reliable records kept. We need a scientific study of the whole situation, to secure accurate information as to capacities of various nationalities for citizenship and possible revisions of our present Naturalization Law.

In a single year nearly ten times as many applicants were refused admission to citizenship on technical and foolish grounds as were rejected because of ignorance or immoral character! The majority failed because of unnecessary difficulties, incompetent witnesses, mistakes of clerks, because they had left the country for a brief period or possessed no certificates of arrival. Statistics also prove beyond doubt that the courts which employ the most incompetent clerks and officials, *always* refuse the highest percentage of applicants. In other words, it is largely a matter of luck—whether the immigrant appears before reliable or unreliable officials! Is such a condition of affairs worthy of America?

Extensive observation indicates that enlarging the immigrant's opportunity for self-expression and manifesting real appreciation of his sterling qualities, intensify his desire for citizenship and frequently hasten his petition for naturalization! This is a challenging fact. Let us, therefore, multiply our "nationality meeting" and foreign holiday celebrations. Let us encourage pageants portraying the history and traditions of our foreign guests. Some time ago New York City promoted a magnificent pageant, "America's Making," in one of the great armories. Contributions of thirty-two different nations were superbly illustrated by their handicrafts, art, literature, music and drama. The number of such undertakings should be greatly increased. We must welcome more operas and plays written by foreigners. We should coöperate with the 1,052 foreign language newspapers in the United States published in thirty-one different languages and the thousands of racial societies, in a serious attempt to interpret America to the foreigner and the foreigner to America. We must also help *American* publications to be more fair and friendly in their attitude toward our immigrant population. We can stimulate song contests and folk-dances among various nationalities, as well as cosmopolitan meetings and celebrations which will eliminate race prejudice.

Surely we will consider it a privilege to aid our foreign guests in their many uplift and welfare movements! In reading the foreign-language publications one discovers such significant items as these: the Federation of Italian Societies in San Francisco has purchased a large hospital; the Italian Dressmakers' Union has founded a vacation home on Staten Island; a group of prominent Italians in New York has established a Society for the Dissemination of Italian Culture; a Russian Association gives lectures to Russian workmen in its splendid club building; a Roumanian organization is establishing libraries and promoting understanding of Roumanian culture in America; a Polish student society is collecting funds to endow a chair of Polish language, history and literature in a State University; a Syrian educational society assists hundreds of poor Syrian students in this country; innumerable organizations are raising funds to aid their suffering fellow countrymen in Europe and to promote English and naturalization classes among their members in America—and so on

(*Continued on page* 100)

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CRANES HOISTS
"RAISE PROFITS"

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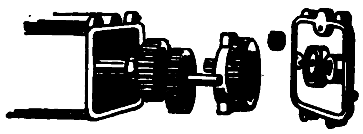

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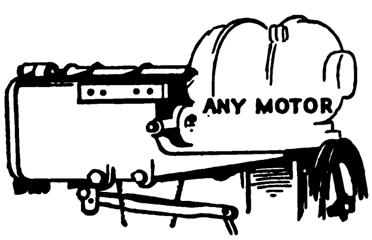

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Any motor fits a Euclid.
Parts enclosed in oil bath.
All parts to jig—interchangeable.

LOW HEAD ROOM
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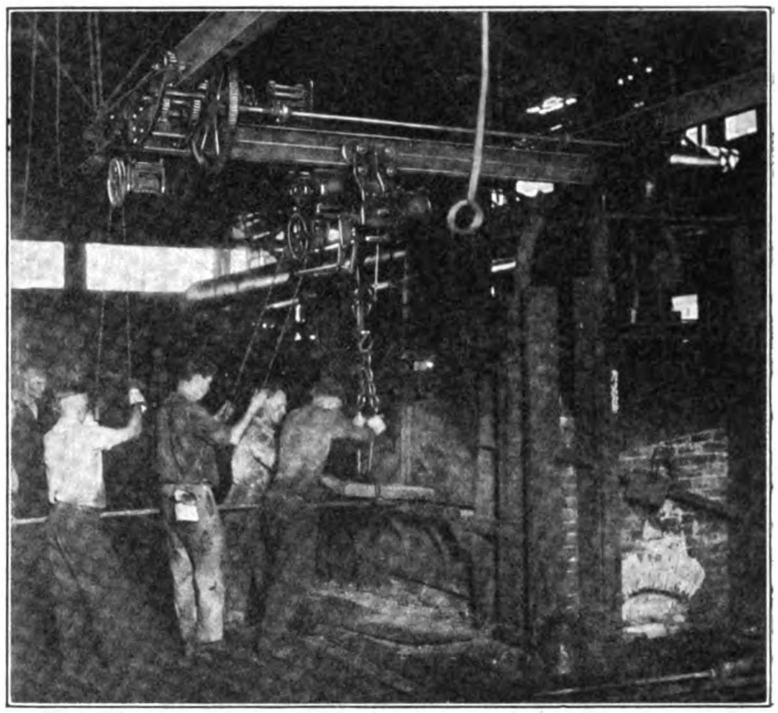


A LARGE STEEL Company says: "Euclid hoists are satisfactory mechanically and are backed up by good service. They cost little for repairs and power. When buying hoists ***we always specify Euclids.***"

After their 15 years' experience with Euclid equipment it is naturally a source of gratification to have one of the largest Steel Companies make such a broad statement.

This testimonial of satisfaction is, however, only one out of many.

Your lifting problem will be easily solved if a Euclid is on the job.

Let a Euclid Crane or Hoist "raise Your profits."

Offices in all principal cities

THE EUCLID CRANE & HOIST COMPANY
EUCLID, OHIO

(*Continued from page* 98)

ad infinitum! Can any one doubt that such methods of self-expression will benefit the United States?

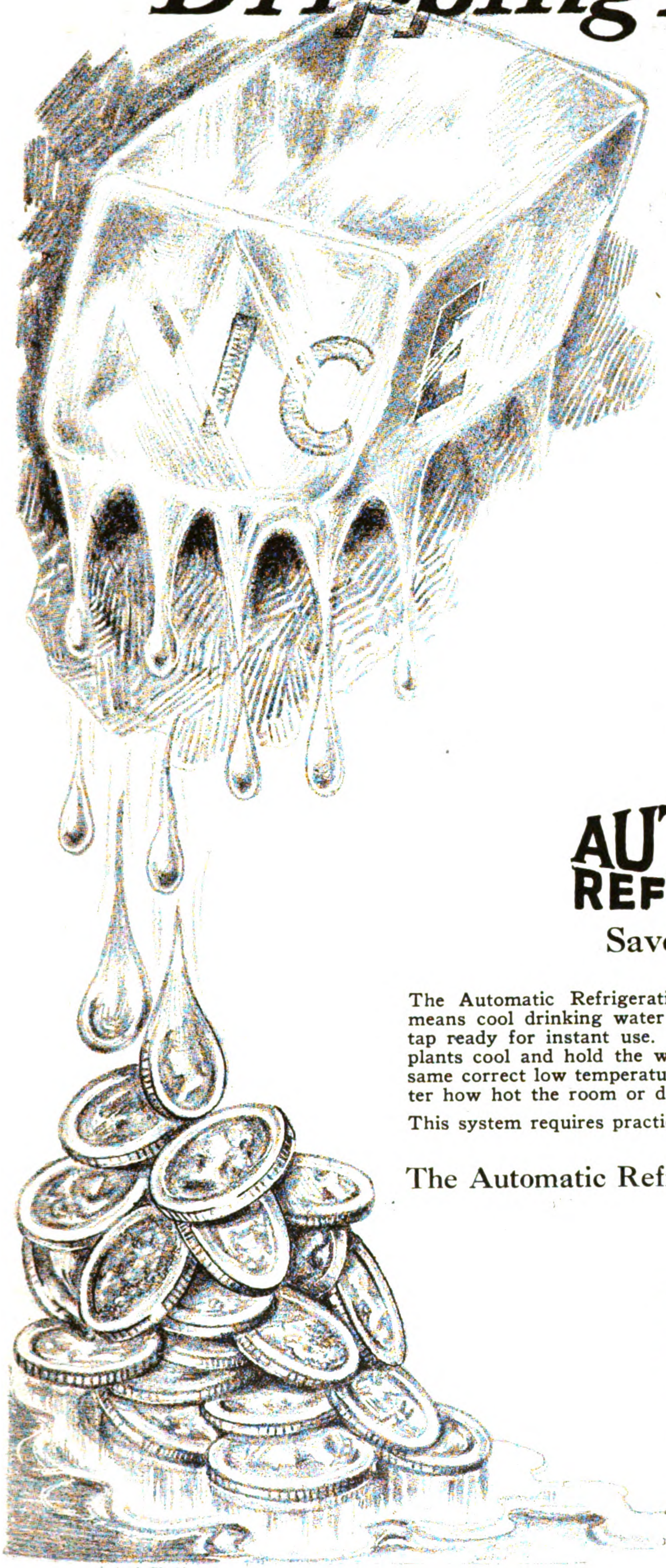
The 22,000,000 of foreign parentage in America constitute a unique problem. Some were born here, while others came at an early age. Strangely enough, our statistics indicate that the criminality of this second generation of immigrants is approximately three times as great as that of their parents! Contact with American life appears to have done them more harm than good. But a closer study of the situation reveals the more probable facts that they were isolated in foreign communities, frequently left school to engage in undesirable employment, and often mistook their new found liberty for license.

"There your whole theory breaks down!" cries the narrow-minded American. "The trouble with these foreign children is that they have been afforded *too much opportunity for self-expression.*" And to the cursory observer this appears plausible. Upon more careful examination, however, it is evident that those of the second generation, born and brought up in foreign homes, were repressed in early youth. They were constantly restrained according to old country ideas, and performed much of the hard work of the family. In school, shop or street they longed many times to tell American children of their old country heroes. But the sons of Uncle Sam sneered at them and called them "dagoes" and "hunkies." Again their desire for self-expression was stifled. Foreign mothers and fathers inevitably understood little or no English so the children became their interpreters. This gave them a semblance of power, authority and independence. Ashamed of being "dagoes" they wrenched themselves free from parental control and drifted into the wrong kind of Americanism. Lack of adequate self-expression in early years led later to a natural reveling in the new freedom which resulted in excesses. Thus they found their way into our criminal statistics.

A large number of others, however, rise above their surroundings, find opportunity to make their contribution to the United States, absorb the best of our ideals, and become successful in business and the professions. Their people are proud of them, we are proud of them and they are proud of America! Most of them are splendid citizens, eager to help their countrymen to follow in their footsteps. They have *found* themselves through self-expression, and are the hope of the second generation. And, whereas 13.1 per cent. of our foreign born are illiterate, .8 of one per cent of the child of foreign born parentage are illiterate. This is three times as good a record as can be claimed by children of native white parents!

At last we are coming to the realization that Americanization, to be useful, must be a gradual growth, fostered by the coöperation of both native and foreign born. It involves renunciation of one's identity and Fatherland and the acceptance of America's best ideals. It means the spiritual fusion of all our immigrant races into a harmonious people. It does not necessitate giving up the best racial characteristics, the obliteration of one's traditions, the betrayal of natural affections for the old country, or the smothering of native art and genius. It means a fuller and nobler expression of one's very best. It is one of the world's greatest coöperative adventures in faith, democracy and internationalism!

Dripping Dollars



These two words thoroughly describe the money waste resulting from the use of the ice cake, bucket and ice cooler of days gone by.

But, the waste is not confined only to the melting ice cake. These obsolete methods require extra expense to keep the cooler or buckets filled—and to some extent clean, depending on the habits of the caretaker. Then there is very often a long line of men waiting their turn for a drink,—wasted time here.

Besides the sloppy, messy condition around the cooler and buckets, there is always the ever-present danger of contamination. Why risk all this expense when one concern alone, through

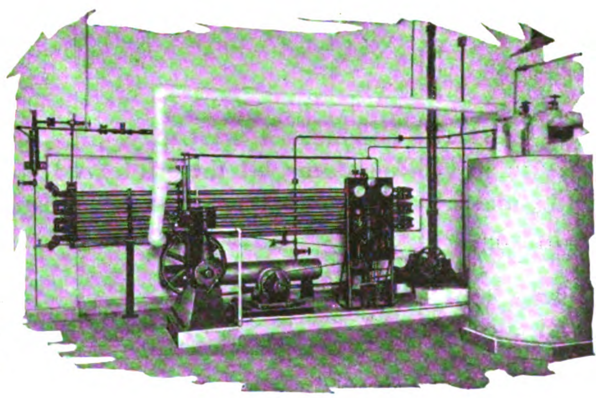
AUTOMATIC REFRIGERATION

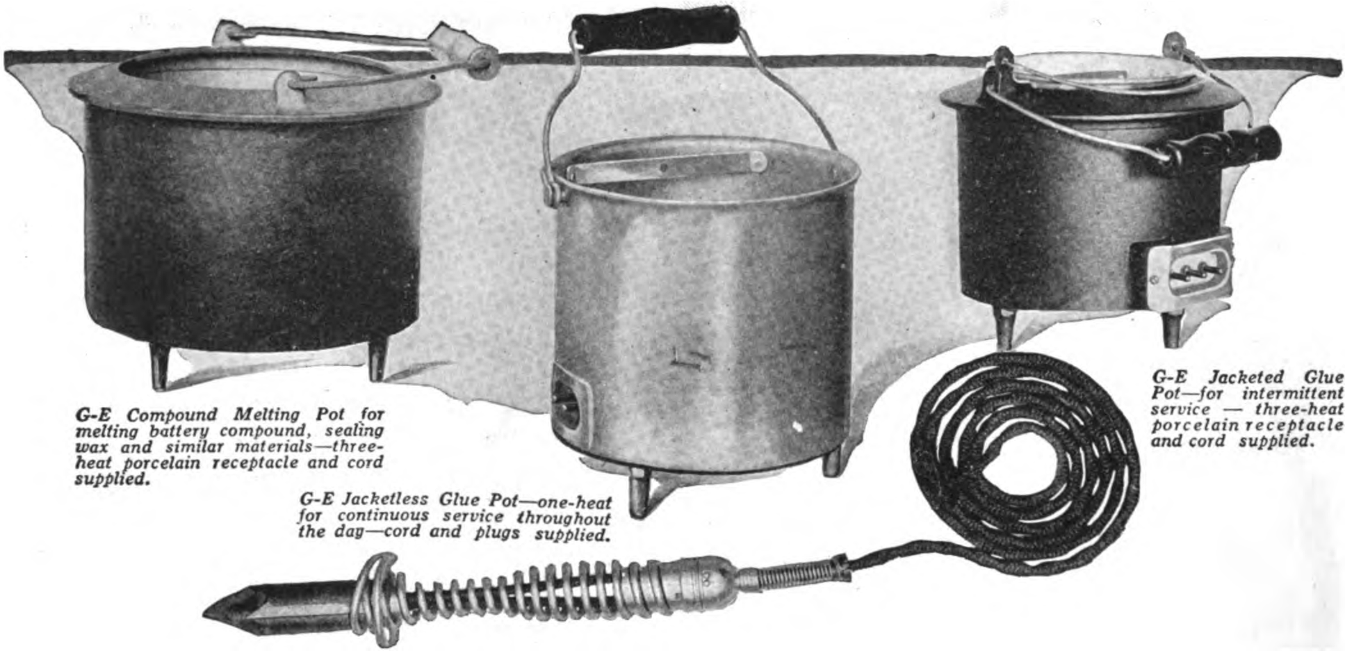
Saved $2700 in one year

The Automatic Refrigeration System means cool drinking water *always* on tap ready for instant use. Automatic plants cool and hold the water at the same correct low temperature, no matter how hot the room or day may be.

This system requires practically no attention. Starts and stops automatically at a predetermined high and low level. It costs nothing to learn free details of this remarkable preventer of "Dripping Dollars." Interesting literature on the subject of Automatic Refrigeration is yours for the asking.

The Automatic Refrigerating Company, Hartford, Conn.



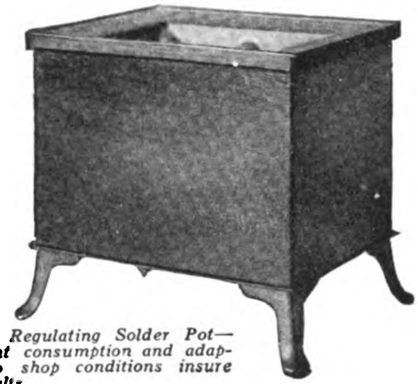


G-E Compound Melting Pot for melting battery compound, sealing wax and similar materials—three-heat porcelain receptacle and cord supplied.

G-E Jacketless Glue Pot—one-heat for continuous service throughout the day—cord and plugs supplied.

G-E Jacketed Glue Pot—for intermittent service — three-heat porcelain receptacle and cord supplied.

G-E Electric Soldering Iron—made in five sizes—for light work as well as average shop requirements.



G-E Self Regulating Solder Pot—low current consumption and adaptability to shop conditions insure better results.

Convenience—Safety—Economy
G-E small electric heating devices

To meet Industry's need for a broad use of electric heating equipment—the General Electric Company manufactures a line of small industrial heating devices that have handy uses about the plant.

There are a great many little jobs, and big ones too in the aggregate, where these small electric heating devices fit in so well that they beat anything ever used before.

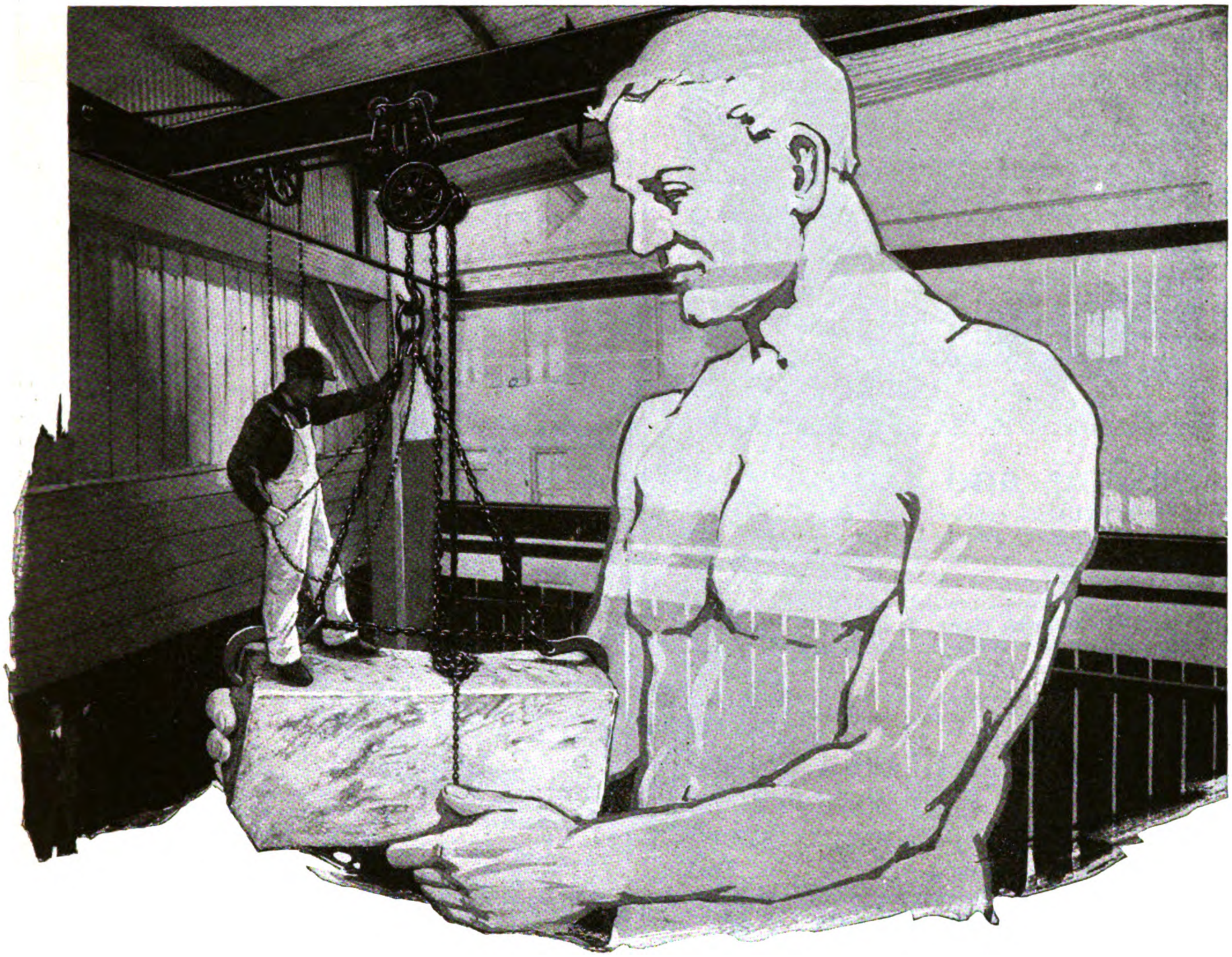
Battery Repair Shops and Manufacturing Plants have work for the Compound Melting Pot—Book Binderies, Furniture Factories, Automobile Factories and others can profitably use these Glue Pots in quantities—in Shops, Garages, Offices, the electric Soldering Iron pays for itself in short order, and if the job requires an old type iron for heavy duty you can best heat that iron in an electric Soldering Iron Furnace.

Put these handy helpers on the job and watch them make good.

General Electric Company
Schenectady, N. Y.
Sales Offices in all Large Cities

39-89

GENERAL ELECTRIC

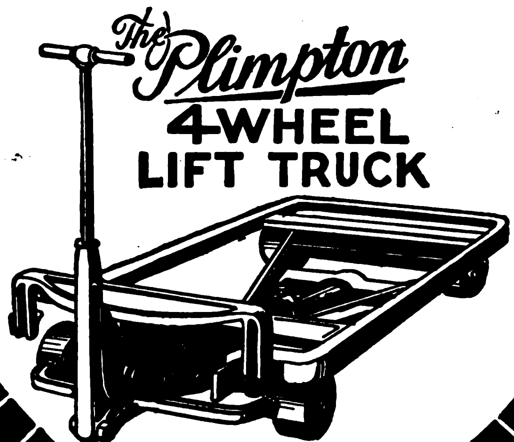


Index to Advertisements

Editorial Contents, see page 4

The Plimpton
LIFT TRUCK CORPORATION
Stamford Conn. U.S.A.

Plimpton lights the way to greater efficiency in mechanical material handling.



"made like an automobile"

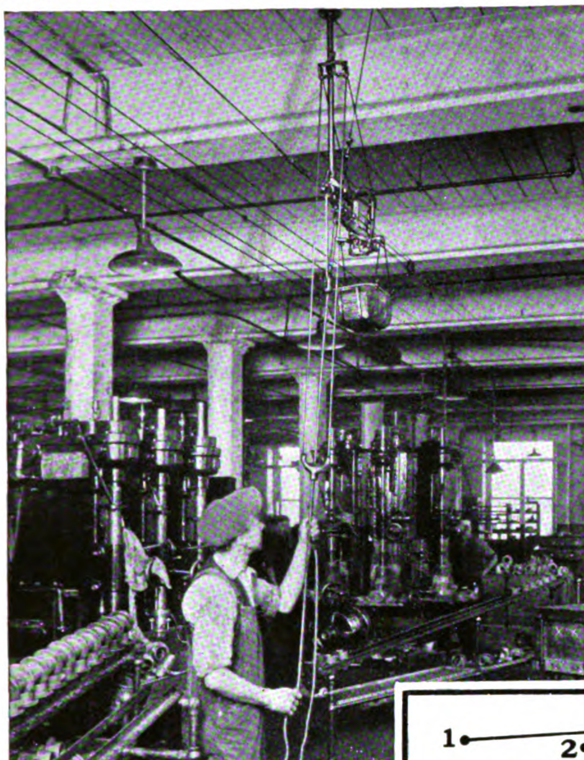
The Plimpton 4-wheel, 4-point Load Suspension Lift Truck is accepted by leading Plant Engineers as a long step forward in the efficient mechanical handling of materials.

Increased trucking mileage, reduced common labor costs, lessened breakage of parts in transit occurs when Plimpton Trucks and Plimpton Platforms are used. These savings run as high as 300 to 400%.

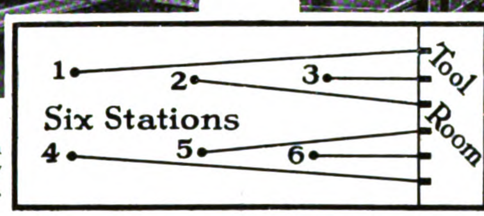
Built Like an Automobile

Plimpton Lift Trucks operate in smallest space, require least lifting effort, carry highest loads. Built like an automobile with right angle steering knuckles and 4-point load suspension they do not tip on turns. Loads do not joggle and fall off.

Write for* "Facts," *giving in detail the many points of Plimpton superiority. An investigation of Plimpton claims always results in their installation.



A pull on the cord sends basket with requisition for sharp tools from any one of the six stations to tool room.



After filling the requisition, the tool room clerk returns sharp tools to worker over Lamson basket system.

New way of distributing tools saves time; increases production

WALKING from the machines to the tool room and back; visiting and talking around the tool room window, both waste time, and cut seriously into production.

Yet these losses can easily be remedied. The picture shows a simple, inexpensive overhead carrier that virtually brings the tool room to the worker.

Carriers do the "walking."

Dull or worn tools, and requisitions for new tools, are sent in a moment by the carriers to the tool room. A pull on the convenient propulsion handle sends the basket spinning down the overhead wire, on its easy running trolley wheels. The sharp tools are returned faster than the worker could even walk to the tool window.

When all the "walking" is done by the carriers, the workers can turn out more production, as they do not leave their work for new tools, nor are they tempted to work with dull tools.

This plan is a money saver for most industries. Cutting dies in shoe factories; needles in knitting plants; dies for die casting or stamping; tools in jewelry shops; shuttles, picker sticks, etc., in textile mills are a few of the things that are economically handled by this carrier.

Profits large, costs small

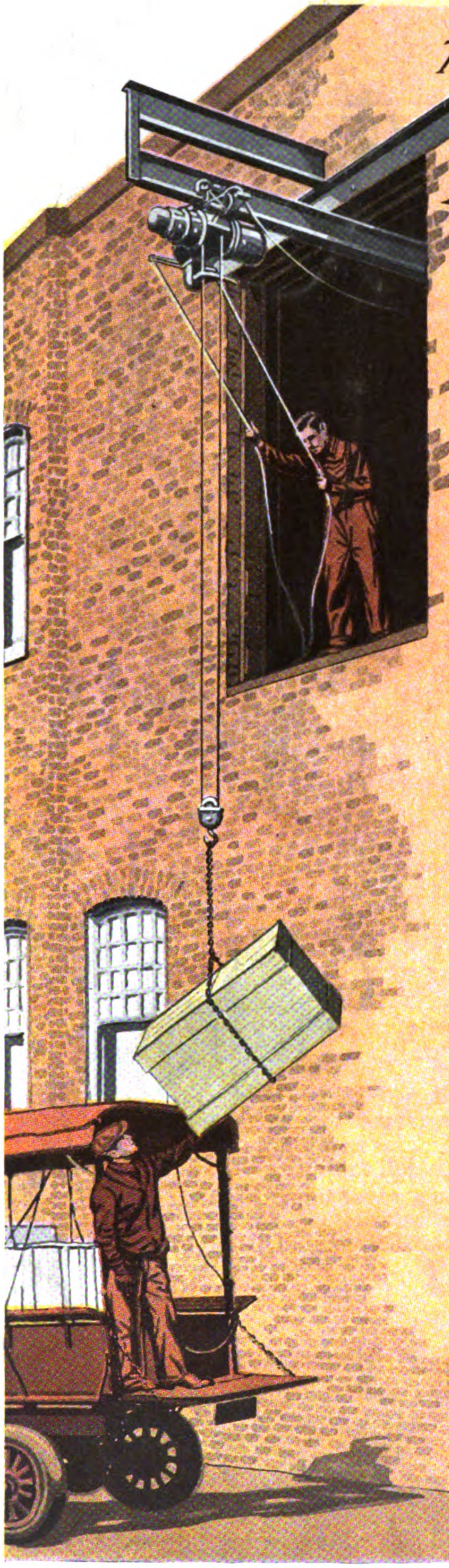
A wire line carrier installation will usually pay for itself in a few weeks or months. An entire department can often be completely equipped for a few hundred dollars. The carriers will go on earning big returns long after the first cost is paid for and forgotten.

A Lamson man will be glad to give you full particulars as to how this system will help you. Or, if you prefer, send for our "Wire Line Bulletin."

THE LAMSON COMPANY

SYRACUSE, NEW YORK

Branches in the principal cities



THE SHEPARD ELECTRIC LIFTABOUT

In this day of strict economy

Load-handling costs cut by small electric hoist

The Soabar Co., Philadelphia, tag manufacturer, installed a Shepard Electric LiftAbout which does the work of an expensive freight elevator. $2,200 was saved in equipment cost. The LiftAbout has greater utility than a freight elevator, for a case may be lifted from a truck and carried, without rehandling, to remote points on the second floor.

Economy in load-handling essential

In this day of strict economy, when keen competition faces the manufacturer in every line, it is of paramount importance to lift and move materials, in the course of production, in the most efficient and economical way.

With the LiftAbout, thousands of business executives are making savings like these: $6,000 cut in handling costs, output increased 25%; 3 men, sometimes 8 released for other work—$4,400 saving; one man does work of four—$2,500 a year saved—and similar economies in practically every line of business. This hoist is the successor to numerous wasteful lifting methods, and pays for its initial cost many times over.

"An electric hoist for everybody"

Whether you handle pins, potatoes, pig iron, molten metal, or milk—if you lift, carry, and put down loads, the LiftAbout will save for you as it has for others. Through its wide application, it truly exemplifies the name by which it has become known—"An electric hoist for everybody."

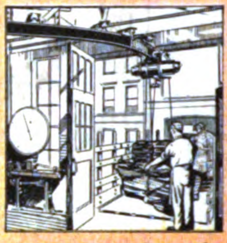
Due to quantity production and standardized manufacture, this sturdy 1/2 and 1 ton electric hoist is available at an exceedingly low price. It has the same features which have made "Shepards" the most widely used electric hoists in America.

SHEPARD ELECTRIC CRANE & HOIST CO.
420 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities
Member Electric Hoist Manufacturers' Assn.

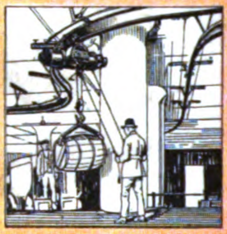
Write for the "Book of Illustrated Economies"

It gives facts, figures, and has photographs of actual installations of the LiftAbout in many uses.

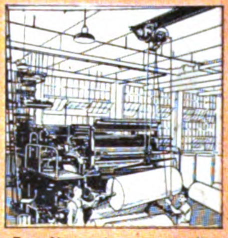
"$6,000 cut in handling costs—output increased 25%."



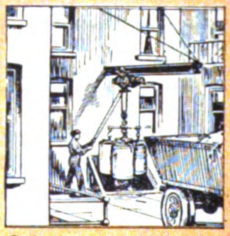
"One man does the work of four—$2,500 a year saved."



LiftAbout easily and quickly carries heavy barrels throughout the plant.



Loading heavy bulky paper rolls onto presses with a LiftAbout.



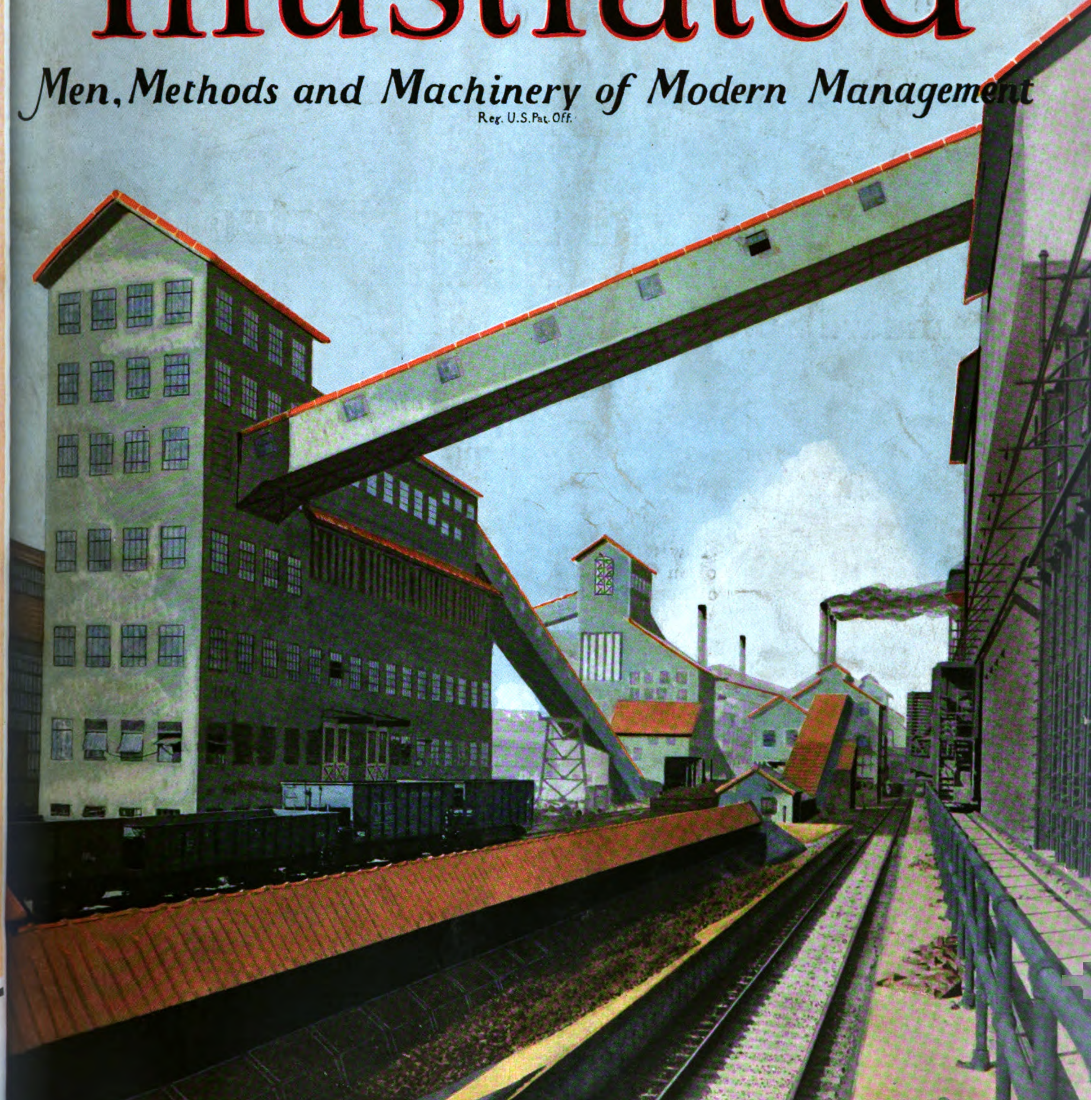
LiftAbout cuts ash handling costs. Several cans handled at one time.

SHEPARD
ELECTRIC CRANES & HOISTS

AUGUST 1924 10 CENTS

Industry Illustrated

Men, Methods and Machinery of Modern Management
Reg. U.S. Pat. Off.



In this Issue

How Mechanical Handling Builds FORD Profits

The Publishers' Column

WE believe that our subscribers and advertisers will be interested in hearing about the constructive editorial work which has led up to the production of this notable special number of INDUSTRY ILLUSTRATED.

Nearly three years ago, after a thorough editorial study of post-war conditions and the (then) coming readjustment of industry, our editors made a very bold and significant prediction. It was as follows: **"The biggest cost savings of today and tomorrow will come from moving rather than from making."**

It requires neither publishing courage nor editorial brains to "fall in line" with a demonstratedly successful editorial policy. It required editorial brains to pick three years ago from the maelstrom of post-war industry the need, on the part of management, of a thorough knowledge of the cost-saving possibilities of mechanical handling.

It required publishing courage, having knowledge of this need, to undertake the three-year editorial campaign which has educated industrial executives at home and abroad with respect to the relation of mechanical handling to today's management problems.

This task has been accomplished through an educational editorial campaign which we believe is unique in the history of industrial publishing. How well and thoroughly it has been done is best proven by an inspection of this issue, which is an eloquent appreciation on the part of the mechanical handling industry, to editorial vision, courage and persistency.

We pride ourselves that this pioneer editorial work has been done without sacrificing one iota of the service which managers and executives have always expected and always received from INDUSTRY ILLUSTRATED. Our editorial treatment of costs, accounting, the control of productive machinery and power, of time study, rate setting, the managerial factors of maintenance, the profit considerations underlying new building construction and plant rearrangement—all of these managerial subjects have benefited by the experience of successful leadership, accumulated editorial knowledge and skill of how in words and pictures to make clear to executives the fundamentals underlying the profitable present day control of men, machinery and equipment.

This issue in itself represents many months of research, study and plant investigation. It represents the unusual privilege of full entree to the works of the Ford Motor Company. The many photographs were especially taken in the Ford Motor Company's plants under the direction of our editors, who spent weeks of time in making a thorough analysis of the mechanical handling situations.

We take pride and pleasure in presenting to our subscribers and advertisers, in the form of this number, an eloquent testimonial of the appreciation by industry of outstanding editorial leadership.

THE PUBLISHERS.

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Published Monthly by
THE ENGINEERING MAGAZINE CO.
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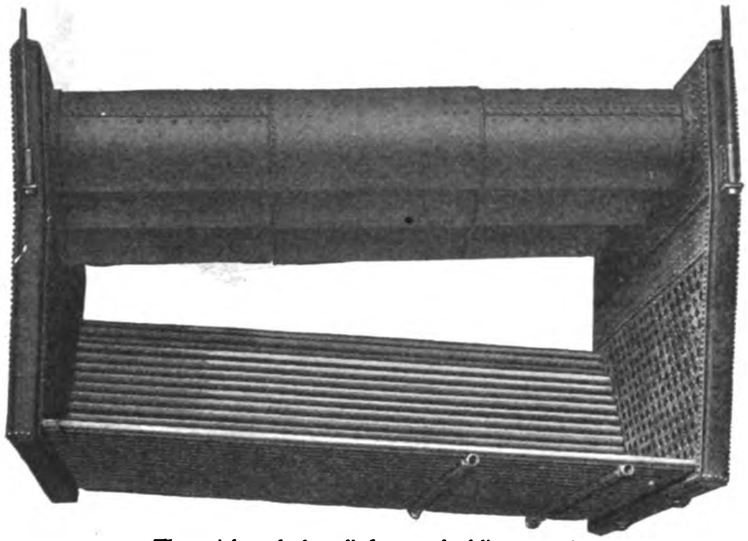
Economy Advantages of THE EDGE MOOR BOILER



The straight steel tubes, all of one standard diameter, reduce overhead and maintenance costs of the Edge Moor Boiler

III. The Tubes

ALL tubes used in Edge Moor Boilers are straight and of one standard diameter—four inches. The usual lengths are eighteen and twenty feet, although the length may be varied to meet special conditions. Unless otherwise specified, all tubes furnished are open hearth seamless steel, of the gauge required to comply with the A. S. M. E. Code for the working pressure desired.

Straight tubes have many advantages over bent tubes. They are easier to inspect, easier to clean, easier to replace. Where every tube in a boiler is of the same size, as in the Edge Moor, it is a simple matter to make replacements, and there is no need to carry a large stock of spare tubes of assorted sizes. Thus overhead as well as maintenance is reduced by the use of straight tubes.

Replacement of tubes in the Edge Moor Boiler is made through the header, thus averting the necessity of waiting for the setting to cool completely, or of working under disagreeable conditions in a partially cooled setting.

While it is obvious from a comparison of the two types that a straight-tube boiler costs more to build than one using bent tubes, the added cost is very soon absorbed in the economies effected.

Details of other features of Edge Moor design and construction contributing to greater economy and improved efficiency are described in Catalog No. 63. Your request will bring a copy promptly.

EDGE MOOR IRON COMPANY

Established 1868

EDGE MOOR, DELAWARE

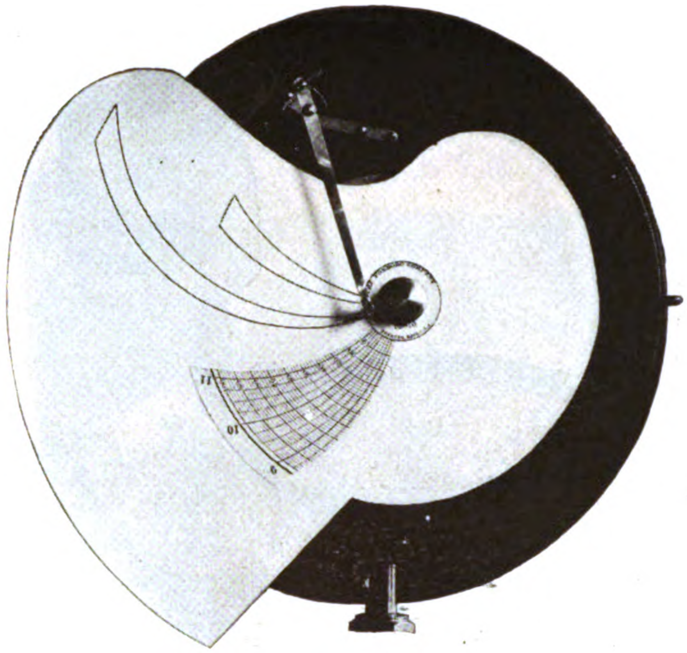
New York Chicago St. Paul Boston Pittsburgh Charlotte Los Angeles

EDGE MOOR BOILERS EDGE MOOR, DEL. U.S.A.

EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

The illustrations in this advertisement are true reproductions of unretouched photographs. Read the affidavit below.



Completion of the test. The pen of this Foxboro Recording Pressure Gauge (range 0 to 100 lbs. per sq. in.) has returned exactly to zero after recording pressures of 100 lbs per sq. in. and 200 lbs. per sq. in., without a sign of weakening. No wonder we have abolished limited "working ranges."

100% OVERLOAD

Can the Instruments You Buy Pass this Supreme Test?

For months we have told you how Foxboro Pressure and Temperature Recorders meet the fundamental requirements of permanent calibration, accuracy and long life.

Now we submit proof.

The test here described proves that you can depend upon Foxboro Recorders not only when service conditions are normal—almost any instrument is reasonably accurate at such times—but when they are unusually severe.

Read Mr. Ellis' affidavit.

"I, George R. Ellis, practicing attorney in Foxboro, Massachusetts, being duly sworn, depose and say that I have no interest directly or indirectly in The Foxboro Co., Inc., of this town.

I further state that the following tests of the Foxboro Helical Tube Movement as shown by the accompanying plates were made and photographed on February 12, 1924. An Helical Tube Movement for recording pressure, total range 0 to 100 lbs. per sq. in., starting at 0 pressure was made to register 100 lbs. pressure, or maximum chart range, hold and return exactly to zero, then register 200 lbs. pressure, or 100% Overload, hold and again return exactly to zero. The Foxboro Helical Tube Movement used in said tests was of standard materials and taken directly from stock."

(Signed) George R. Ellis

COMMONWEALTH OF MASSACHUSETTS

Norfolk, SS.

Subscribed and sworn to this ninth day of May, A. D. 1924, before me

Helen L. Miller, Notary Public

Here is legal proof of our claims that the Foxboro Improved Helical Tube Movement is permanent in calibration and will not fatigue, set, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

The advantages of Foxboro construction are forcibly brought home to you at times when plant efficiency, even safety, depends upon the accuracy of a record.

Send for Bulletin A-98-2

THE FOXBORO CO., INC.

Neponset Avenue, Foxboro, Mass., U. S. A.

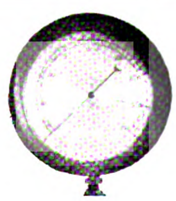
New York, Philadelphia, Rochester, Los Angeles, Chicago, Pittsburgh, Birmingham, San Francisco, Boston, Cleveland, Tulsa, Portland, Ore.

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

Peacock Brothers, Limited
179 Delorimier Avenue
Montreal, Canada

6865

Starting at zero, pressure jumps to 100 lbs. per sq. in. Note that this corresponds to extreme range of chart.



Pressure drops to zero. Pen returns to zero at once. No lagging. No indication that tube has set.

Pressure jumps to 200 lbs. per sq. in., a 100% overload. Notice the prompt, accurate response of the pen. No vibration.

Provision for Emergencies
Inspires Confidence

Emergency Hospital, Kny-Scheerer Equipped

A Friend in Need

When pain is given relief or prompt attention is received to an injury, an employee is inspired with a greater loyalty and a keener desire to work "with" and not just "for" the company.

Factory emergency hospitals afford a means of rendering a service that not only brings the workman back to his bench physically better, but with an improved mental attitude that results in better work.

The Kny-Scheerer Corporation for over a quarter of a century has manufactured surgical instruments and equipment that belong in emergency hospitals. The services of its Engineering Department are at your disposal.

Electro-Medical Apparatus
First Aid Equipment
Hospital Furniture
Hospital and Surgical Sundries
—Enamelware
Glassware
Rubber Goods
Hydro-Therapeutic Apparatus
Instruments
—General Operating
Specialists
Surgical
Invalid Conveniences
Laboratory Equipment
Operating Room Equipment
Sanatorium Equipment
Scientific Apparatus
Sick Room Conveniences
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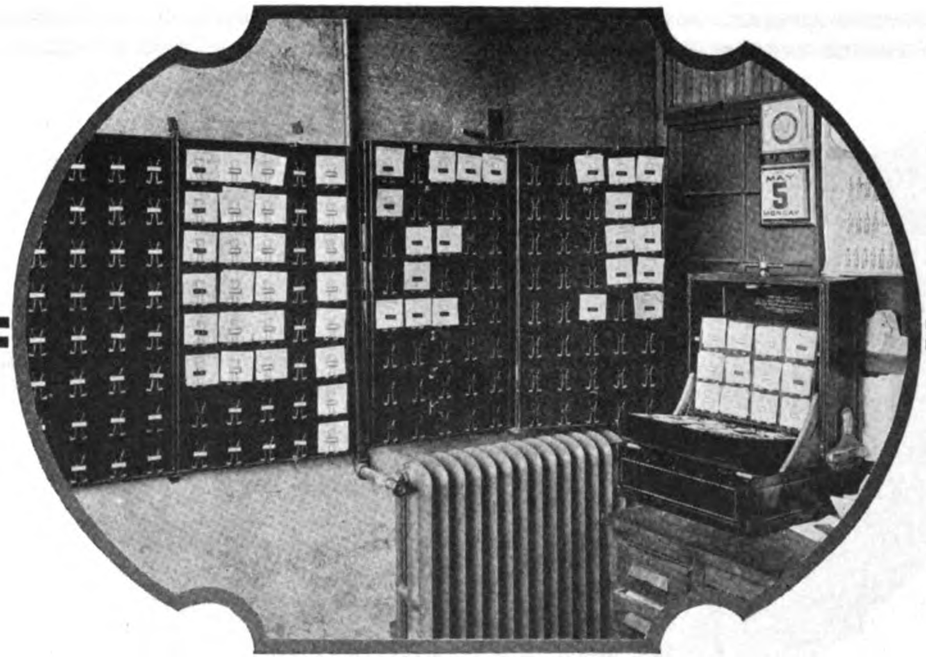
—Bed Pan
Dressing
Instrument
Utensils
Water
X-Ray Apparatus and Equipment

The KNY-SCHEERER Corp.
OF AMERICA
119 Seventh Avenue —Dept. L New York, N.Y.

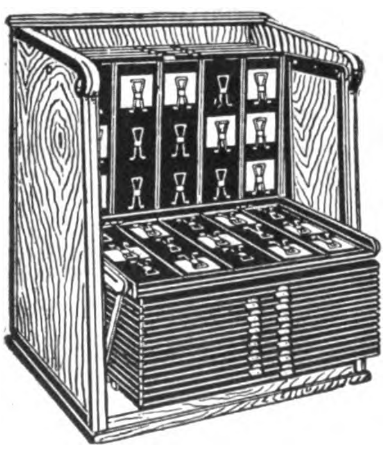


Production Cost Record Cuts 50% from Scrap

—McCaskey system makes better organization possible

Production costs were way up at The Mueller Brass Foundry Co., St. Louis, Mo. Not only that, but actual production was full of uncertainties. There was no exact check on men, material, time, etc., and the scrap heap ran high. Mr. H. P. Mueller, their president, tells how simply a McCaskey system remedied these losses:

"In order that we might actually know our production costs and thereby arrive at our actual profit or loss on a job we made a careful survey of various cost systems three years ago with the result that we installed a McCaskey system to give us the desired information.



A record of every job

"Now as each job goes through the foundry each man's time is recorded on McCaskey pads together with the order number, operation, amount of raw material used, scrap resulting, number of finished pieces and other vital information. These slips are sent to the cost department where costs are figured and production and scrap reports are made out daily.

"—have a detailed check on every man"

"Knowing the facts has resulted in two big things. First, the foreman, superintendent, and executives have a detailed check on every man and job. If a job slows up, if the scrap runs too high, or if any one of a number of things happens, they know it immediately and steps are taken to right things. Without the McCaskey system the only way to make such a check would be to personally supervise the work of every man—a physical impossibility. The second result is that the men themselves take more interest in their work. They know that if the reports show scrap running too high on their jobs, their jobs are in danger—and they work to hold them.

"—resulted in a 50% reduction in scrap"

"The McCaskey system has resulted in the reducing of our scrap 50%—a considerable saving in dollars. We now have what we believe to be a real foundry system. Knowing our costs and being able to guide our production enables us to give quick and accurate estimates to our customers and has resulted in an increase in our business. We would not consider returning to the uncertainties of the past in counting profits or losses by simply taking the difference between material costs and selling price, the method followed in most foundries even today."

Why Not a McCaskey in Your Plant?

McCaskey systems are in scores of plants. They are checking tool losses, keeping cost and delivery records, keeping perpetual inventories, in fact they are adapted to any place a detailed record must be kept. They are making savings in plants similar to yours. We would like to show you how they will work in your plant. There is no obligation. Write us today.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division ***Alliance — Ohio***

CANADIAN PLANT ***GALT, ONTARIO***

Industry Illustrated
The Pictorial Presentation of Practical Management
JOHN H. VAN DEVENTER, *EDITOR*
W. THOMSON LEES, MATTHEW W. POTTS, *Associate Editors*
ADOLF SCHILDKRAUT, *Art Director*

How Mechanical Handling Builds Ford Profits

THE accompanying panoramic insert portrays but a portion of the extensive River Rouge Plant of the Ford Motor Company, and presents the plant only from one side; so that it is necessary for the reader to imagine the buildings which are hidden by those in the foreground, in order to appreciate the magnitude of such an enterprise. Even though only a portion of the plant is shown, there is more visible industrial life and industrial activity in this one picture than could be obtained by photographing and collecting illustrations of half a dozen other industrial plants. A few of the specific buildings are marked on the panoramic view, but a word picture enumerating the various buildings and industries will be of interest.

As integral parts which go to make up the immense River Rouge Plant, we find the following:

Coke ovens with all the by-product industries that are related to the coking of coal, such as benzol extraction, ammonia sulphate (fertilizer), coal tar and other products.

Coal pulverizing plant, where coal is prepared for combustion in Power House No. 1, which generates a large portion of the power to operate the electrical equipment in this plant.

Blast furnaces for the making of iron from ore and other raw materials which have previously been handled from lake boats by means of the unloaders and gantry cranes operating over the outside storage bins.

A pigging building, in another part of the plant, connected with a large jobbing foundry, which is itself an industry worthy of being separate and apart. The cupola buildings are located at the end of the main foundry building where motor blocks and other Ford parts, used in the manufacture of Fordson tractors and Ford cars are made.

Beyond this foundry building is a machine shop where all parts for the Ford car motors are finished.

The electric furnace building is fully equipped for the manufacture of steel, and the electric furnaces in this building will be operated by electricity generated in Power House No. 1.

The cement plant is complete in every detail and will soon be turning out Ford cement.

A sinter plant is located to the left of the gantry crane in the center foreground of the four-fold picture and to the left of the blast furnace stoves. Here flue dust from the blast furnaces is mixed with steel borings to produce sinter, which is again fed back into the blast furnace properly mixed with raw materials.

The tractor assembly building is complete with machine shop and assembly rooms, sheet metal shops, etc., to produce Fordson tractors. These tractors are immediately run under their own power to the tractor shipping platform where they are properly crated for domestic and foreign shipments.

To the far end of the tractor assembly building, but not visible in the large picture, is a complete woodworking shop for the manufacture of Ford car bodies. The chips, shavings and refuse from this wood-working shop are used as fuel in Power House No. 3.

In addition, but not at all visible in the picture, is a complete glass plant for the manufacture of plate glass.

There is also a sawmill which handles lumber in the form of logs, cuts it, sorts it, and this lumber is then kiln dried and seasoned on the same plant property. There is also a structural steel shop where all sorts of structural steel parts are fabricated.

At a point to the left of the large illustration, and adjacent to the end of the furthest gantry crane, is a building which is devoted entirely to the construction and repairing of steam locomotives which are used on the D. T. & I. Railroad, which is a part of the Ford industries.

This is but a sketchy and very meager description of the River Rouge plant and of course does not begin to tell the details of operation in all the buildings mentioned or shown. These, after all, are aspects fully covered in Mr. Van Deventer's articles in INDUSTRIAL MANAGEMENT, September 1922 to September 1923.

With such large scale operations and with the well known production requirements of this Company, it can literally be said that hundreds of thousands of tons of materials are handled in and about this plant every twenty-four hours. Practically all of the materials used are received in a raw state and are manufactured into the finished products at this one center. What, then, is the greatest problem of this industrial plant? It is the *efficient handling of materials.* Moreover, as several separate industries are included within this plant, it can safely be said that practically all types of materials handling equipment are employed at one point or another. The key to the various types of equipment and their points of use, as shown under building headings, on the panorama, will give the reader a quick visual picture of where various types of equipment are employed. The text which follows on succeeding pages will endeavor to point out individual pieces of equipment.

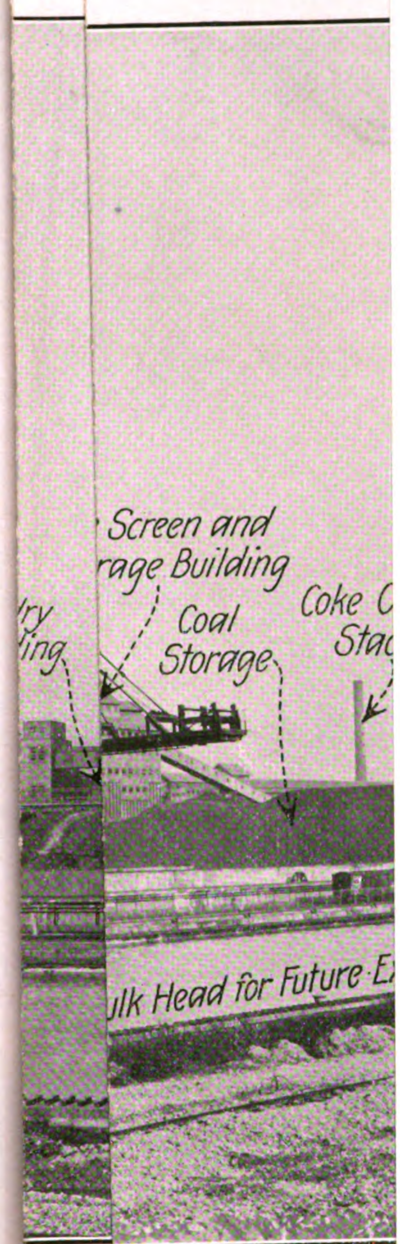
It is axiomatic that Ford industries operate on the principle of economic operation in each and every department, and the coördination of departments, operations and industries is carried on the same basis and mechanical means of handling materials are employed wherever possible.

In such a diversified industrial plant no one type of handling equipment can predominate, and so we see employed here the old style hand truck and other simple types of handling mechanisms, straight through to the large equipment such as gantry cranes and boat unloaders.

Some industrial executives seem to think they have their plants well equipped if they employ one or two screw conveyors, a belt conveyor and an overhead traveling crane. It is true that their plants are not on the scale of the River Rouge plant, but the same principle of economic operation holds true, regardless of the size of the plant. The Ford plant is, therefore, a valuable lesson in showing how materials handling equipment can be employed in every industry on both a large and a small scale. Executives must study their handling problems and must learn to fully understand the limitations and special advantages of the various types of equipment which are now manufactured.

If the executive readers of this magazine will look at the Ford plant as a complete demonstration of what is possible, and not regard it merely as the *Ford* plant, they will obtain a good object lesson in how, when and where to apply mechanical appliances to the handling of materials in the common industries.

R



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MECHANICAL HANDLING *at* RIVER ROUGE

By Matthew W. Potts

Receiving and Distributing Raw Material
Materials Handling in the Blast Furnace Building
The World's Most Modern Foundry
Handling Large Casting Through the Machine Shop
Power House Fuel Handling and the Electric Furnace Building
The Saw Mill and the Tractor Assembly
Successful Innovations in Plate Glass Manufacture
Handling Diverse Materials in the By-Products Plant
Miscellaneous Industries Within the Ford Plant

Receiving

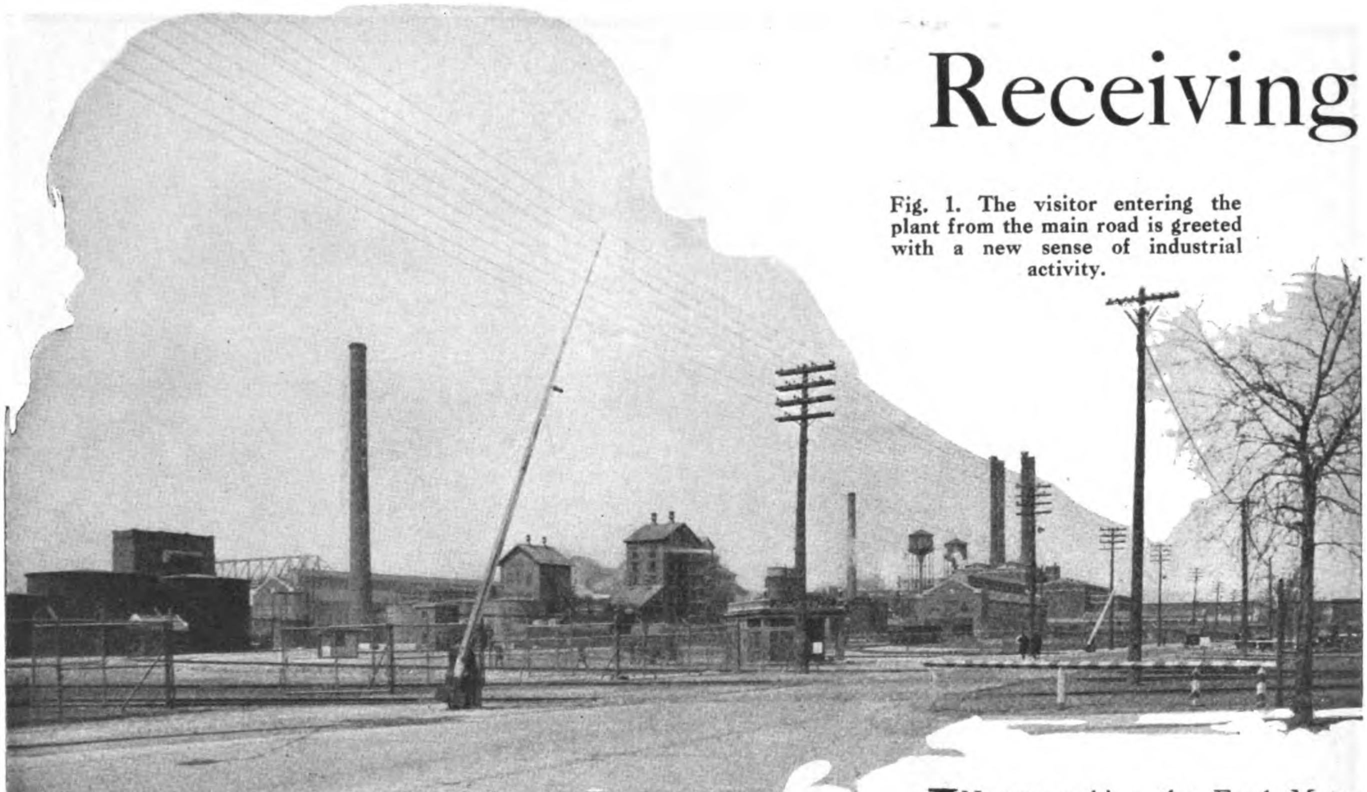


Fig. 1. The visitor entering the plant from the main road is greeted with a new sense of industrial activity.

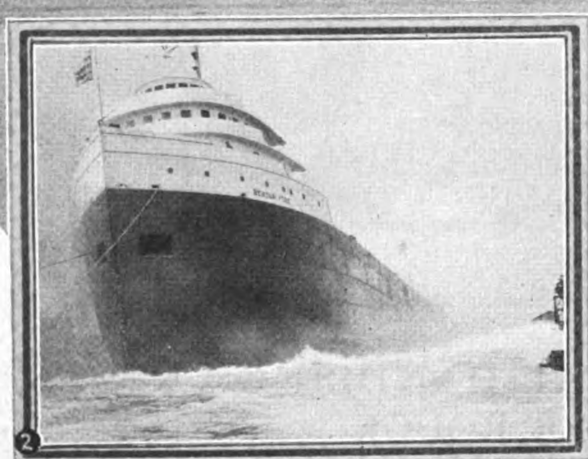


Fig. 2. The Ford Motor Company have found it advisable to build their own Lake boats for transporting material.

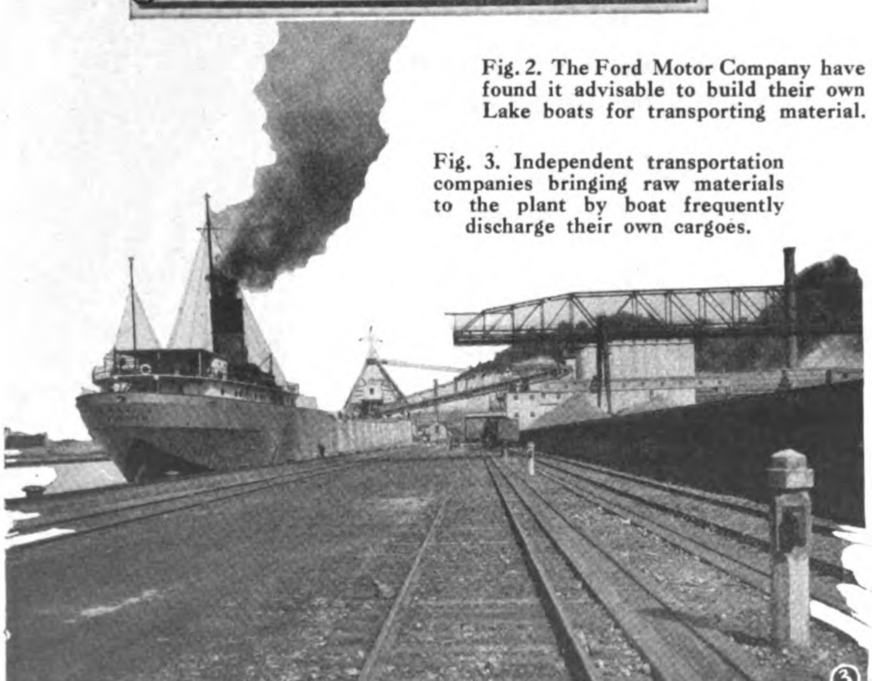


Fig. 3. Independent transportation companies bringing raw materials to the plant by boat frequently discharge their own cargoes.

IN approaching the Ford Motor Company's River Rouge Plant by trolley or automobile, it is not necessary to ask anyone to tell you when you have arrived, for the plant is visible long before you reach your destination. By far the greater number entering this plant come in by way of the main road (Fig. 1), and obtain a view of the plant looking northwest. Immediately the individual feels dwarfed by the immensity of the plant and by an impression of great activity under smooth and harmonious control. If one could approach the plant from the west and arrive at a point near the center of activity, as presented in the panoramic view, the sight would even be more wonderful and a better conception of the magnitude of this individual industrial enterprise could be obtained.

As previously stated, the individual arrives by the main road; but the raw material, which is eventually transformed into various products, arrives by water through the gateway, shown in Fig. 9, which is at the southern end of the plant property.

This waterway is one of the first and most important materials handling methods employed and while it is "manufactured" from nature's elements and not from mechanical equipment, it is no less important. The installation of this waterway was made possible only by the Ford

and Distributing Raw Material

Motor Company as they had to bear much of the expense incidental to widening and deepening the River Rouge, and at the same time they do not have a monopoly; other property owners and industrial plants also profiting by this improvement. At the time when the river was deepened it is hardly possible that the company contemplated operating their own boats for handling raw materials, but within the past year two large lake boats for the handling of bulk materials have been launched. These boats were designed and built by the Ford Motor Company and they will be owned and operated by the same company. Fig. 2 shows the launching of the *Benson Ford,* which was the second boat built and which has a capacity of 12,000 tons. This boat was launched on April 26 and it is possible that by the time this article is published it will have been transporting materials from the Ford mines to the River Rouge Plant.

At the present time, and even after their own boats are in commission, it will be necessary to transport materials by regular Lake transportation companies. Figs. 3 and 4 show the facilities provided for the unloading of Lake boats. These illustrations present the most modern type of self-unloading boat and while the details of all the equipment in these boats are not here explained, they would undoubtedly make an interesting article in themselves. Fig. 3 shows the boom belt conveyor, which is a part of the boat equipment, discharging limestone to the receiving bins, while Fig. 4 shows the bow of the boat and illustrates how the ore bridge gantry crane immediately transfers the material from the receiving bin to the outside storage bins. In addition, Fig. 3 will give the reader a conception of the detail with which the Ford engineers plan all their plant property. Here we see a general view of the bulkhead and it will be noted that three railroad tracks and a roadway have been provided for the handling of materials in railway cars. In order to

Fig. 4. The season of Lake shipping being short, it is necessary to provide quick ship turn-around. Materials handling equipment makes this possible.

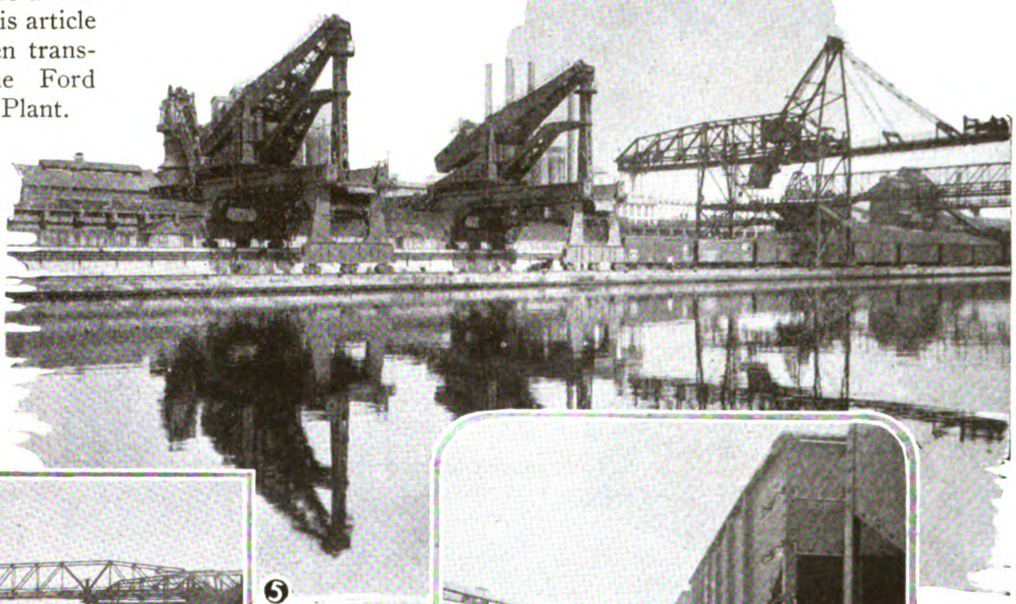


Fig. 5. Boat unloading devices are a part of the plant equipment to facilitate the unloading of ships not equipped with materials handling devices.

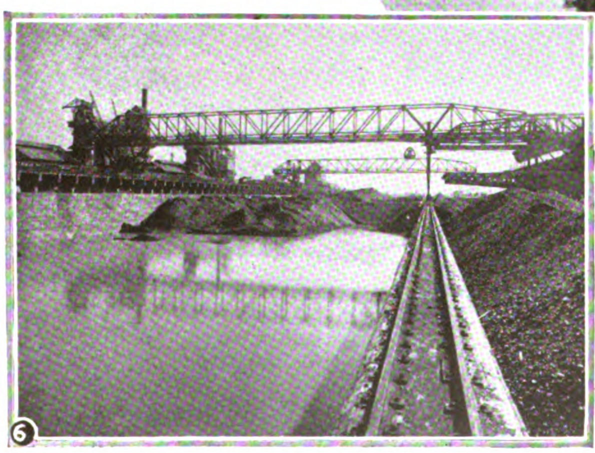


Fig. 6. A general view of raw materials, storage bins, and traveling ore bridge gantry cranes.

Fig. 7. Power driven cable hauls facilitate the movement of loaded and empty cars on high line.

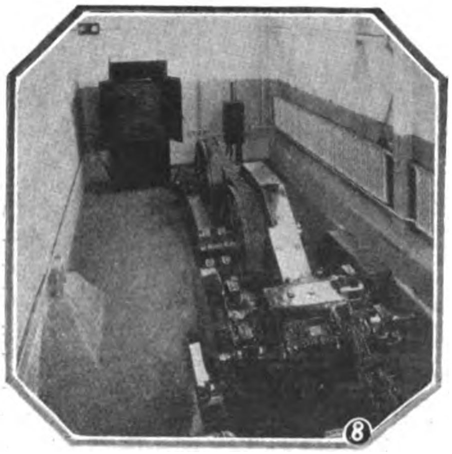
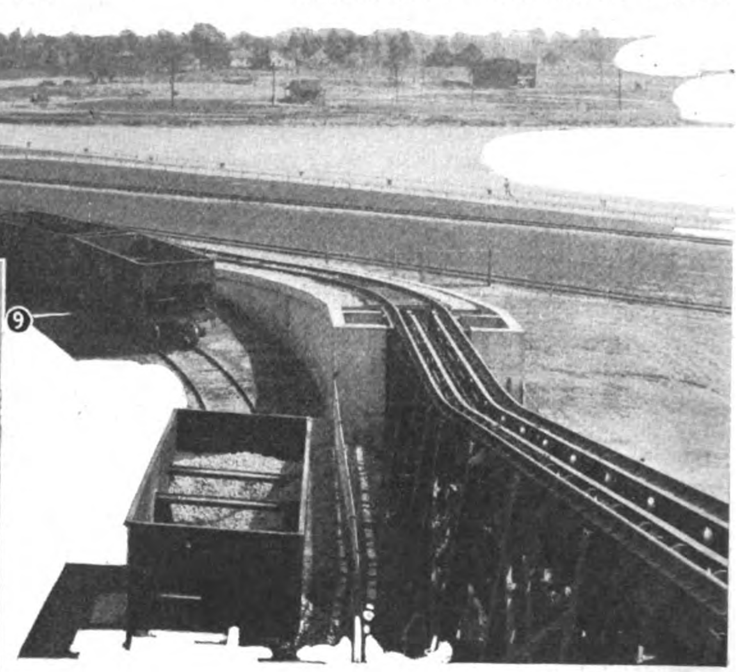


Fig. 8. This view shows the drive mechanism for the cable haul on high line.

eliminate waiting for a locomotive to shift cars from place to place on the bulkhead and also to do away with the necessity of a labor gang with pinch-bars, the company has installed a cable haul the full length of the bulkhead, or approximately one half mile from center to center of sheaves, thus using a cable more than a mile long. To drive this cable a 100 hp. motor is required, but the facility of shifting cars by this method justified the expenditure. In order to make the operation simple, and also to provide the maximum safety precautions, remote control stations are placed in concrete pillars, approximately fifty feet apart, and from these control stations the cable haul can be started in either direction, or stopped, as desired. This permits the shifting of cars at any point on the bulkhead without requiring the man to telephone, signal, or walk to the main drive house when he desires to move a car either five feet or one hundred feet. It would be difficult to estimate the time saved by the installation of this remote control



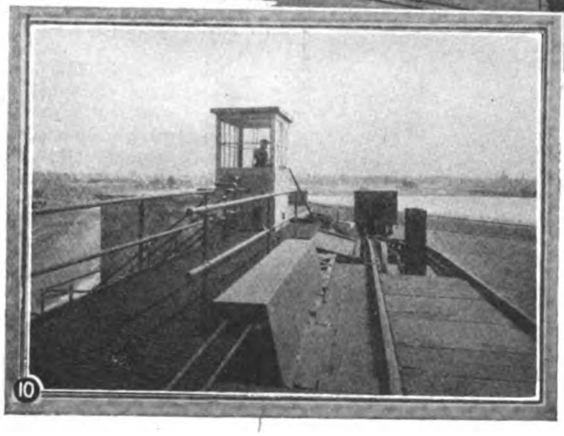


Fig. 10. Start of the conveyor for lowering cars from high line, the remainder of which is shown in Fig. 9.

Fig. 9. This view shows the gateway by water to the Ford Motor Company's River Rouge Plant and also illustrates the method of lowering empty cars from high line to ground level.

Fig. 11. The proper drive for conveyors is important and this view illustrates the compact unit which drives the conveyor shown in Figs. 9 and 10.

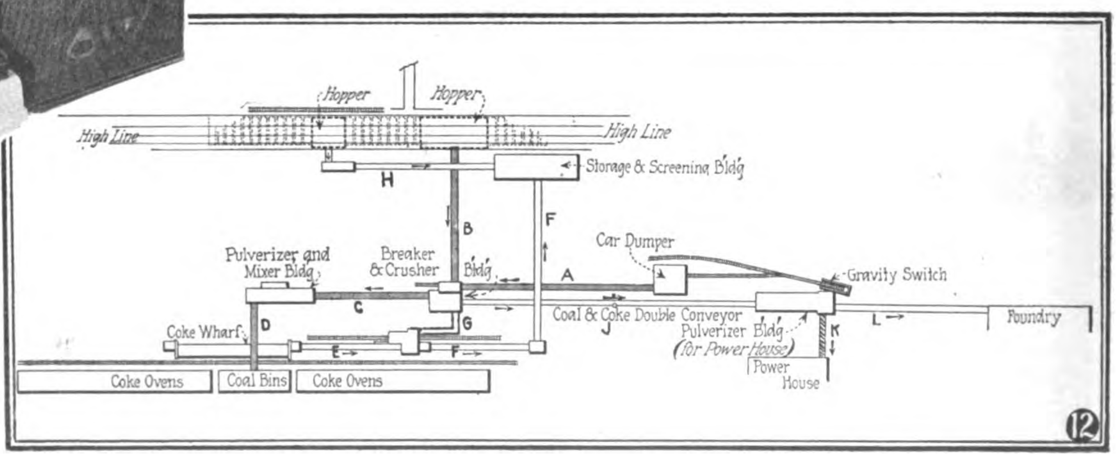


Fig. 12. A diagrammatic view showing the layout of high line, car dumper, coke ovens, and various conveyors and buildings, which are a part of the coal and coke handling system.

system but the writer feels safe in saying that it saves thousands of man-hours per year.

Not all boats which bring raw materials to this plant are equipped for self-unloading, and so the Ford Motor Company has provided every facility possible to permit quick ship turn-around. Two types of unloading equipment are shown in Fig. 5. This equipment is self-propelled in every respect, even to moving any distance desired in a longitudinal direction, and is operated direct from third rails which are clearly visible as mounted on the retaining wall of the outside storage bins. Each unloader is capable of handling over 600 tons of materials per hour and when realizing that the average Lake boat is rated at from 10,000 to 12,000 tons, it will be seen that by continuous working a ship could be unloaded every day. This not only benefits the Ford Company but is of great assistance to the Lake transportation companies, as it permits them to keep their boats in transit, handling pay loads, instead of being tied up for days and depending upon recuperating their expenses by demurrage charges.

To further facilitate the handling of raw materials, the outside storage bins

(*Continued on page* 152)

Fig. 13. A general view of some of the buildings and conveyor galleries which are shown in the diagrammatic view, Fig. 12.

Fig. 14. A general view of the car dumper, showing the method of propelling full cars up the incline by means of a barney car pusher.

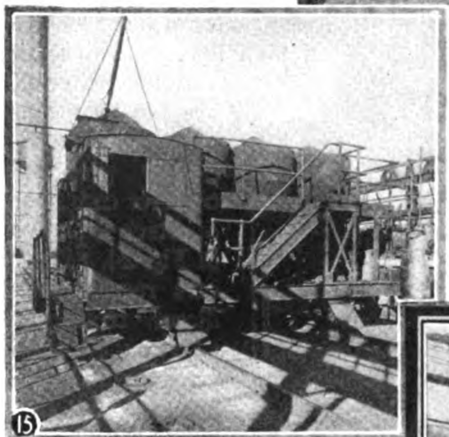


Fig. 15. The charging of coke ovens is done by means of an electrically propelled four compartment hopper car, as shown.

Fig. 16. Pushing a coke oven every eleven minutes is the work performed by this mechanical pusher.

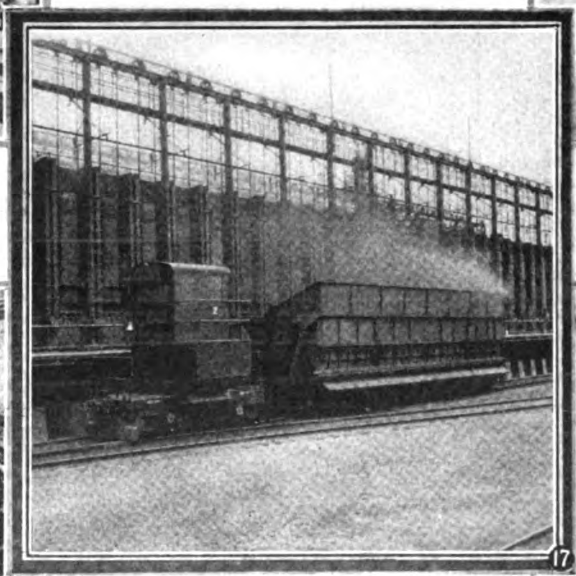


Fig. 17. A mechanical pusher ejects the coke into the quenching car shown above and the electric locomotive immediately propels same to the quenching tower.

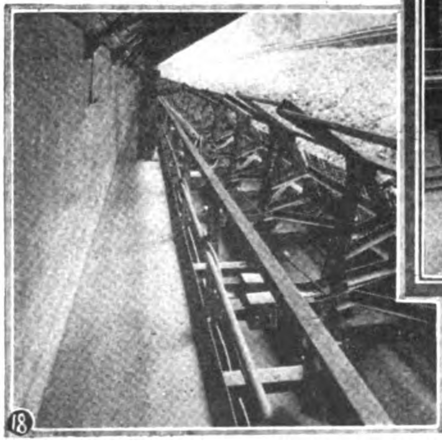


Fig. 18. A view in the coke wharf showing the method of feeding coke to the belt conveyor E, shown in Fig. 12.

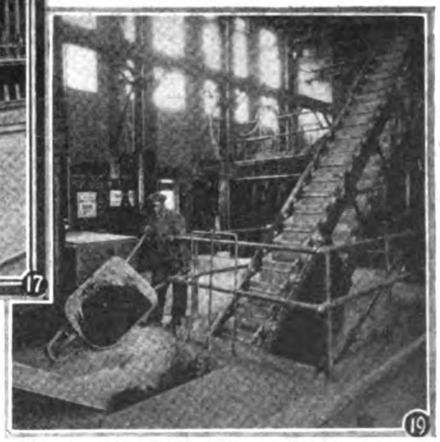


Fig. 19. Inclined bucket elevator, handling coke breeze and clay to a mud mill, located in the coke oven building.

Materials Handling in the Blast Furnace Building

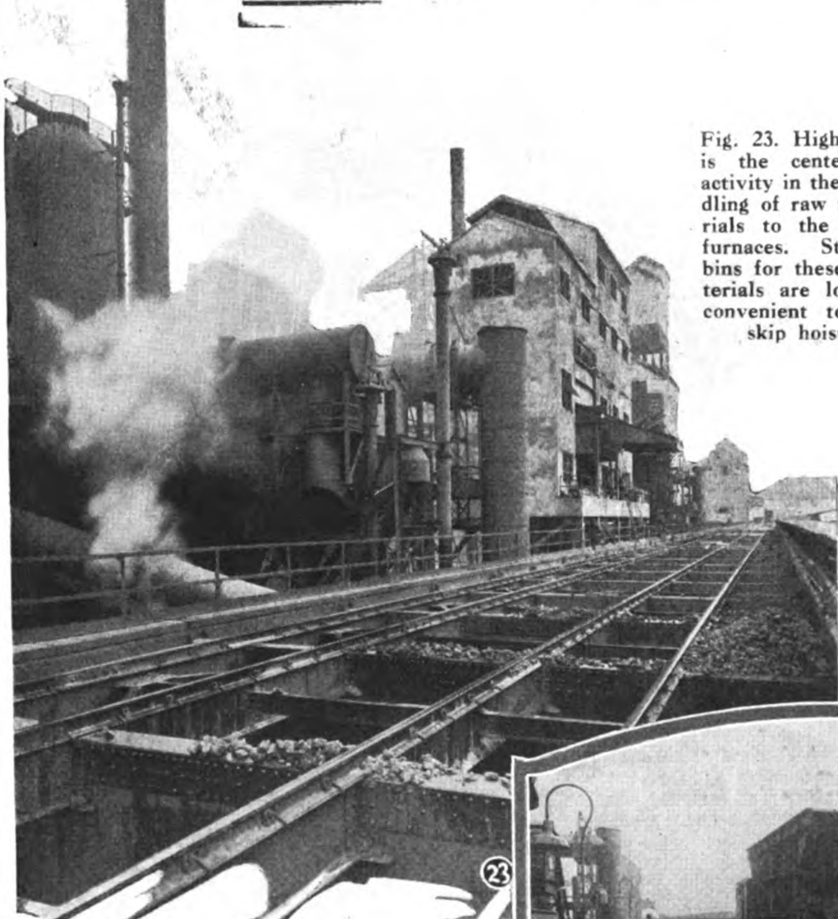


Fig. 23. High line is the center of activity in the handling of raw materials to the blast furnaces. Storage bins for these materials are located convenient to the skip hoist.

ON describing the mechanical handling of ore, coke and other blast furnace materials we will not be particular in stating size of charge or giving too many details. We will, however, trace the line of travel in its entirety. The principle of efficient materials handling is applied here as elsewhere with the result that an immense quantity of metal can be produced with unbelievably small labor cost.

When we consider that the blast furnace unit consists of three furnaces, each having a capacity of approximately 500 tons per 24 hours, we begin to realize the amount of raw material, as well as finished product, that must be handled. High line is the center of activity for the incoming raw materials and Fig. 23 shows the raw material bins, located on high line, to which the various materials are fed by means of several electrically propelled transfer cars; one of which is shown in Fig. 24. These cars receive coke direct from the storage and screening building (see Fig. 12), which can be seen with its overhanging chutes from the back-

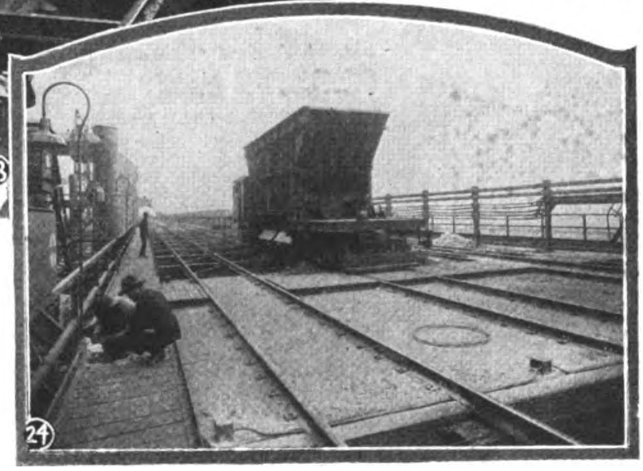
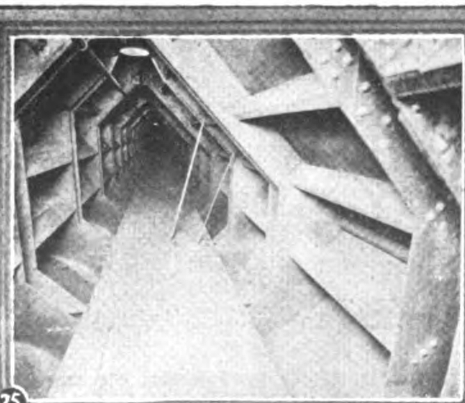


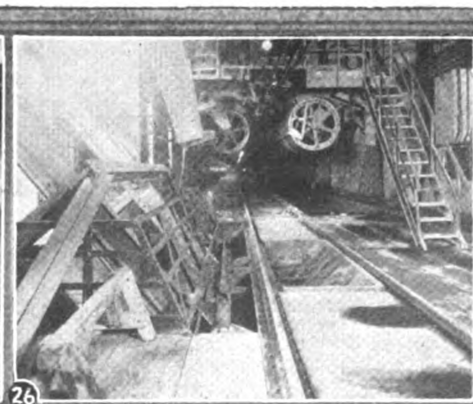
Fig. 24. Raw materials are transferred from various points on high line to storage bins by means of electric transfer cars. The one for handling coke has an exceptionally large hopper, as shown.

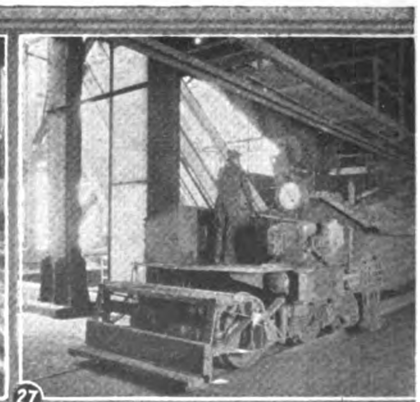
Fig. 25. Under the storage bins in high line is this working gallery, which is located directly above the power driven feeders.

Fig. 26. The power driven feeders, under high line storage bins, and one of the skip hoist pit hoppers, can be seen in this illustration.

Fig. 27. One of the transfer cars which handles raw materials under high line. Note the single operator who propels the car and discharges the material.







ground of Fig. 24. Transfer cars, of the same type but with smaller bodies, are used for the handling and transferring of iron ore and limestone. This ore and limestone is reclaimed from the outside storage bins by the ore bridge gantry crane (Fig. 6), is deposited to the transfer car direct from the bucket, and is then hauled and dumped to the hopper adjacent to the blast furnaces. These hoppers have slanting sides and are built of steel plate, with a gallery between each set, where workmen can get at the discharge opening if desired. Beneath this gallery are located revolving drum gates which automatically feed the material to the charging car. These gates, the tracks upon which the charging cars operate, and the roomy working space under high line, are shown in Fig. 26, and the stairway to the gallery, as well as the skip

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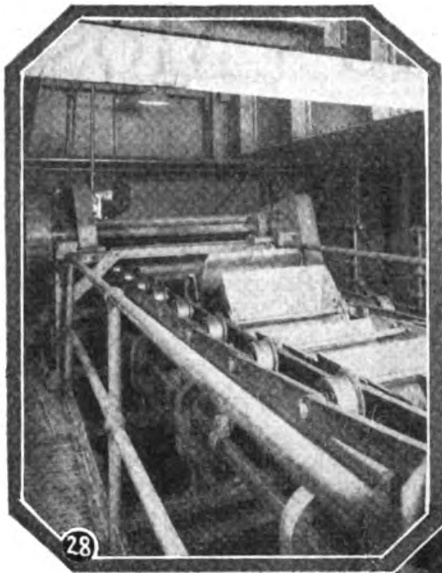
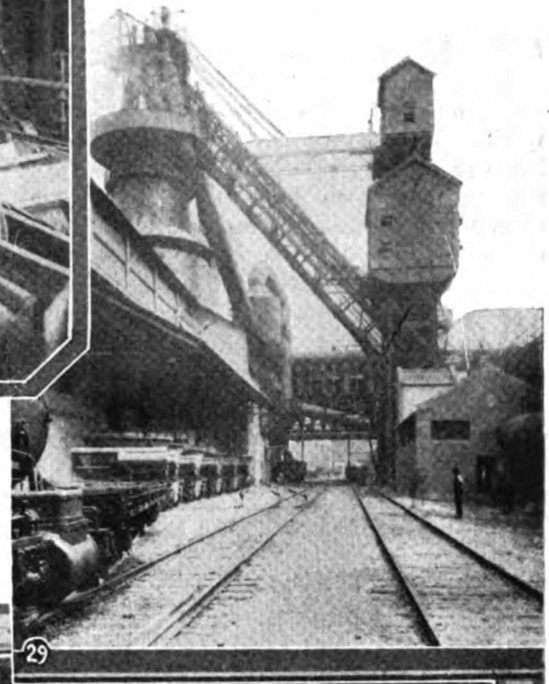


Fig. 28. Instead of picking up spilled materials by hand a pivoted bucket elevator conveyor is installed under the skip hoist pit hopper.

Fig. 29. A general view of one blast furnace, skip-way and skip hoist drive house. High line is just visible to the right of the picture.



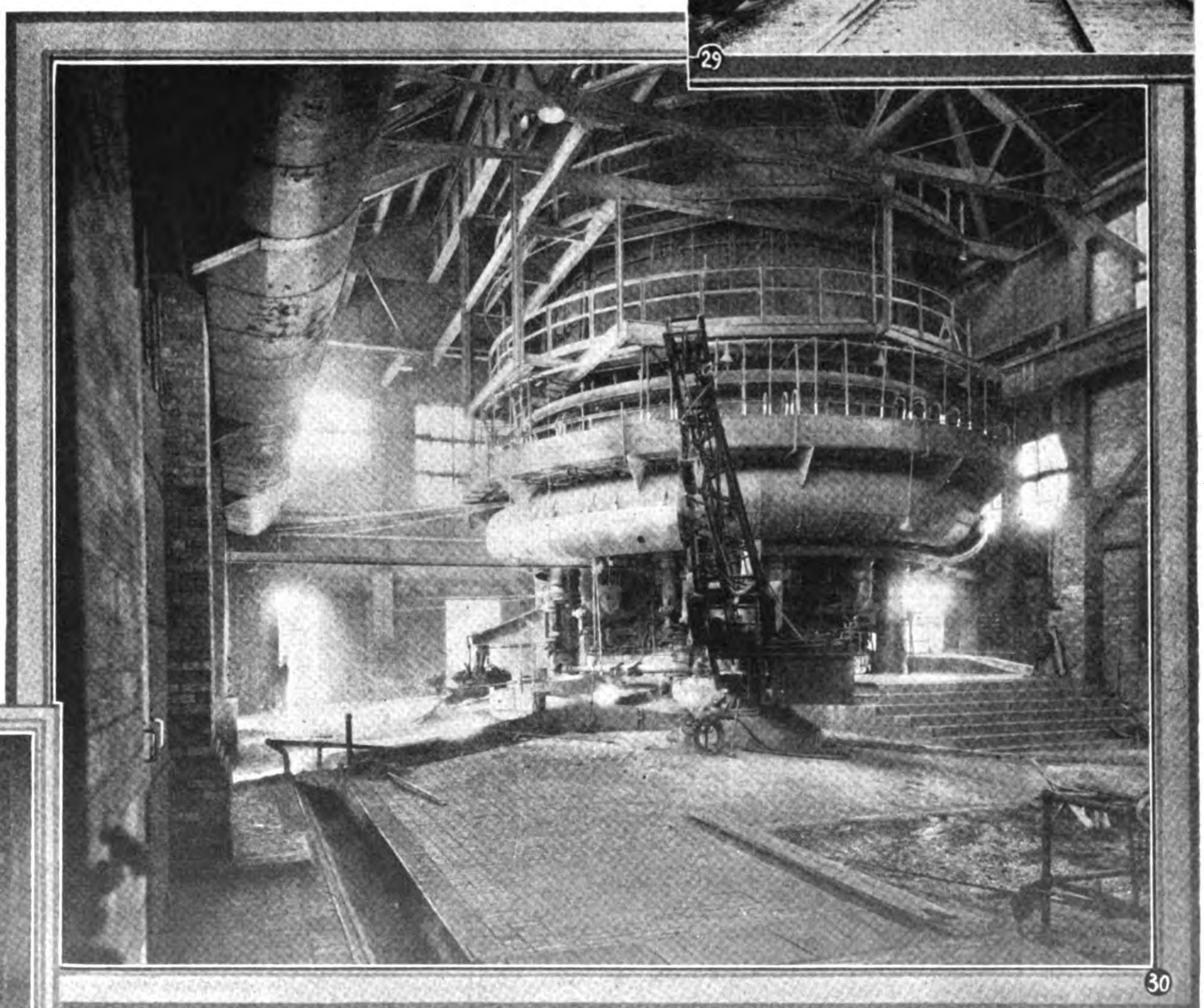


Fig. 30. The blast furnace is both a production and a handling mechanism for the reason that it reduces raw materials to a molten mass, which flows freely by gravity to the ladle cars which are located outside the building.

The World's Most Modern Iron Foundry

THE foundry at River Rouge is without a doubt the largest and most up-to-date in the world. Here 1,840 tons of molten iron are poured daily and it would be difficult to estimate how many tons of materials are handled in caring for the castings which are produced. When we consider the one item of molten iron poured and then realize the quantity of sand, cores, flasks and other materials and equipment which must be handled to produce this metal, and the castings which are the ultimate result, we can appreciate the tonnage which must necessarily be handled every 24 hours.

Activity here is beyond expression but all through the foundry, demonstration after demonstration of the principle of materials handling is presented, and one viewing this spectacle immediately realizes that this principle is the keynote and backbone of the entire Ford quantity production schedule.

A few of the many conveyors in this plant foundry are shown in Fig. 33 and a list showing some of the types of equipment employed can be obtained by referring to the fourfold panoramic view. This list is given more or less under headings as to the class of material and is not segregated into individual types.

In order to simplify the story of materials handling in this foundry for the reader, we have divided it into five parts, under the following

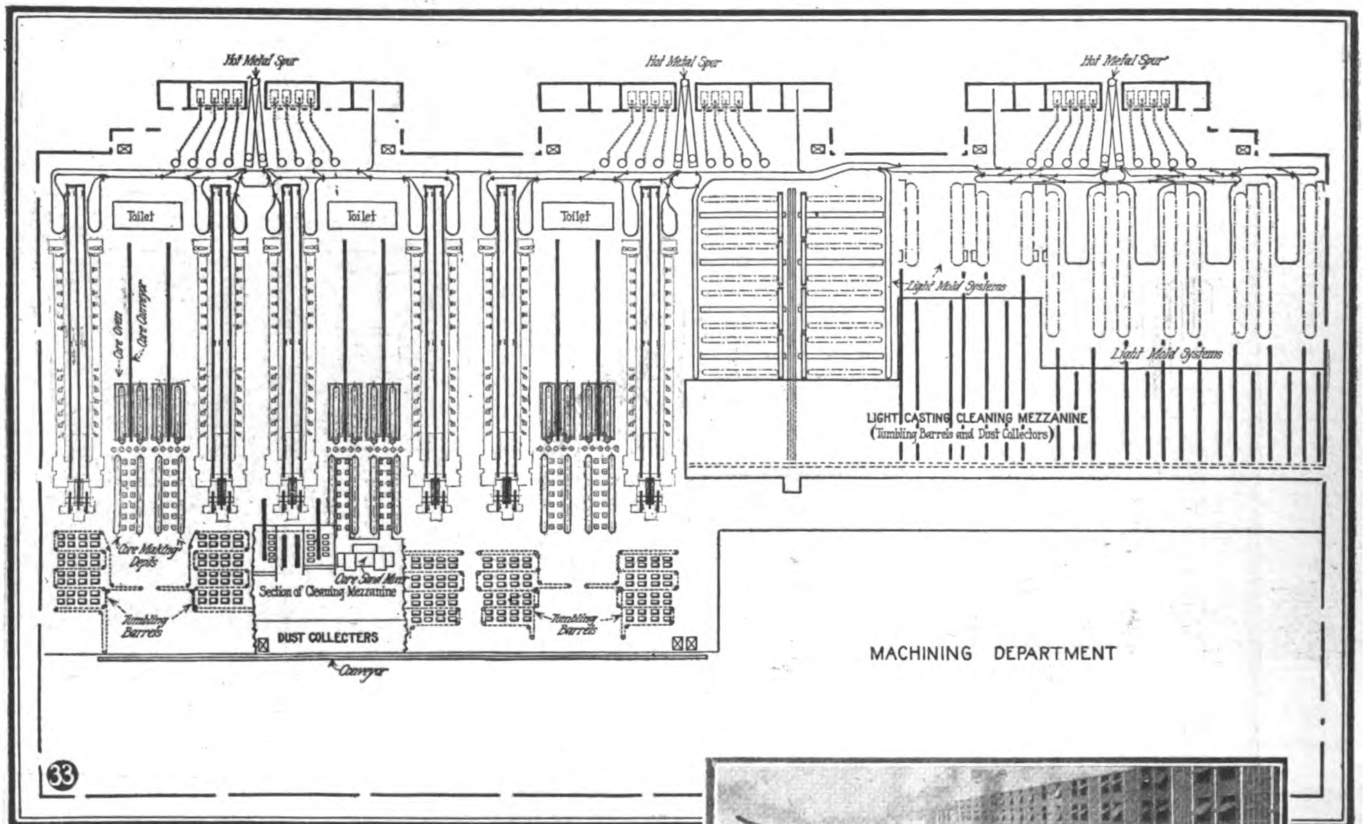


Fig. 33. This diagrammatic view shows only a portion of the various conveyors, monorail systems, and other materials handling devices in the world's most modern foundry.

Fig. 34. The cupola stock gallery is equipped with several traveling cranes which handle the raw materials from cars to charging floor with the assistance of electric magnets and grab buckets.

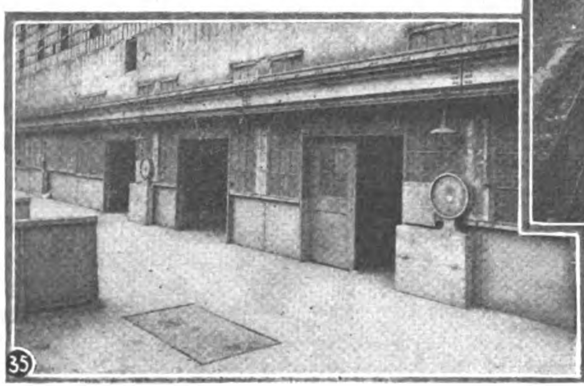


Fig. 35. The cupola charging floor contains many scales for the weighing of raw materials. Note the location of the scale platforms and the distance from the scale dials which are placed near the doorways.

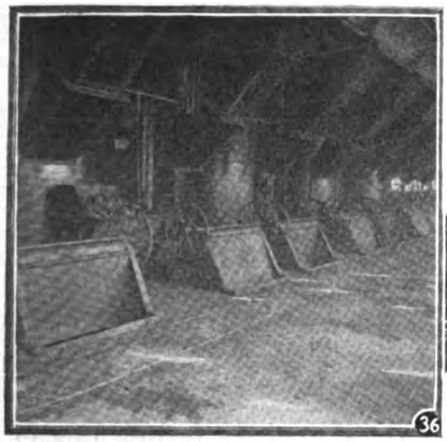


Fig. 36. Industrial railroad cars are used to transfer coke from storage hoppers to chutes which deliver to the cupola charging floor.

headings:

(1) Raw materials to hot metal in the cupola buildings.

(2) The handling of both new and reclaimed foundry sand.

(3) The handling of cores.

(4) The handling of large castings from pouring to tumbling barrels.

(5) The handling of small castings from pouring to tumbling barrels.

By referring to Fig. 33 in connection with all these subdivisions a complete and clear picture should be obtained.

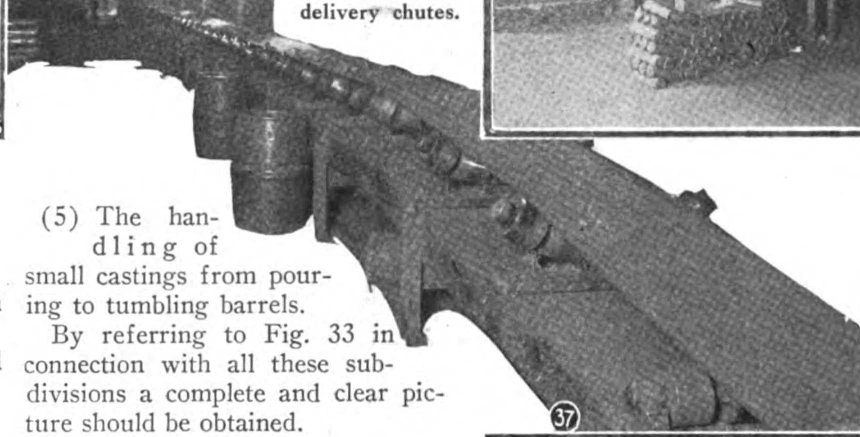


Fig. 37. Hot fins and risers removed from castings in the foundry are immediately transported by belt conveyors for re-charging in the cupola.

Fig. 38. A view of the cupola charging floor, showing cupola door and coke delivery chutes.

Raw Materials to Hot Metal in the Cupola Buildings.

The handling of materials in the cupola buildings is so well taken care of that in passing through one does not realize the quantity and tonnage being handled; and it is difficult, without considerable study, to comprehend the various directions from which materials are brought into the three buildings which house the thirty-two cupolas. On the outside of these buildings and running the full length, as shown in Fig. 34, is a raw material storage in which pig iron, scrap, limestone, etc., are stored in separate bins. Over these bins are four traveling bridge cranes equipped with full turntable boom

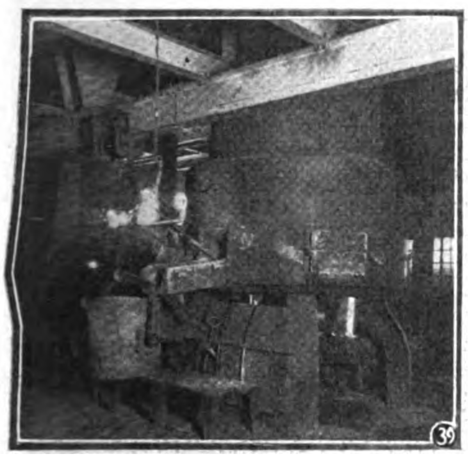


Fig. 39. Hot metal is drawn from the cupolas to ladles suspended from chain hoists fastened to I-beam monorail trolley.

Fig. 40. General view of one of the new perforated bucket elevators for the handling of granulated slag.

Fig. 41. Special gantry crane which pours hot metal from the ladle cars to smaller containers at the various hot metal spurs, shown in Fig. 33.

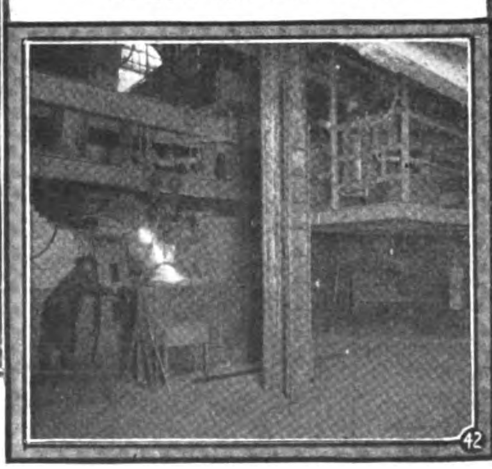


Fig. 42. One of the small containers on a hot metal spur, pouring molten metal into the cupola ladles. Note the operator's control cage in the upper right hand corner.

Fig. 43. A general view of the handling equipment for transporting new foundry sand from railroad cars to the various sand handling systems in the foundry.

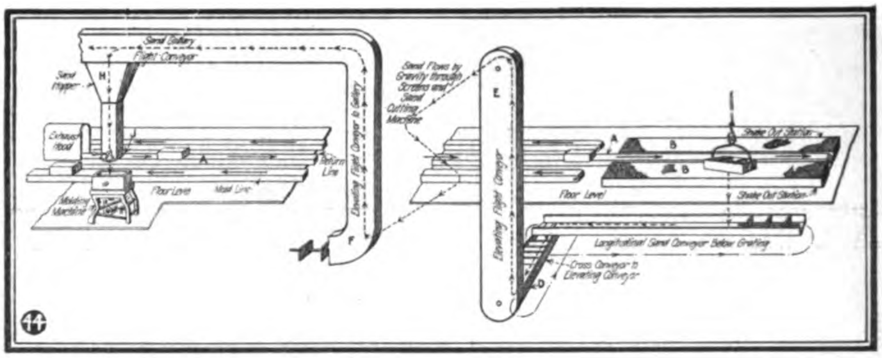


Fig. 44. Diagrammatic view of the sand handling system used in conjunction with the manufacture of large castings.

cranes, which are used for unloading materials from the railroad cars to the various bins. Scrap metal and pig iron are handled by using electric magnets in conjunction with these cranes, while the limestone is picked up with grab buckets.

The raw material storage is on the same level as the cupola charging floor and the various raw materials are placed in charging buggies and are weighed on the scales shown in Fig. 35 and are then transported in and dumped (Fig. 39) at the cupola charging doors.

Two floors above the charging floor is a belt conveyor which receives coke from conveyor ("L") as shown in Fig.

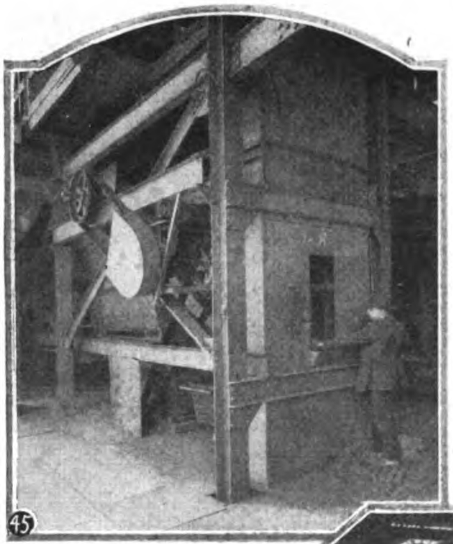


Fig. 45. Inspection door in the side of an elevator conveyor so that man can examine the condition of the sand being used.

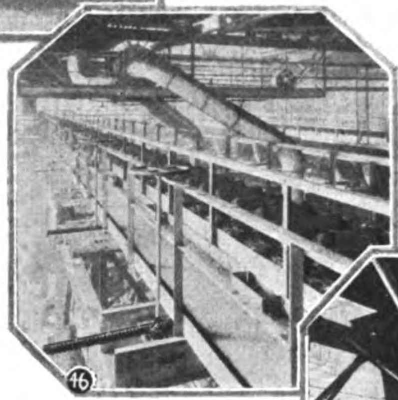


Fig. 46. General view in the sand gallery, showing type of elevator conveyor used for the raising and transporting of foundry sand.

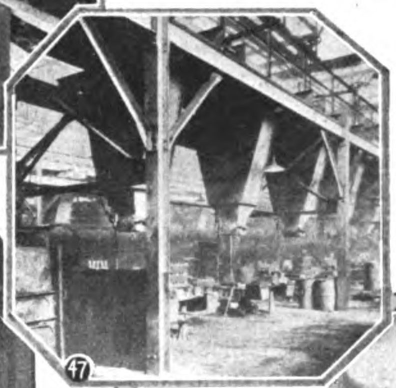


Fig. 47. View directly under the conveyor, shown in Fig. 46, illustrating the individual storage hoppers and their relation to the molding conveyor.

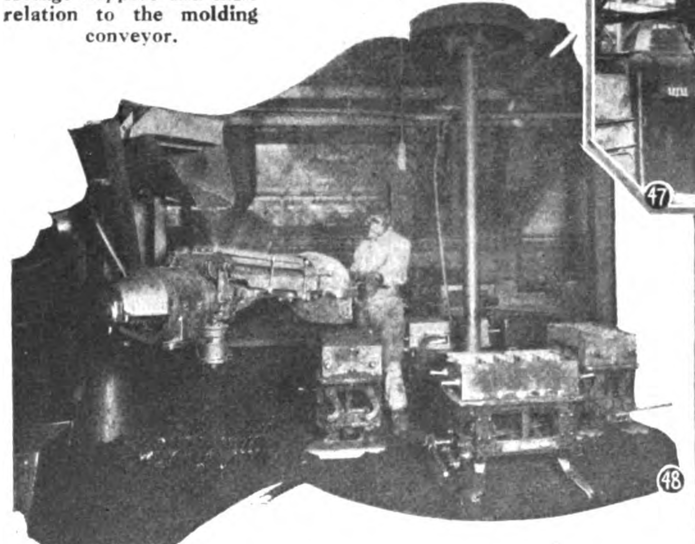


Fig. 48. A centralized sand handling unit where the flasks are filled mechanically while rotating on a turntable.

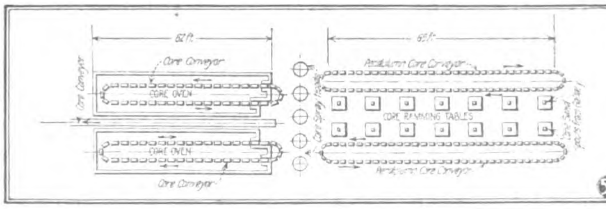


Fig. 50. Diagrammatic view of the core making department, showing relation of the pendulum core conveyor to the core oven and also the core conveyor, which carries finished cores to the molding line.

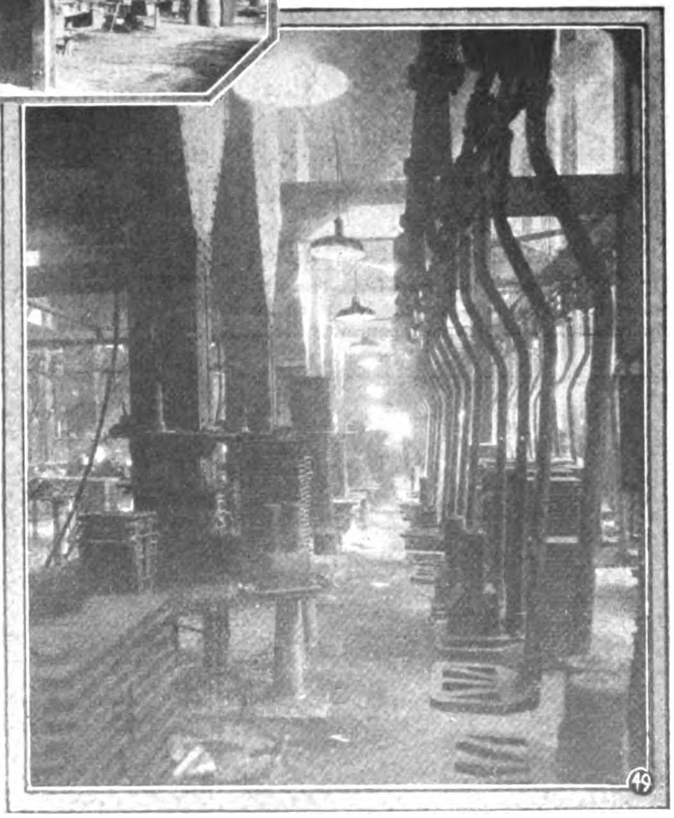


Fig. 49. General view in the core making department, showing sand storage bin, core ramming tables and pendulum core conveyor.

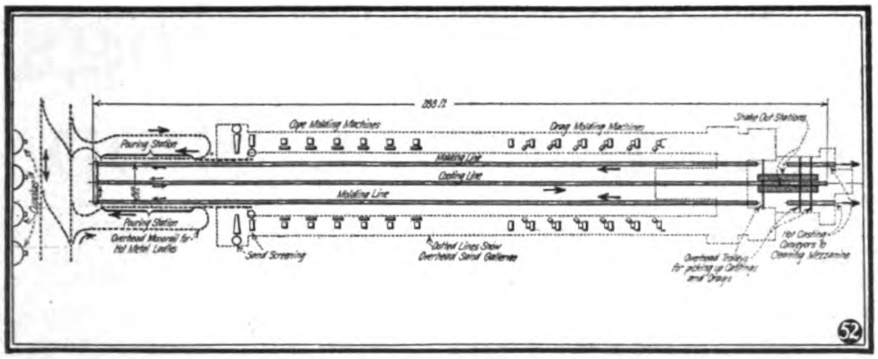


Fig. 52. Enlarged drawing, showing one of the six molding and casting conveyor units, which are an important part of the production equipment of this foundry.

12. This conveyor is equipped with a tripper which can be moved to any point desired for discharging the coke to the various bins. From these bins the coke is discharged through chutes and gates to industrial cars, as shown in Fig. 36, and these cars are located on a floor below. With this industrial car equipment it is possible to draw coke from any one of the storage bins and discharge it to individual chutes as shown in Fig. 38 to the cupola charging floor.

On the same floor with the industrial railway is an overlapping pan conveyor which is used for transporting back scrap from the foundry and from the machine shop to the cupola building. In addition, the belt conveyor, shown in Fig.

(*Continued on page* 156)

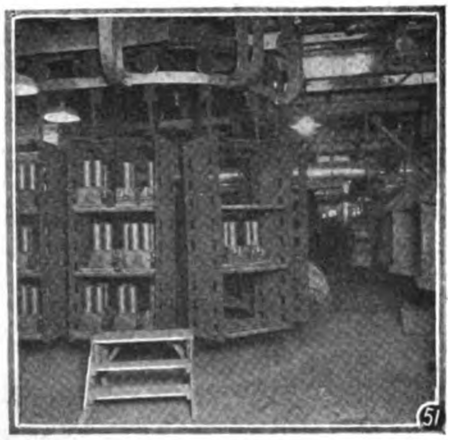


Fig. 51. View showing the loading and unloading point of the core oven conveyor. The spray hoods are visible to the right.

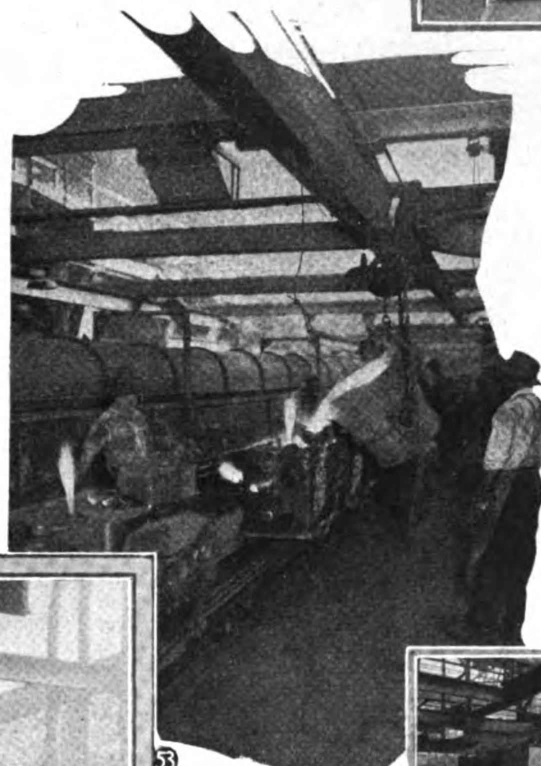


Fig. 53. Hot metal is transported from the cupola to the pouring station by means of I-beam monorail trolleys and is poured direct to flasks at the end of the molding line conveyor; thus production takes place on materials handling equipment.

Fig. 54. Hot residue metal is immediately poured into pigs which are cast on a moving conveyor.

Fig. 55. View of the shake-out station shown to the right of Fig. 52. Note the rope hoist which is fastened to the overhead trolleys for transferring castings to the hot casting conveyors.

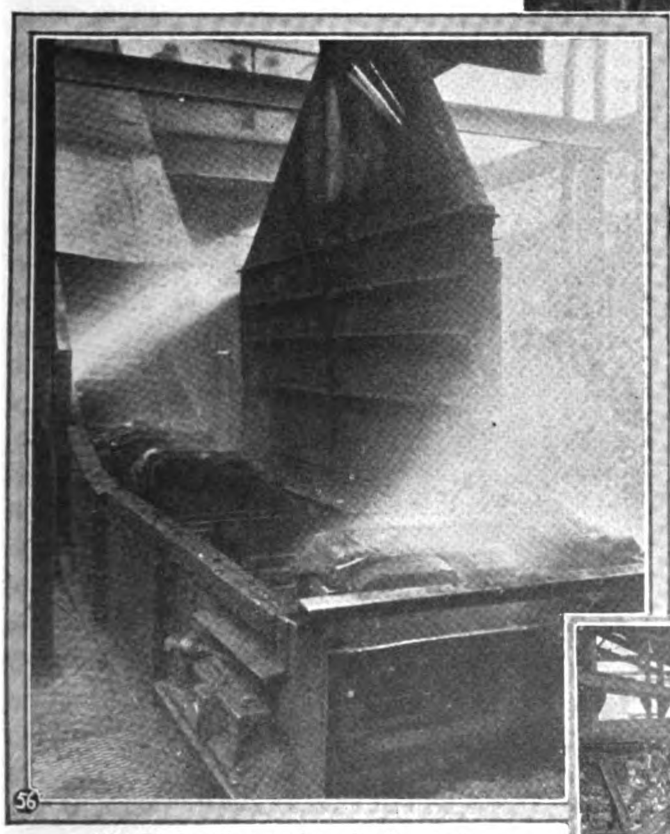


Fig. 56. Loading station of a hot casting conveyor which elevates the hot castings to the mezzanine or cooling floor.

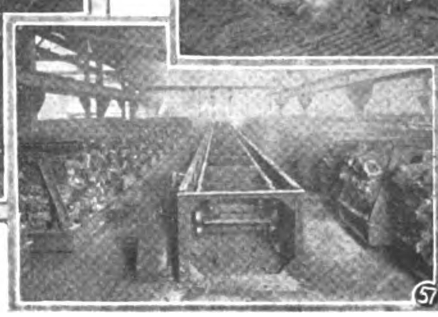


Fig. 57. View of the hot casting conveyor showing the horizontal run on the mezzanine floor and racks of castings placed on each side for cooling.

Handling Large Castings Through the Machine Shop

IN the machining and finishing of castings every move from machine to machine and even into and out of the machine is performed mechanically. We have previously described the special platform conveyors (Fig. 60) that bring the semi-cleaned castings from the mezzanine floor to the tumbling barrel floor. In Fig. 63 we present a picture of the same conveyor on the horizontal and show how chain hoists, suspended from I-Beam trolleys, are employed for lifting the castings from the conveyor and depositing them in the tumbling barrel. Fig. 64 shows how this same conveyor runs between the batteries of tumbling barrels and also illustrates one of the right-angle turns, previously described. This conveyor not only feeds semi-cleaned castings to the tumbling barrels, but is also used to carry the cleaned castings from the tumbling barrels to the machine shop. Upon arrival at the machine shop proper, the castings are transferred to a wood platform conveyor upon which several operations are performed and this conveyor is also used as the first inspection table. At various intervals along the run of this conveyor the castings are transferred to runs of gravity conveyor. It will be noted that this is the first point so far where gravity conveyors are employed, but from now on they will be mentioned frequently for in the machine shop it might be said that miles of gravity conveyors are installed. Fig. 70 shows the method of supporting gravity conveyors from the floor and illustrates how Fordson cylinder blocks are handled with this type of equipment.

Ford motor blocks are also handled on gravity conveyors at various stages during finishing and, at the same time, both Fordson and Ford castings are handled on different types of special platform conveyors. These special platform con-

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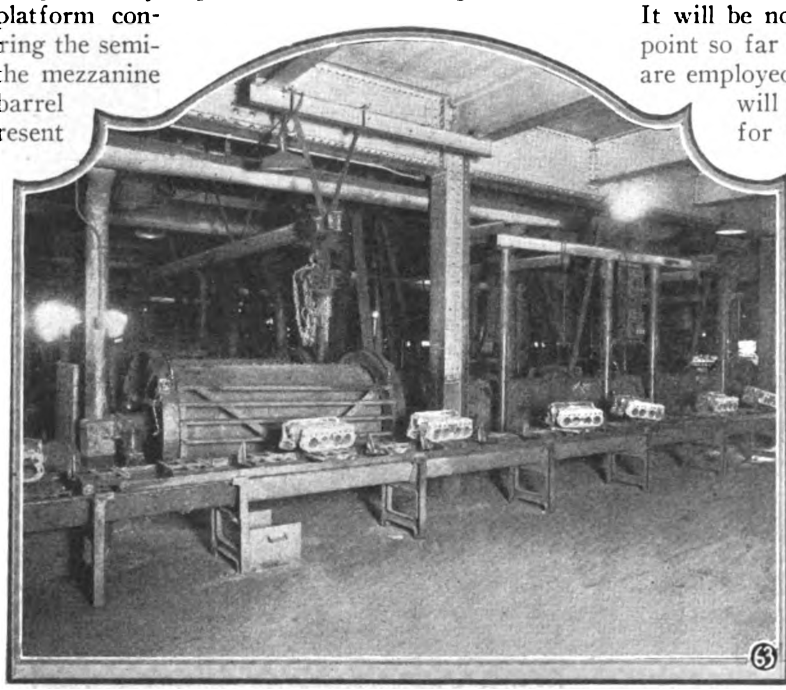

Fig. 63. Chain hoists suspended from I-beam trolleys are used to transfer these castings from conveyors to tumbling barrels.

Fig. 64. One of the right-angle turns in the special platform conveyor, which handles castings to and from the tumbling barrels.

Fig. 65. Another type of platform conveyor transporting castings to several operations in the machine shop.

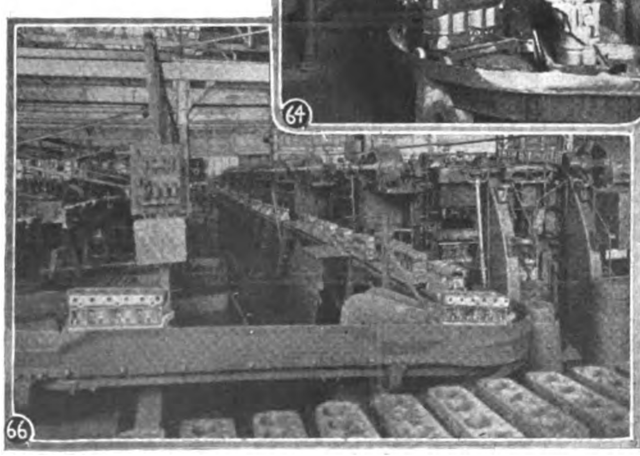

Fig. 66. Conveyors are considered as important in the machine shop as any piece of production equipment. They will be found running between each row of machines.

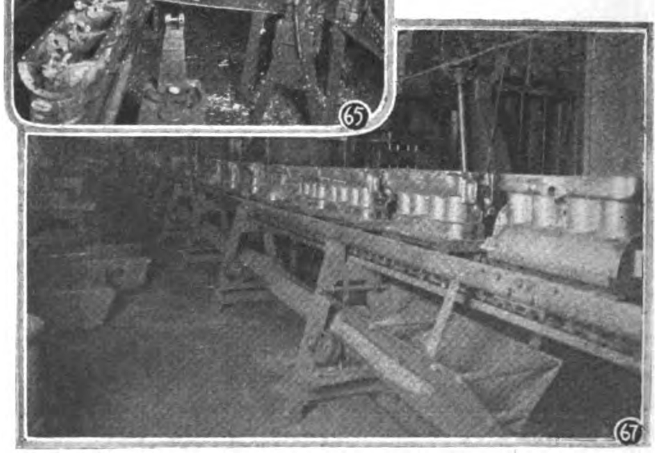

Fig. 67. Frequently the supports that carry one conveyor are also utilized to carry a second conveyor. Note the belt conveyor, underneath, which handles borings.

Power House Fuel Handling and the Electric Furnace Building

IN preparing coal as fuel to operate the boilers in Power House No. 1 at the Ford Motor Company's River Rouge Plant, conditions are somewhat different to that in most industrial plants. In the first place, aside from blast furnace gas, only pulverized fuel is used and thus the coal is handled through two distinct operations, pulverizing and burning.

The pulverizer building is separate and apart from the power house and coal is brought to this building over belt conveyor "J," as shown in Fig. 12, it having been prepared at the coal breaker house and reduced to nut and slack sizes. This material is carried at the rate of 250 tons per hour, and upon reaching the building it is discharged through a chute into the enclosed pivot bucket conveyor which distributes it according to its moisture content to the proper storage bunker.

After being held in storage, which after all is only for a matter of a few hours, the coal is fed

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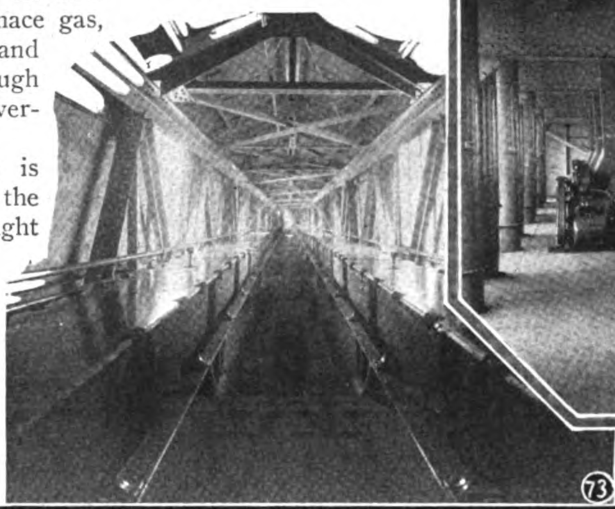


Fig. 73. These two sixteen inch screw conveyors handle pulverized coal from pulverizer building to Power House No. 1 at the rate of 65 tons per hour.

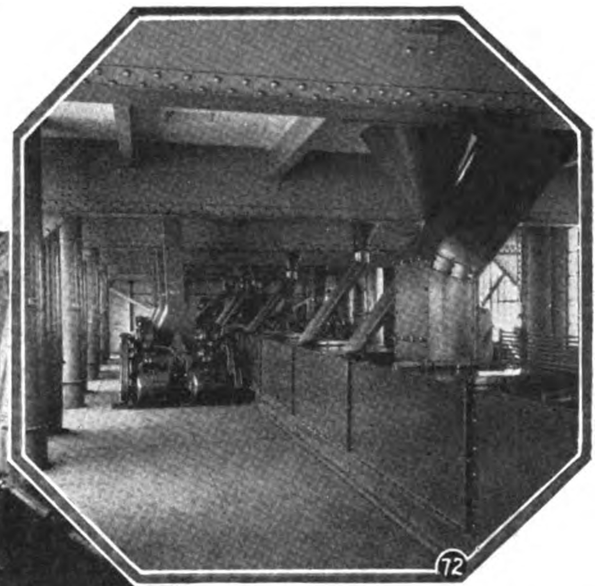


Fig. 72. A view in the pulverizer building where coal is prepared prior to being conveyed to Power House No. 1.

Fig. 74. Sixteen inch screw conveyors are used for distributing the coal to the bunkers over the boilers in Power House No. 1. One line of these conveyors is plainly visible.

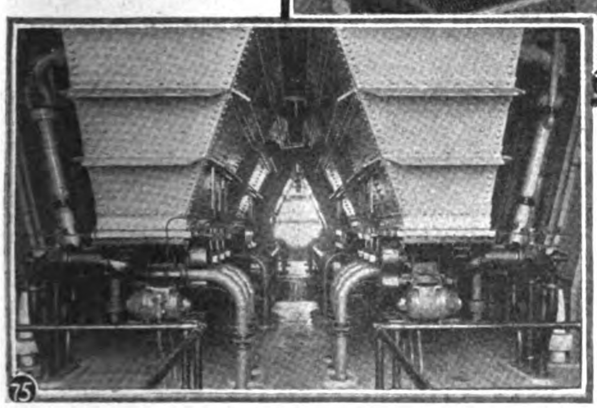


Fig. 75. Small screw conveyors and currents of air feed the pulverized coal from the bunkers to the fire box. Some of the feeding mechanism is visible in this illustration

Fig. 76. The efficiency of this boiler house and power plant is such that very little ash or cinder needs to be drawn off from the boilers. For this reason no conveyor system is installed.

The Saw Mill and

Fig. 80. General view of the saw mill, showing method of unloading logs and the conveyor elevating them to the gang saw.

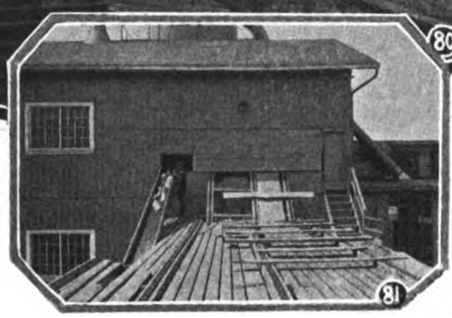


Fig. 81. Chain conveyors transferring wood slabs from saw mill to storage pile.

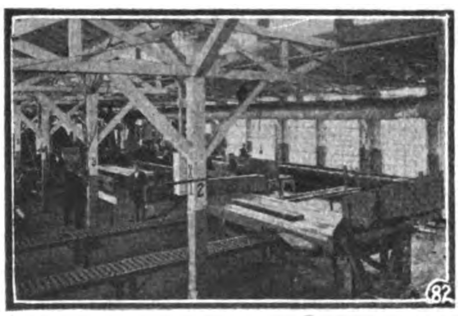


Fig. 82. In the saw mill proper, gravity conveyors are used in the handling of wood slabs between various operations.

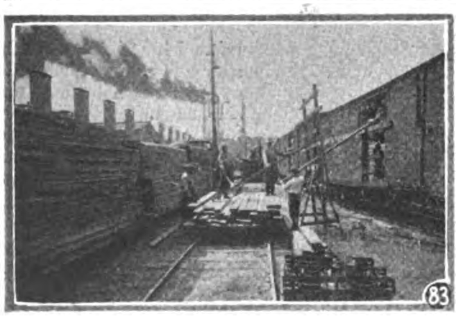


Fig. 83. Unloading cars of lumber, grading same and loading it direct on kiln cars, reduces handling costs.

THE camera did not have range enough when taking the panoramic picture as shown in the insert to include the saw mill (Fig. 80). This saw mill is located about a half a mile from Power House No. 3 and across the River Rouge to the left. It is an interesting building, to start with, because it transforms one immediately into a new spirit of industry. The buildings are built of wood while the other newer buildings of the plant are built of brick and steel. The efficiency of the handling methods in this saw mill, however, is decidedly modern and every bit of space, as well as material produced in this building, is utilized. Again, as described in the other buildings, "man-handling" is reduced to a minimum and mechanical handling, using various types of conveyors, is utilized on every operation. To start with, the logs are unloaded from the railroad cars by means of a boom derrick and hoisting engine and occasionally a locomotive crane is used for the same purpose. These logs can be held in yard storage or immediately rolled into the water trough, from which they are fed to the mill by a chain drag conveyor or log haul. This activity is shown in Fig. 80, and it will be noted there are only two men in the picture. The third man, or operator, is running the hoist. These men never lift the logs by hand and in addition to handling the logs they check the amount received.

When the logs reach the end of the haul they are again deposited to a small storage space from which they are fed mechanically to the band saw. As the slabs are cut from the log, they are deposited on gravity conveyors and sorted to different smaller saws for cutting and distrib-

Fig. 84. Gasoline tractors are used for hauling loads of lumber in and about the kiln buildings.

Fig. 85. Short lengths of gravity conveyors materially assist in handling large pieces of lumber during sawing operations.

Fig. 86. Battery of cyclone collectors, which are part of the pneumatic conveying system.

the Tractor Assembly

uted to outside storage and to the main mill floor. Some of the pieces which are cut from the smaller slabs are fed down steel-lined chutes and are loaded to trailers for transfer to the kiln building. Slabs for outside storage are deposited on chain conveyors which transfer the lumber over the roadway to a long chain conveyor equipped with wooden flights; which in turn carries the same parts to the outside storage pile. The chute and conveyor mentioned above are shown in Fig. 81. The lumber which is to be immediately cut into shape is transferred by chute to the main mill floor, which is on ground level. Here it is carried by gravity roller conveyors through various operations, and as the parts are cut, they are deposited on a belt conveyor which is visible along the outside wall of the building. From this conveyor they are sorted and loaded to different trailers.

These trailers are large four-wheel trailers equipped with springs and rubber tires, and when fully loaded are hauled by gasoline tractors to another building, near the lumber kilns, where kiln cars are loaded.

As the requirements of the River Rouge plant call for a million board feet of lumber per day, it is necessary to receive some by freight cars. The method of unloading these freight cars, grading the lumber and storing it direct on kiln cars is shown in Fig. 83. The lumber thus handled is easily transferred to the kilns for drying. After being dried, it is again removed, without re-handling and hauled over a system of tracks and transfer cars by means of gasoline tractors, as shown in Fig. 84. It will be noted that in both of the previous illustrations long boards are be-

Fig. 87. Close-up view, showing connection between cyclone collectors and cable flight conveyor which transports the refuse away.

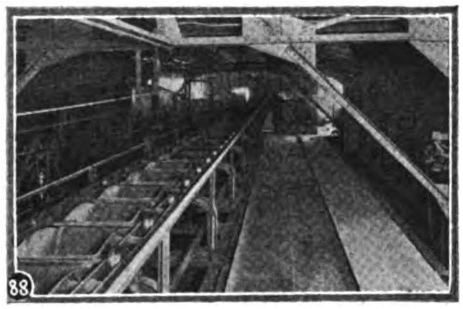


Fig. 88. Pivoted bucket conveyor and drag flight conveyors over the bunkers in Power House No. 3.

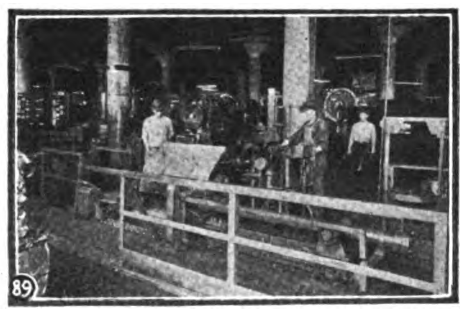


Fig. 89. Baling scrap metal in the body stamping department. This is all done mechanically.

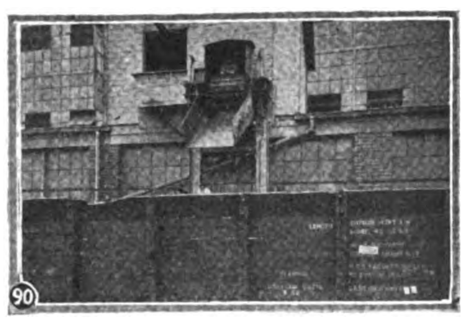


Fig. 90. Bales of scrap metal are discharged from a baling machine to a beaded flight conveyor which elevates same, finally discharging the bales to cars outside the building.

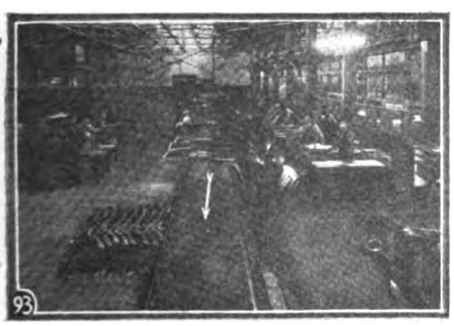


Fig. 93. Note that at this point the space between the chains is covered with sheet metal.

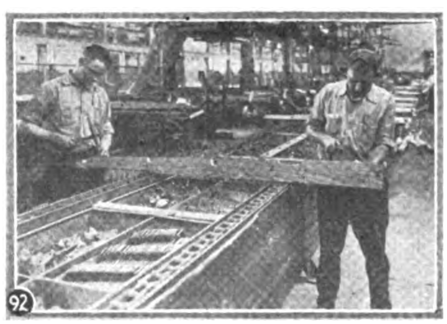


Fig. 92. Chain conveyor upon which body sides are assembled. Note the parts in bins between the chains.

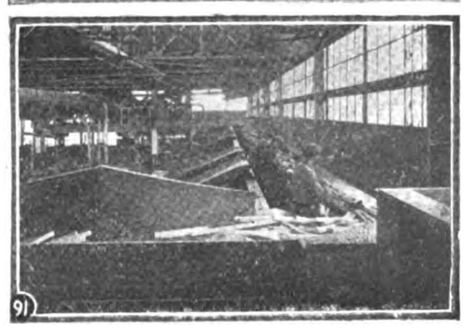


Fig. 91. General view of rough stock conveyor C, showing men sorting lumber.

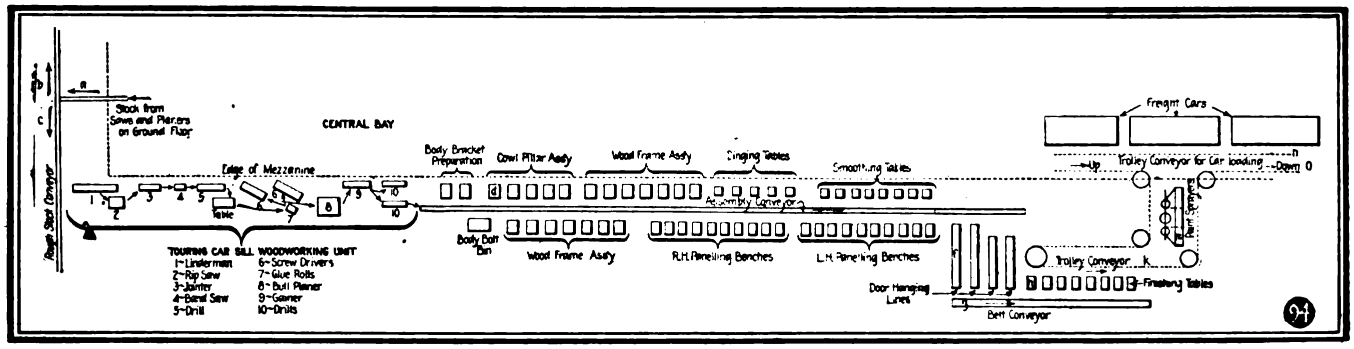


Fig. 94. Diagrammatic plan view, showing location of conveyors and various operations in the body assembly department.

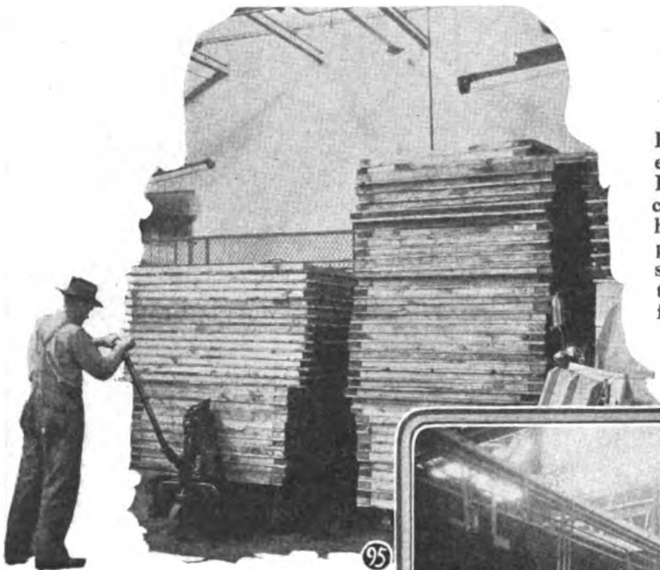


Fig. 95. Hand lift trucks materially reduce the handling costs in the export packing department.

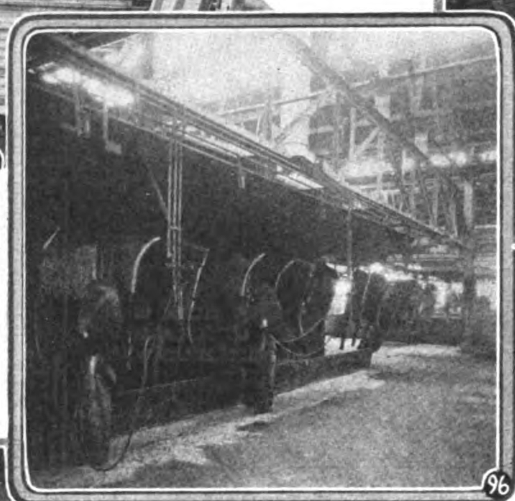


Fig. 96. The painting of the interior woodwork of body sides is done while the parts are being conveyed to the cars for shipment.

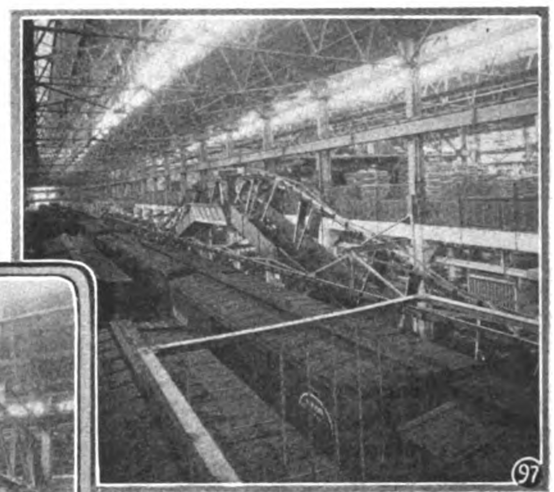


Fig. 97. General view of I-beam trolley chain conveyor handling body parts from the second floor to the first floor for car loading.

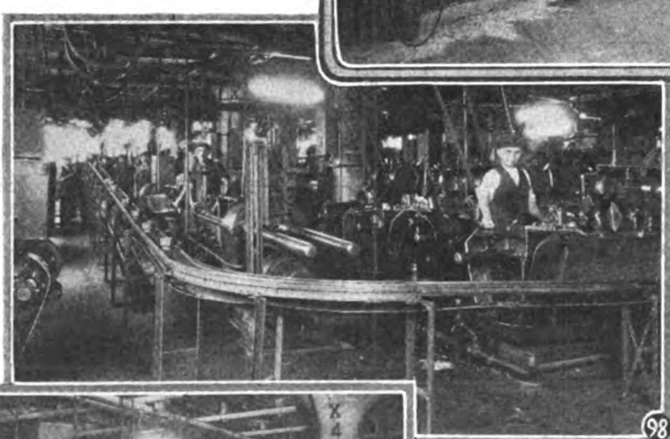


Fig. 98. Closely spaced small roller gravity conveyors are used for handling many semi-finished, and finished, machine parts.

Fig. 99. Providing guides in which parts can roll is one form of gravity conveyor which is easily constructed.

ing handled, but at the present time the Ford Motor Company is cutting green lumber into body shapes. These shapes are being kiln dried and then handled by the same method as the long boards are being handled. In the near future an article on wood conservation, showing the method of cutting the lumber, will be published in these pages, so we will not touch upon this phase at the present time.

After the lumber is taken from the kilns it is immediately transferred to the tractor assembly building in which the body parts are cut, shaped and finished on the first and second floor and finally assembled into body sides and floors on the second floor. We find in the wood cutting and shaping departments the same use of gravity conveyors, belt conveyors and, in addition, wood platform conveyors as we found in the main saw mill. Every handling of the lumber is done with a minimum movement and all transportation is carried on by means of continuous conveyor, either of the chain, belt, or wood platform type; and by the same type of conveyors, the lumber is elevated to the assembly or second floor.

When a million board feet of lumber is used per day, it is natural that there would be a considerable amount of chips, shavings, sawdust and other small wood parts and to handle this material by buggies or small carts would be difficult. In order to keep the wood shop clean at all times, an efficient refuse collecting system is installed. This system is pneumatically operated by means of suction fans; and pipes are spaced at intervals so that the sweepers or cleaners only need to brush or sweep the refuse to one of these pipes and it is immediately sucked up into one of the cyclones shown in Fig. 86. Here the surplus air is taken out through a top vent, and the refuse material which has been separated by centrifugal action is deposited in the cone shaped hopper, from where it can be carried away under two different systems; one system being to discharge through a chute into trucks standing on the roadway outside the building, the other method being to discharge into a cable flight conveyor directly under each cyclone. The battery of cyclone collectors and their two methods of discharge are clearly shown in Figs. 86 and 87. The carrying run and the return run of the cable flight conveyor is shown in Fig. 97. The distance from center of drive to sheave to tail sheave is approximately 700 feet and at all times this conveyor is filled with material. This conveyor transports the wood refuse to two different chain flight

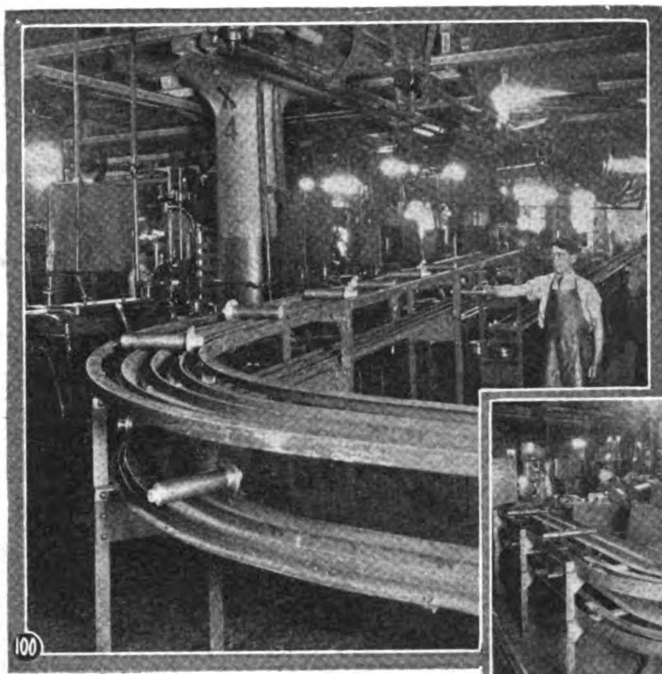


Fig. 100. This special gravity conveyor is provided with guides and also narrow services upon which the parts roll.

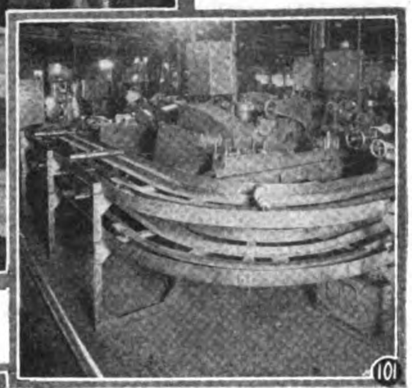


Fig. 101. Handling a highly finished worm drive shaft is accomplished without damage by means of the gravity conveyor shown.

Fig. 102. A very unwieldy, highly finished part is also being handled on the close spaced gravity conveyors, as shown.

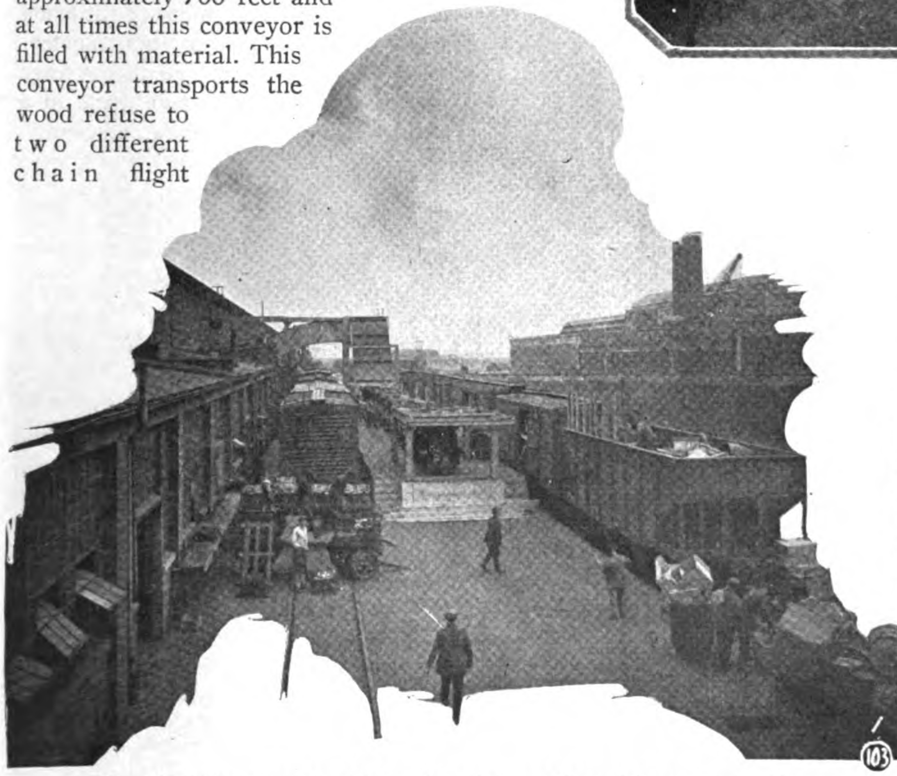


Fig. 103. This scene of activity shows how trailers, bringing materials from the main machine shop, are unloaded at the tractor assembly building. In the center of the picture is visible the conveyor which handles the tractor wheels from cars to assembly lines.

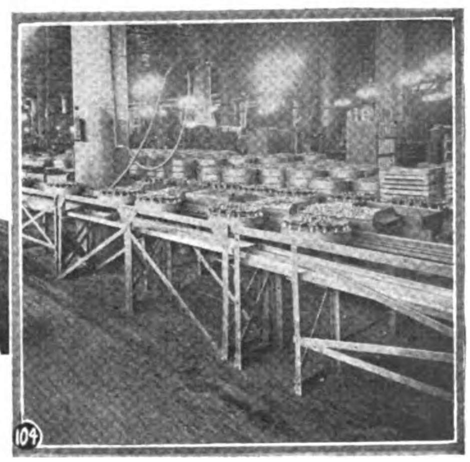
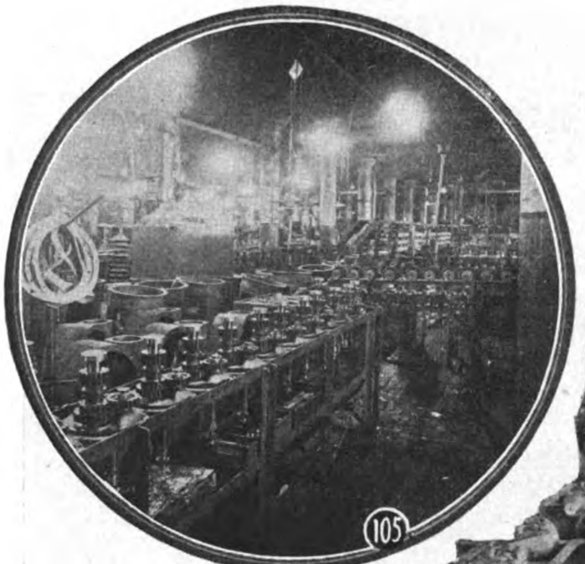


Fig. 104. Work benches in the form of angle drives permit the parts to be slid from one workman to another, as the assembly progresses.



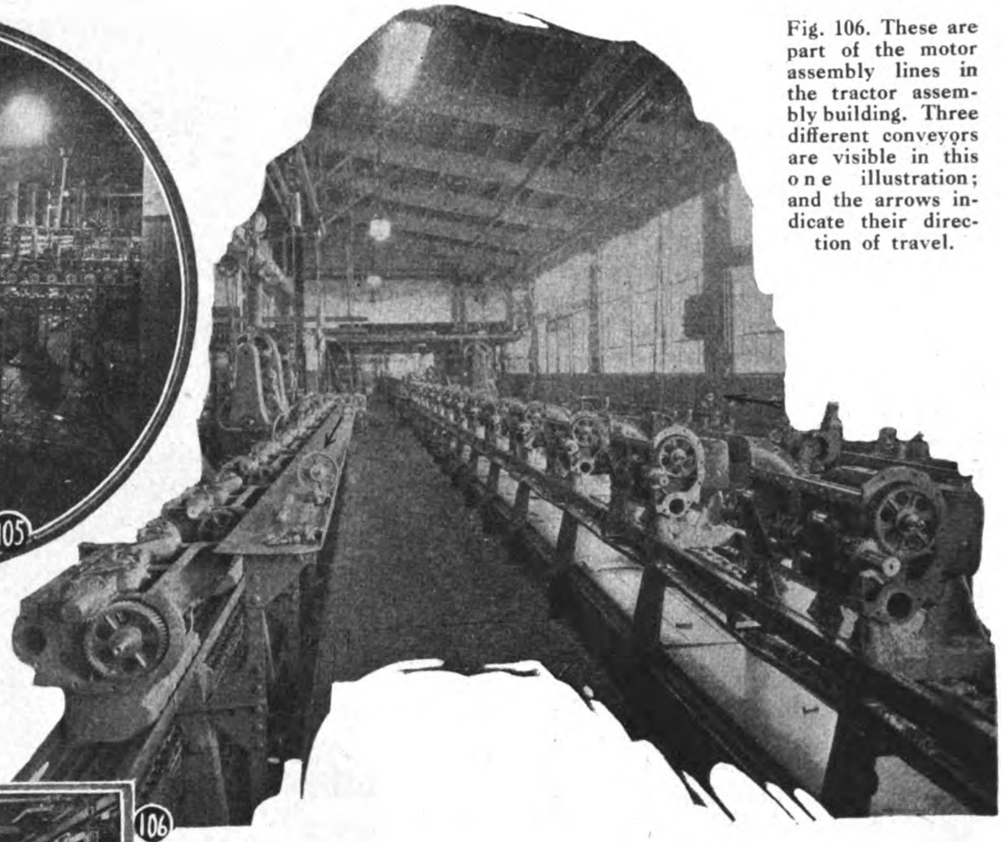


Fig. 106. These are part of the motor assembly lines in the tractor assembly building. Three different conveyors are visible in this one illustration; and the arrows indicate their direction of travel.

Fig. 105. This shows another assembly table, handling a different part than that illustrated in Fig. 104.

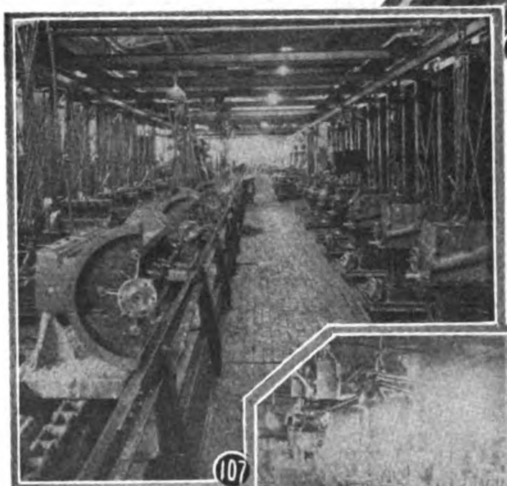


Fig. 107. I-beam trolleys, equipped with pressed steel rope hoists, are used to transfer the assembled motors to and from the conveyor line on the burning-in process.

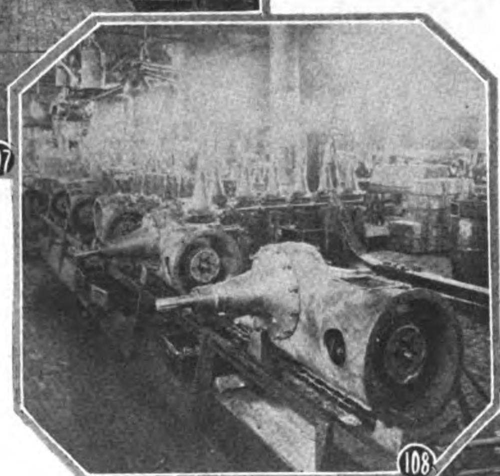


Fig. 108. This is the start of the assembly conveyor where the tractor rear ends are built into one unit.

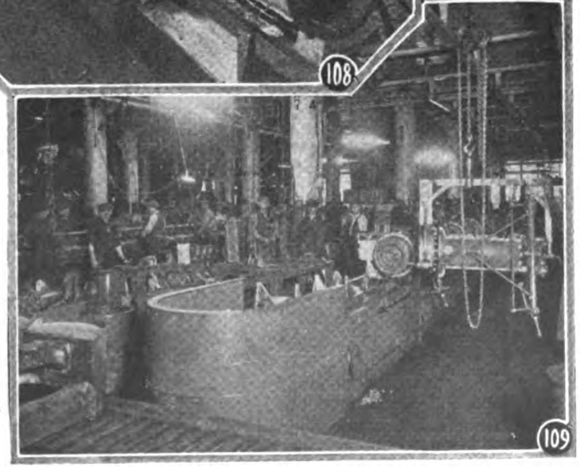


Fig. 109. At this point radiators are tested, and the conveyor in the foreground is carrying the motor unit. One unit in a special sling is being transferred to the main tractor assembly conveyor by means of an I-beam trolley.

conveyors which elevate the material on the incline and they carry it on the horizontal, finally depositing it in a bunker over the boiler house in Power House No. 3, as shown in Fig. 88. Here it is mixed with air and burned. The idea of utilizing wood waste as power fuel, incidentally, would not occur to the average executive as being worth while in a plant which utilizes coal so efficiently.

The Assembly and Shipping of Body Parts.

In making the complete body parts, such as sides, doors, floors, etc., it is necessary to use a large quantity of sheet metal, and about one quarter of the tractor assembly ground floor is turned over to the storage and stamping of such parts. At the present time the sheet metal is unloaded from the box cars and placed direct on platform hand trucks and transported adjacent to the machines where it will be worked. It is then transferred from the hand truck to the floor, where it remains until used. This system of handling is not considered entirely satisfactory and a number of improvements are now under consideration. After the parts have been formed they are handed in a continuous line from one machine to another and finally transported up-stairs to the body assembly floor by freight elevators.

All scrap metal is collected in buggy trucks and brought to baling machines located at different points in the department. Here the scrap is baled mechanically as shown in Fig. 89, and the finished bale drops onto a beaded flight conveyor which runs on the horizontal, and then on an incline to the outer wall of the building, where the bales are deposited in freight cars. These freight cars are later transferred by means of yard locomotives to the electric furnace building or to the cupola buildings.

In making the assembly of each body unit the same method of continuous straight line travel is maintained, and Fig. 94 is diagrammatic of the routes and operations performed while the materials are traveling on conveyors. It will be noted at the left-hand side that wood stock from saws and planers on the ground floor is elevated to the second floor by means of a belt conveyor—"A," and the material from this conveyor is deposited on belt conveyor—"BC." A general view of the discharge point, from conveyor "A" to conveyor "BC" is shown in Fig. 91. This conveyor is used as a sorting table and the men, as they select the lumber, throw it into the steel chutes behind them and it is then put in bundles and transported to the assembly conveyors, or taken through the various operations shown in the touring car sill working unit (Fig. 94). The conveyor "BC" is one continuous belt, and the feed point from conveyor "A" to this conveyor, shown in Fig. 91, is practically in the center of the run. If the men shown working on "C" belt pick up a piece which should go to the other side of the building, they drop it on the return run of the belt, which is really "B" belt, and men working under the

(*Continued on page* 170)

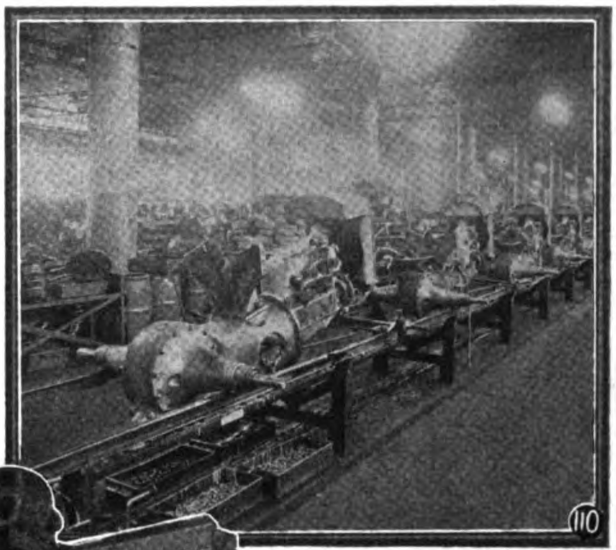


Fig. 110. This shows the start of the tractor assembly conveyor.

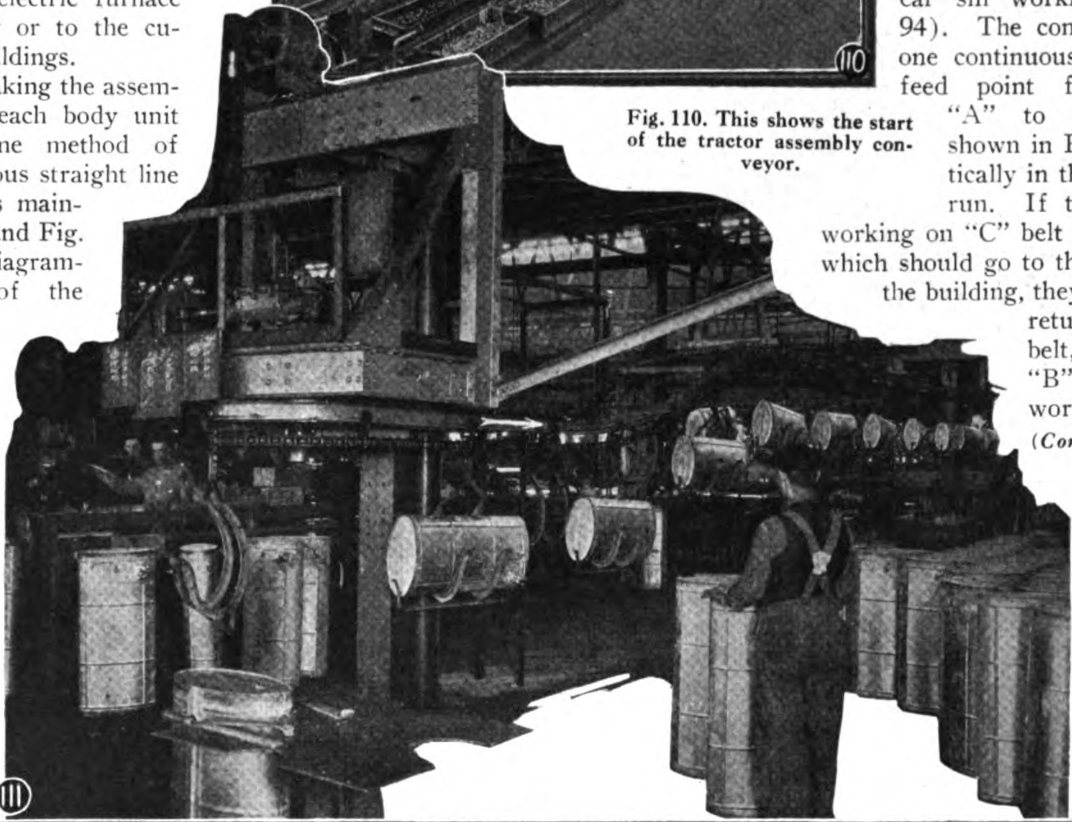


Fig. 111. This is a close-up view showing one of the many I-beam trolley chain conveyors, carrying gasoline tanks from second floor to the tractor assembly lines on first floor.

Fig. 112. Discharge end of the tractor assembly conveyor showing Fordson tractors completely assembled.

Fig. 113. Fordson tractors being packed for export and loaded direct to flat cars. Note the gravity conveyors in the floor that assist in moving the heavy cases.

Fig. 114. Electric monorail hoists reduce the handling costs of lift ingthe tractors after the wheels have been removed for packing in export cases.

Successful Innovations in Plate Glass Manufacture

THE River Rouge Plant of the Ford Motor Company is of more than passing interest for the reason that while this plant is known as a great automobile and tractor producing unit, there are also several individual industries which go to comprise the complete whole, and at the present time other industries are being added. Thus we find, under one management and organization, an independent industrial enterprise that not only makes the product which it eventually sells, but also produces a number of the parts and a large portion of the accessory material which ordinarily is purchased from others. It has been shown in previous articles that the castings are produced from raw materials which this company has handled from their natural sources. Wood parts have been treated in the same manner, having been received at this plant in the forms of logs or boards. It is therefore not to be wondered at that in this plan of independent industrial activity we find a plate glass plant which produces all the windshield glass, sedan and coupé glass and other glass parts used in the final production of Ford cars and, again, this is not only a finishing unit but is a manufacturing unit which produces the plate glass from raw material received in bulk.

The plate glass plant building is not shown in the panoramic view for the reason that it is located to the left of Power House No. 3, on the west side of the River Rouge. The accompanying illustrations, especially Figs. 127 and 128, will give the reader some idea of the length and breadth of the structure, and, at the same time, these illustrations will show some of the manufacturing equipment. This plant is not only equipped with the most modern materials handling methods but is also equipped with the latest developments of plate glass manufacturing equipment, all of which would make

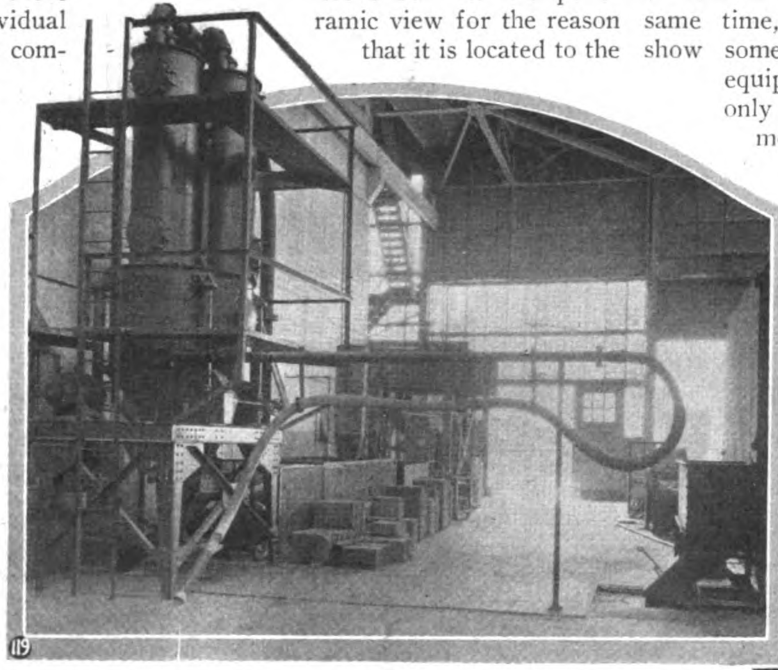


Fig. 119. High vacuum pneumatic conveying system and belt conveyors feeding to a bucket elevator are the methods employed for handling raw materials from cars.

Fig. 120. Cullet produced from scraps and defective production is transported to the storage bin by means of a belt conveyor.

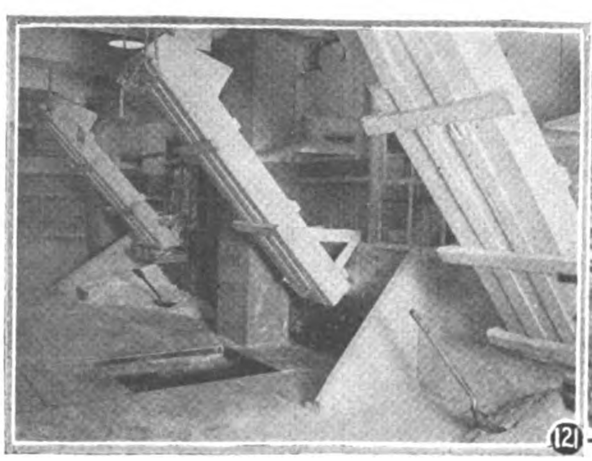


Fig. 121. Screw conveyors draw off the materials from storage bins and deposit same through chutes to the floor, where it is mixed in the proper proportion for batch loading.

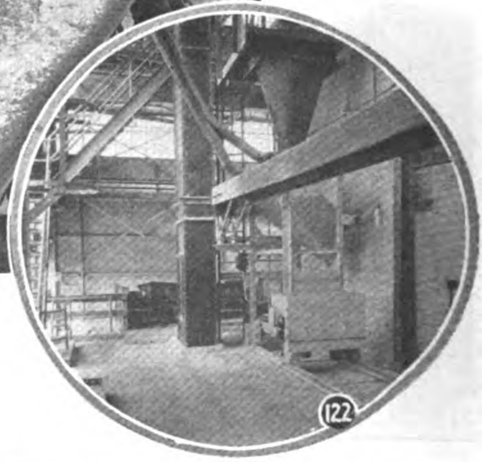


Fig. 122. Batch material is raised by a bucket elevator and deposited in a small hopper, from which it is fed to the electrically propelled weigh larry car.

an interesting article but which will not be described here for the reason that we are dealing with handling operations only.

Considerable thought was given to the handling of various productions in this plant at the time the building was designed, and so we find one bay, the full length of the building, devoted to a railroad siding, unloading apparatus, storage bins and loading equipment. In this bay all materials are received and shipped and in this one bay, we find operating such equipment as pneumatic conveyors, belt conveyors, continuous pan conveyors, overhead traveling cranes equipped with grab buckets and special slings.

The greater portion of raw materials, such as silica sand, salt cake, soda ash, pulverized limestone and cullet, are unloaded direct from the cars by various methods, as shown in Fig. 119, and are immediately elevated and conveyed to storage bins adjacent to the unloading equipment. A portion of the equipment is visible in the illustration, but elevators, etc., are located between the bins and are therefore behind the wall. The method of oper-

(*Continued on page* 178)

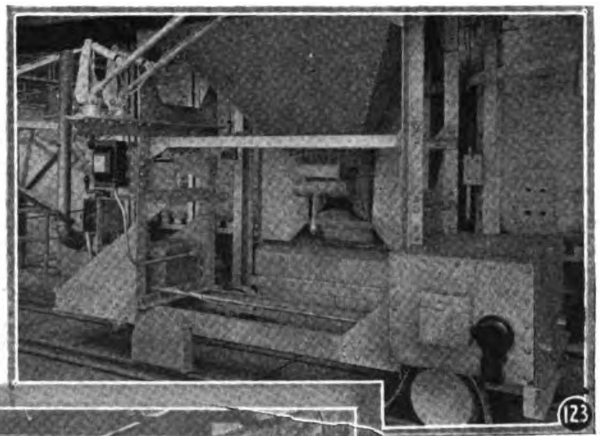


Fig. 123. Feeding batch materials direct to the charging opening of the glass furnace.

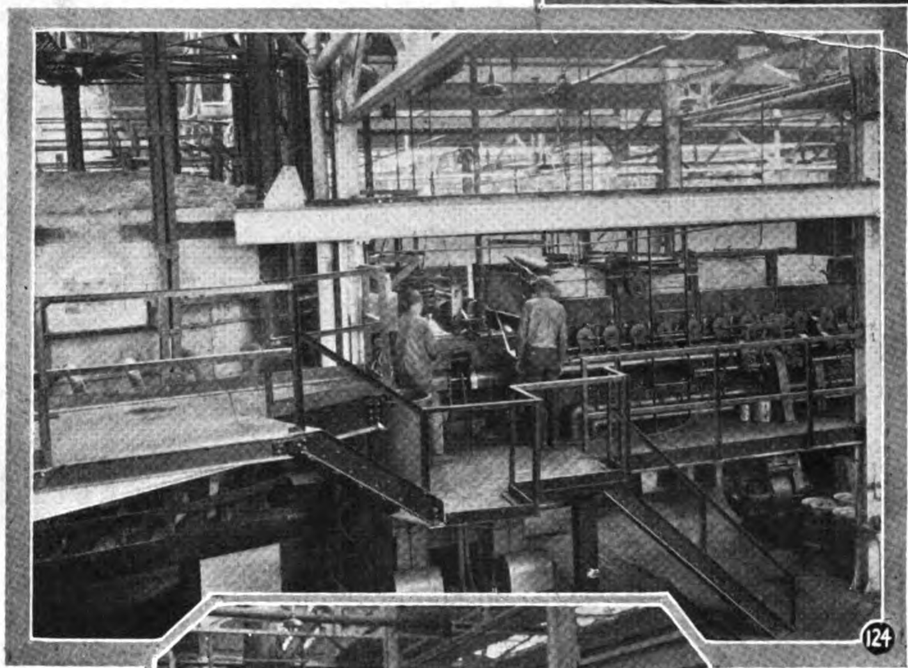


Fig. 124. At this point molten glass is being discharged from the furnace, rolled into a continuous sheet and fed direct to the lehr.

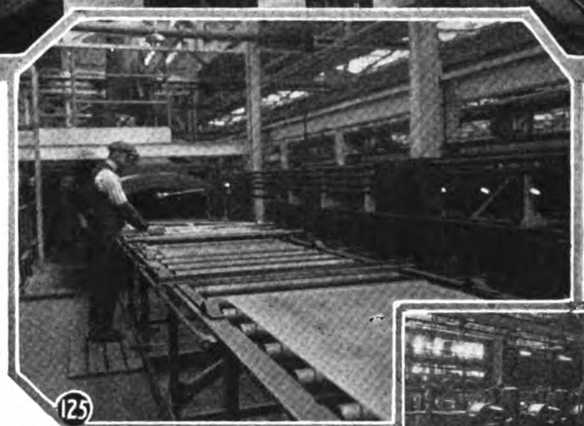


Fig. 125. The discharge from the lehr is clearly visible and the man is cutting the glass into the desired length.

Fig. 126. Glass is lowered from the lehr platform to the polishing floor by means of belt conveyors.

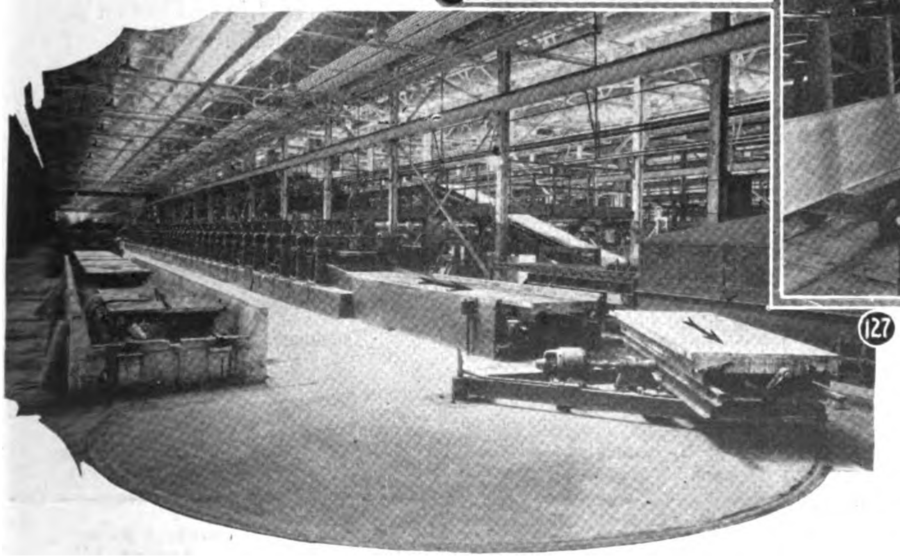


Fig. 127. View showing relation of the lehr to the two polishing lines and also illustrating the method of transferring cars from one line to the other.

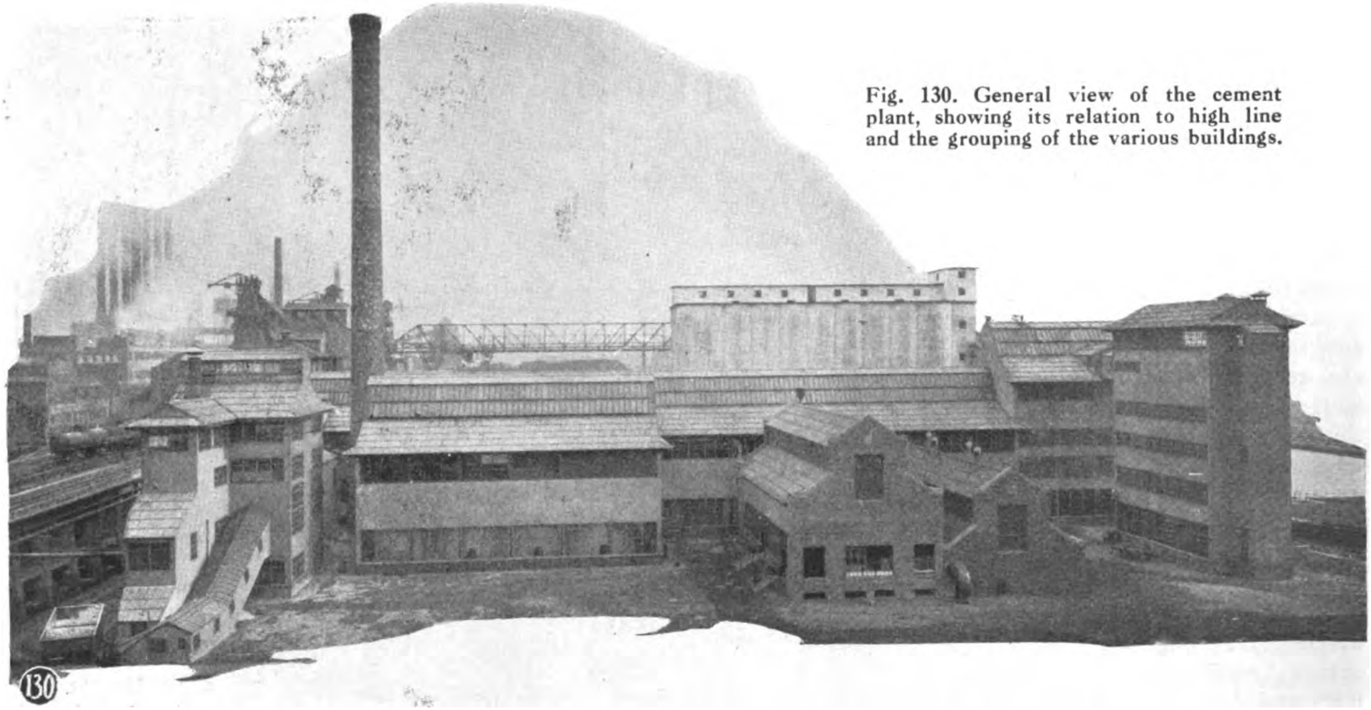


Fig. 130. General view of the cement plant, showing its relation to high line and the grouping of the various buildings.

Handling Diverse Materials in the By-Products Plant

WITH such large coke oven units and blast furnaces as are found in the River Rouge Plant it is natural to find some by-products industries but the engineer making a tour of inspection is surprised to find these industries operating on such a large scale. The size of the cement plant, cement silos, etc., can be clearly seen from the panoramic view but the by-products building or the coke ovens are not visible. The accompanying illustrations will present some of the materials handling equipment used in the transportation of materials in both these plants.

Handling Materials in the Cement Plant

For two or three years, slag from the blast furnaces and cupolas has been transported in trains to a dumping ground on the west side of the

(*Continued on page* 180)

Fig. 131. Lump slag is taken from the track hopper by a beaded flight feeder and conveyor.

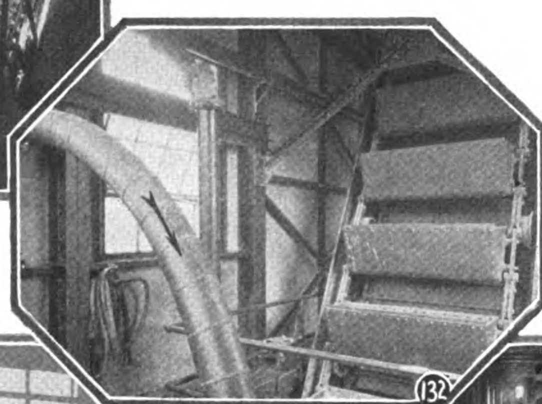


Fig. 132. The pipe marked with an arrow brings granulated slag in the blast furnace to the cement plant. Perforated bucket elevator, for handling it, can be seen to the right.

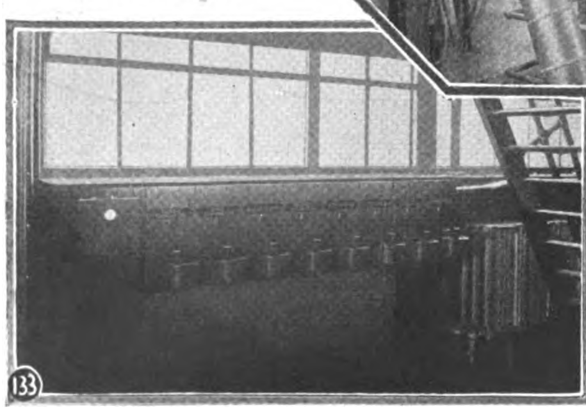


Fig. 133. Centralized control boards for all materials handling equipment greatly facilitate the starting and stopping of each piece by a single operator.

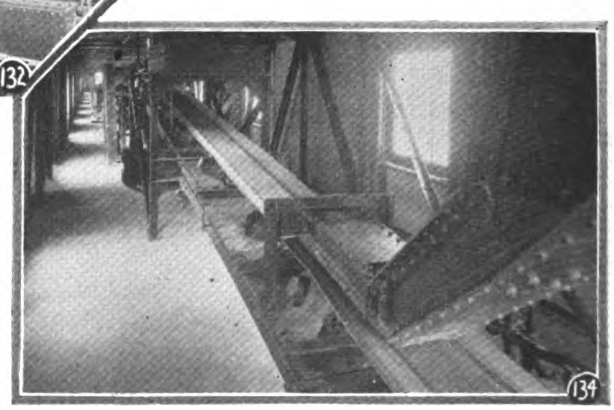


Fig. 134. General view in the conveyor gallery over the clinker storage area, showing belt conveyor, automatic weighing machine and feeder chute.

Miscellaneous Industries Within the Ford Plant

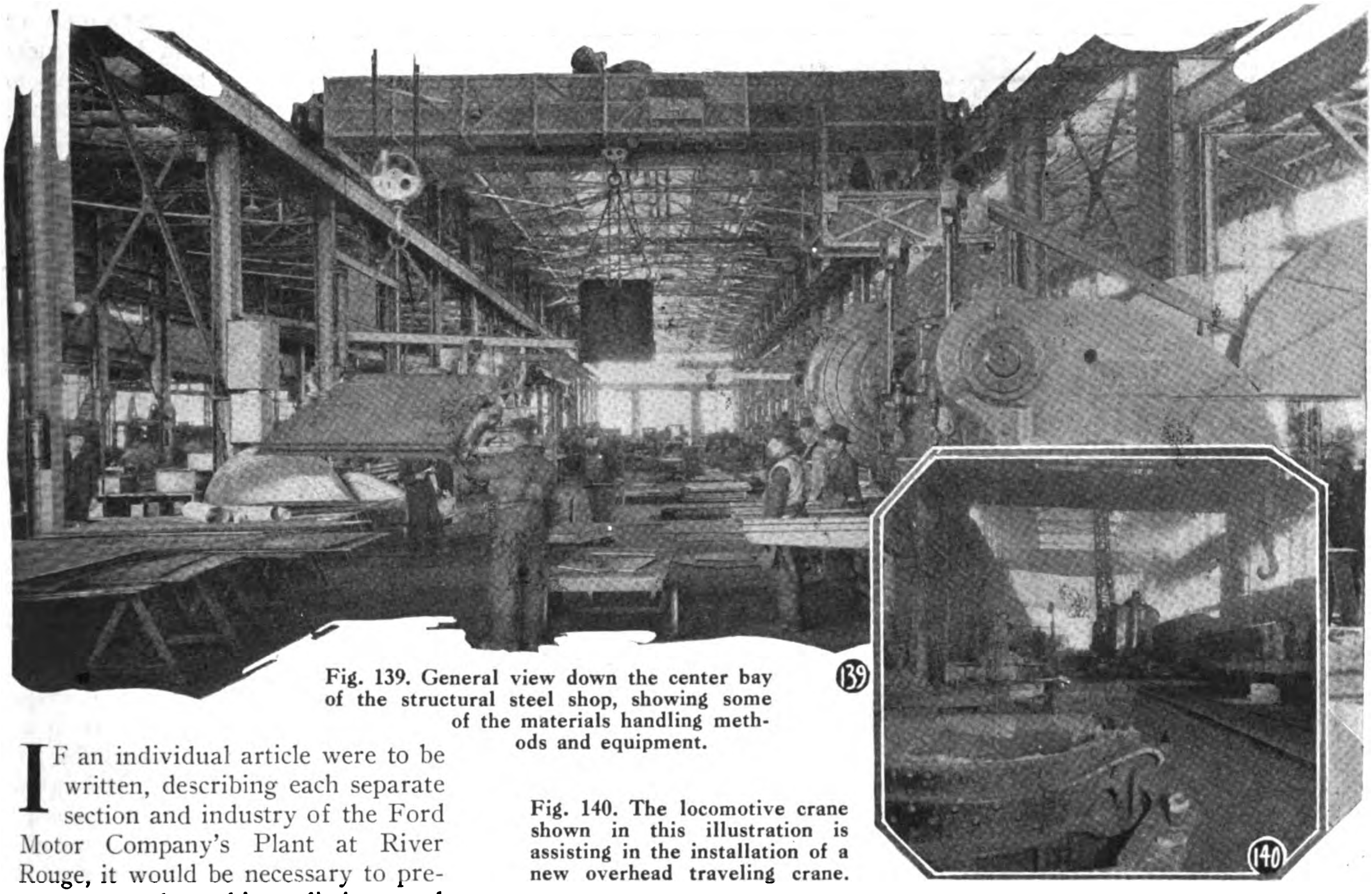


Fig. 139. General view down the center bay of the structural steel shop, showing some of the materials handling methods and equipment.

Fig. 140. The locomotive crane shown in this illustration is assisting in the installation of a new overhead traveling crane.

IF an individual article were to be written, describing each separate section and industry of the Ford Motor Company's Plant at River Rouge, it would be necessary to prepare more than thirty distinct and separate descriptions. Even with twenty-six sub-headings, shown in connection with the panoramic view in these pages, it has been necessary to combine one or two sections, as space would not permit, even on this large sheet, detailed itemized lists of the materials handling equipment employed in each section. For the same reason—namely, lack of space—we are describing in this one article the structural steel shop, the new jobbing foundry, various operations in the paper making plant, handling methods employed in the plant yard, and a minor description of the machine shops and locomotive repair shops of the D. T. & I. Railroad, which is also a unit of the Ford Motor Company's materials handling system.

Structural Steel Shop.

When entering the structural steel shop one is surprised at the size of the building and the various activities taking place therein. This shop is an industrial enterprise that, while lost in the magnitude of the River Rouge Plant, would be considered a large shop if placed in the average city or town. The reader can obtain an idea of the size of this plant and the activities therein by looking at Fig. 139, which is a general view down the center bay. The building is three bays wide and somewhat longer than shown in the illustration.

The handling of materials in this shop is all done by mechanical means, and each piece of production machinery is equipped with hoists of various types for the lifting and transporting of sheets in process and finished pieces of equipment. Many of the building columns are equipped with jib cranes from which are suspended I-Beam trolleys that support both chain and electric hoists.

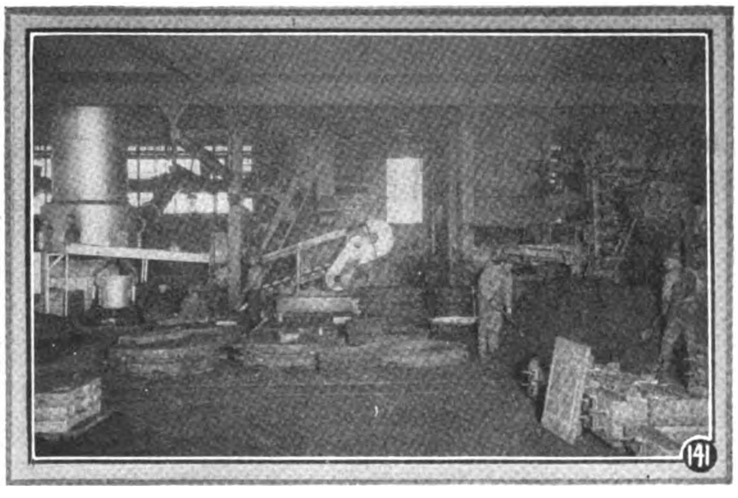


Fig. 141. In this one illustration several types of materials handling equipment are visible, and it will be noted that there is more equipment than men.

A few of these are visible in the illustration. Each crane bay is equipped with two overhead traveling cranes and these handle heavy sheet stock and other parts, longitudinally and traverse of the building. One of these cranes is shown in Fig. 139, and the hook and sling of the second crane is shown lifting the sheets from truck to marking table in the foreground. For short hauls, and for handling small pieces of sheets and shapes between various operations, platform hand trucks are used. For transferring from one machine to another, an occasional length of gravity roller conveyor is used.

Various methods are employed for hauling both raw stock and finished materials into and out of the building. Sheets are transported from outside storage by means of an I-Beam monorail system and these sheets are then picked up by the overhead cranes or placed on hand trucks for transportation to various machines. Occasionally, individual trailers are hauled into the shop by means of gasoline tractors, and this same type of equipment is employed for transporting finished equipment to the point of use. Automobile trucks are also used for the same purpose.

In order to make handling operations with the overhead cranes as easy as possible, a number of different slings are employed, and to describe all of these slings would be a story in itself; but a number of them are already known to our readers.

It must be remembered that this shop is not on a quantity production basis and yet it employs various types of materials handling equipment in order to reduce its labor costs. In this shop everything of a structural steel nature from fire ladders to large bins, hoppers, and even

(*Continued on page* 183)

Fig. 142. On the jobbing foundry pouring floor, industrial railways and overhead traveling cranes are used on the majority of materials handling operations.

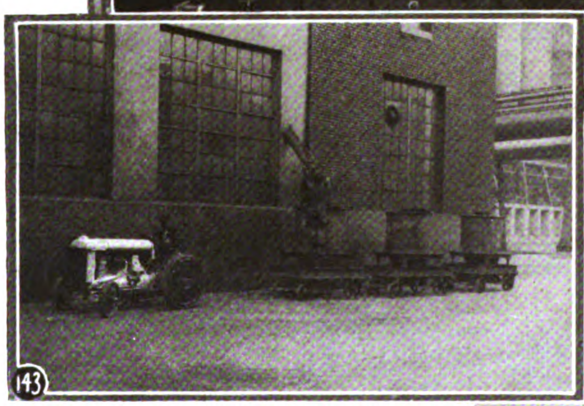


Fig. 143. Hundreds of trailers and more than one hundred gasoline tractors are used in and about the plant yard for the transportation of various materials.

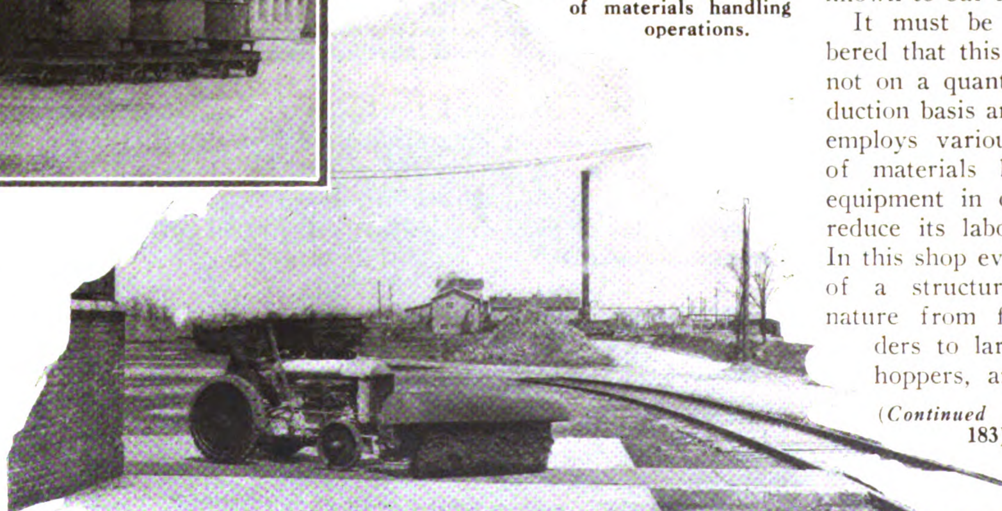
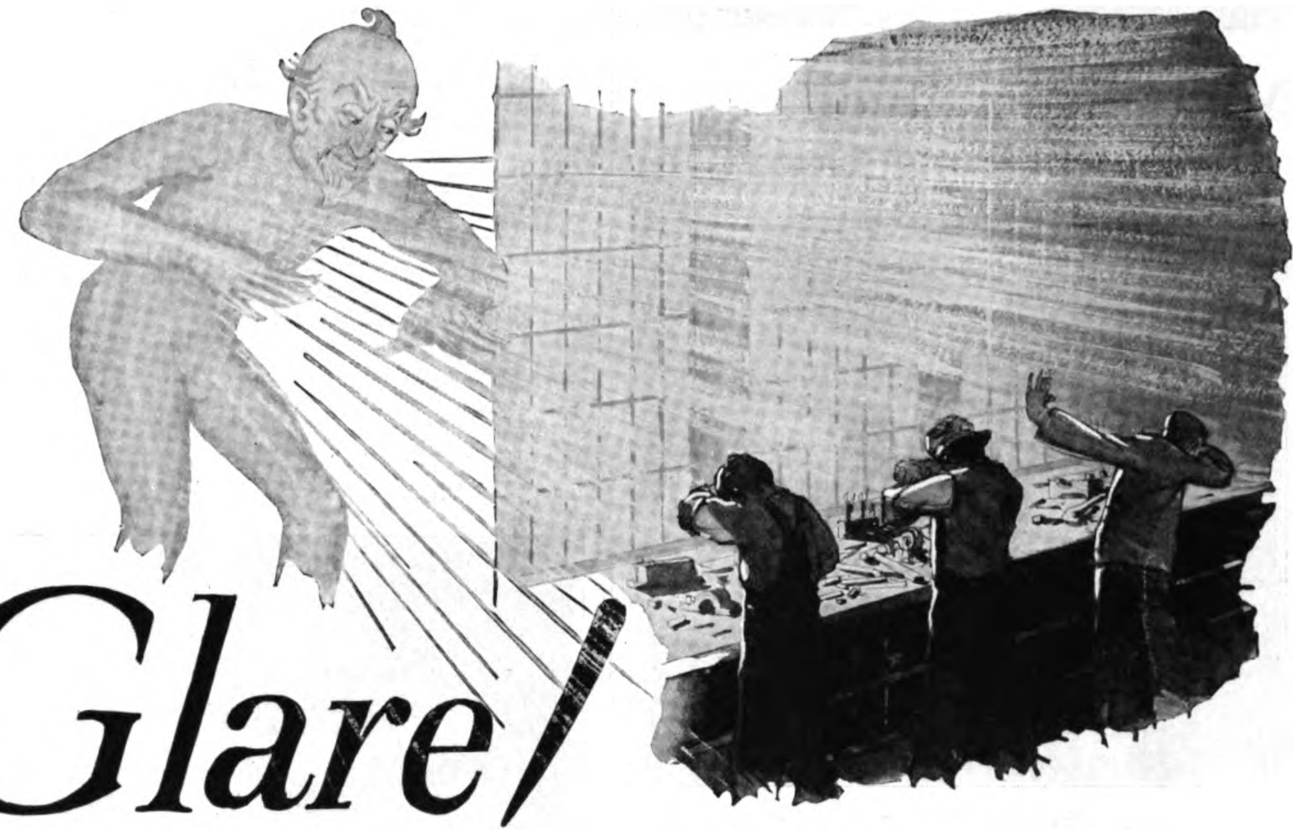


Fig. 144. Gasoline tractors, equipped with brushes, sweep the plant roads in summer and equipped with plows remove the snow in winter.

Fig. 145. This is a partial view of the miscellaneous freight yard at the north end of the plant, which is fully equipped with various mechanical handling devices.



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Materials Handling in the Blast Furnace Building

(*Continued from page* 21)

hoist pit hopper, is visible in the foreground.

The charging cars are electrically operated and are equipped with scales for weighing the charge. These cars run back and forth on the tracks under the storage bins and receive the required proportions of limestone, ore and coke, according to weight, as indicated by the scale dials, and then transfer this charge to the various blast furnace skip hoppers. The skip hoist car comes to rest in a pit immediately below the tracks and the car operator, by simply turning an air valve, is able to discharge the compartments of the charging car individually. When loaded, the skip hoist car is hoisted up

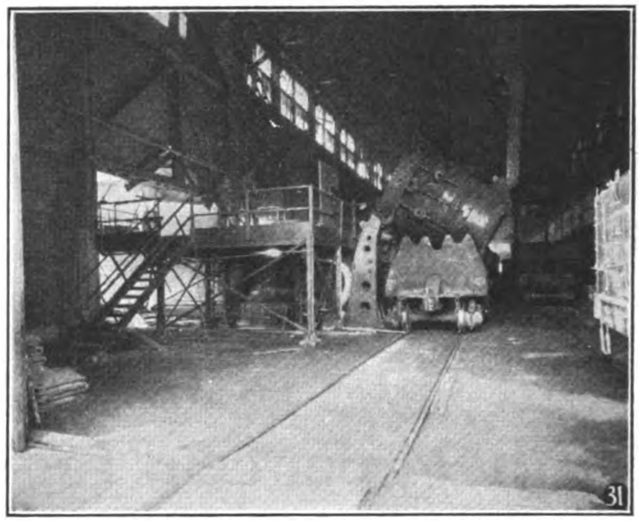
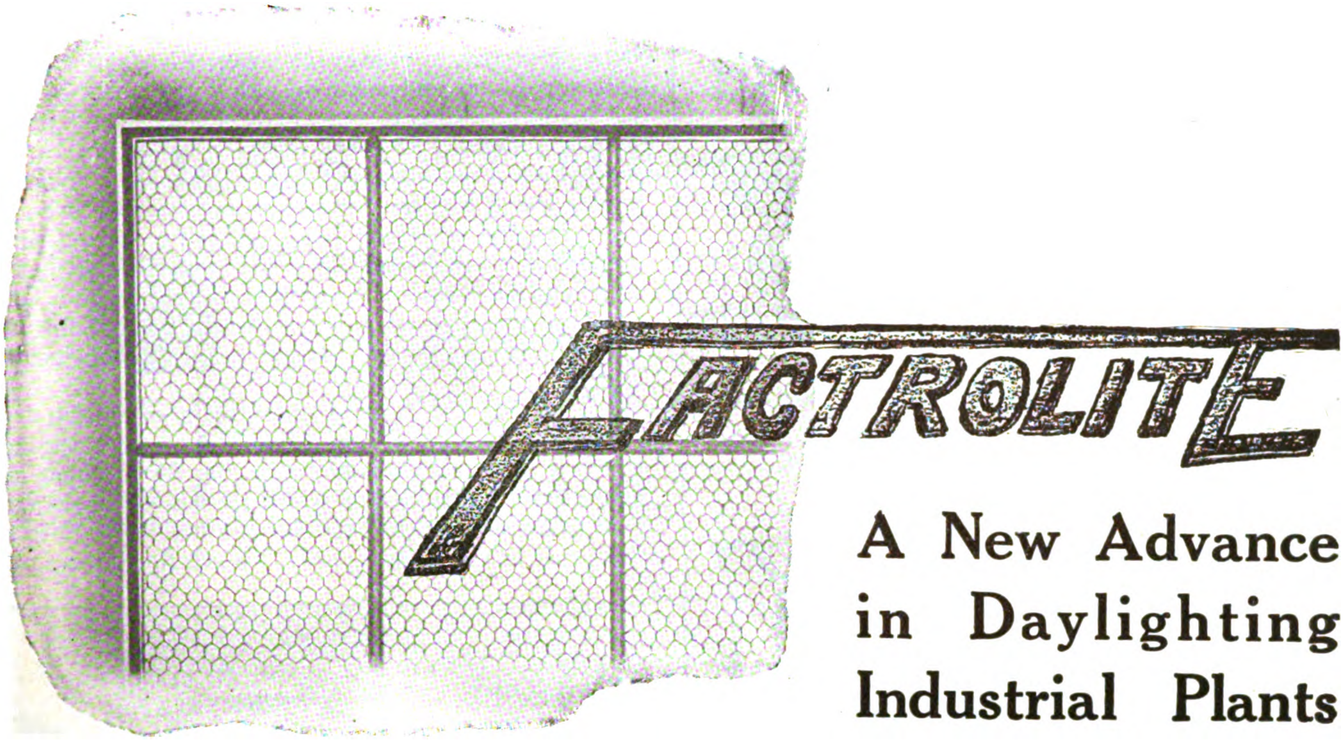


Fig. 31. Dumping a ladle car, filled with 50 or more tons of molten metal, is an operation that should be done mechanically, and the above illustration shows how this is accomplished by using an electric hoist and stationary trunnion brackets.

the inclined skip-way to the furnace top. A general view of one blast furnace, skip-way and skip hoist drive house and its relation to high line is clearly shown in Fig. 29. The bottom of the bucket on the skip hoist car is machine finished so as to fit the top of the bell hopper at the top of the blast furnace, and a slide gate is provided so that no gas may escape. Hinged arms on the skip hoist car allow the bucket to swing into position on the bell hopper at the same time that it is lowered into place, and immediately upon settling, the charge is automatically dumped and a signal light appears in the control house. By simply throwing a switch the bucket is returned to the skip hoist car and again lowered for an additional charge.

In dumping the load from charging car to the skip hoist car there is a spillage of considerable material in a day, as a number of charges are handled, but instead of reclaiming this material by hand a continuous pivoted bucket elevator-conveyor is installed under the bucket pit with an additional hopper. At intervals, this conveyor is started, the material is elevated and conveyed to a point above the skip hoist pit, shown in Fig. 28, and the buckets discharged into the hopper (which is visible in Fig. 27) from whence the material can be drawn when desired.

(*Continued on page* 42)



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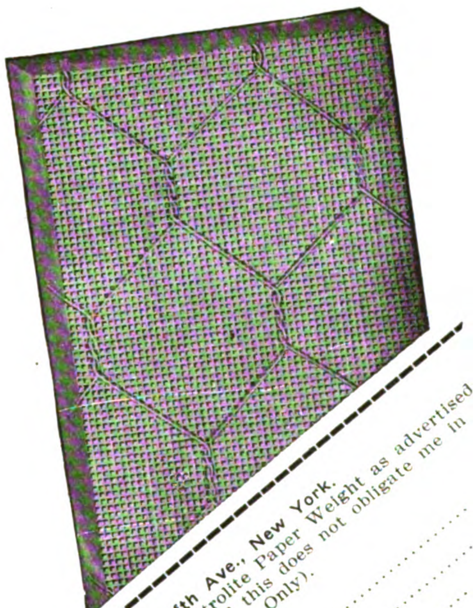

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(*Continued from page 40*)

Very little handling is required in the blast furnace building proper, insofar as the material is concerned, but apparatus, tools and other operating equipment have to be lifted from time to time, and on these minor operations the men are in every case assisted by mechanical means wherever possible. Fig. 30 shows a monorail trolley which lifts and transports the splasher over the blast furnace hot metal hold. A self-contained pillar crane is also visible and this crane is used for lifting of dams and skimmers when desired. In addition, a large overhead traveling crane is installed in this building for handling sand, clay and various heavy loads when required.

On leaving the furnace, the stream of molten iron enters the clay-lined iron runner or trough through which it is directed, as shown in Fig. 30, to either one of the hot metal ladle cars, which are located on the railroad siding outside the blast furnace building. Each of these cars is of 80 ton capacity. When filled, these cars

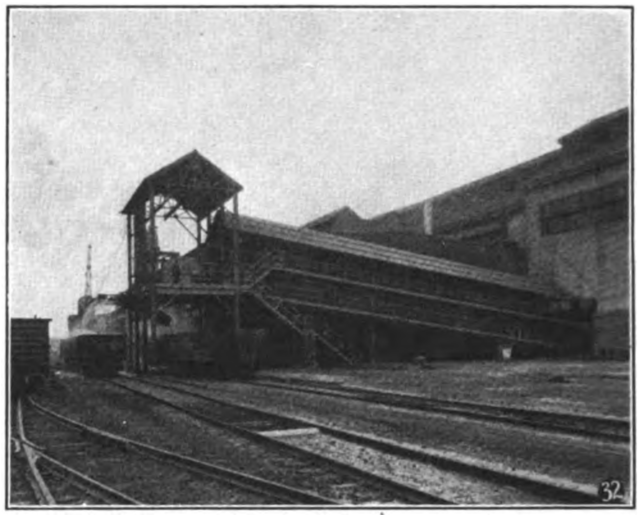

Fig. 32. Fig. 31 shows the pouring of hot molten metal to the feed end of the pigging conveyor, while this view shows the cooling section and the method of discharging the pigs to railroad cars which will deliver same to other parts of the plant.

are switched by locomotives, either to the foundry for direct mixing with cupola metal or to the pig house.

The pig house is located at the southerly end of the jobbing foundry and consists of a casting machine, which is made up of iron molds running in the form of two chain conveyors. On the way to the pig-house, hot metal cars are weighed on track scales and by deducting the tare weight of the car from the gross load, a record is obtained of the net weight of metal poured into pigs. Having reached the pig house, the hot metal ladles are seized and tilted by means of a 125-ton hoist, after the manner shown, Fig. 31, and the metal is directed into troughs which lead it into the moving mold. These are so designed as to interlock and to be proof against hot metal leakage. Fig. 32 shows the overall length of the pigging machine and in addition the water spray and the method of loading to the cars. Slag from the blast furnace is drawn off into ladle cars, as shown in Fig. 29, which are hauled in trains by steam locomotives to a dump. It will not be long before this slag will be drawn off from the blast furnace and immediately granulated and then pumped to the receiving pit in the cement plant which will be described later.

How Ford Builds Profits Through Mechanical Handling at River Rouge

THIS is the era of mechanical handling.

The truth of this statement is vividly impressed upon one who visits the River Rouge Works of the Ford Motor Company. Probably in no other one concern, or within the limits of any other single plant, are there so many varieties of handling equipment put to profit-making work at so many different kinds of tasks.

At this great works forty thousand men are employed. But of this forty thousand you can scarcely find a dozen who are employed at lifting or carrying or hauling. Ford has found that men can be more profitably employed than to put them to work competing with machinery, especially at work which modern machinery can do better, faster and cheaper.

Ford has also found that the greater part of the cost of any product is represented in the moving of the materials or parts that comprise it. **Moving and handling in the average manufacturing plant, comprises from 75 per cent. to 90 per cent. of the entire *making*.** If you do not believe this is so, analyze a few of your own jobs and see how little of the actual time you pay for goes into the actual cutting or forming or shaping or putting together.

Ford found this policy of mechanical handling to be such a profit builder—such an eliminator of waste time and motion and money, that today it is the most obvious part of each of the many industries that he has gathered together in his great manufacturing chain. Mechanical handling is not only the key-note in his motor building departments but in his power plants, chemical works, glass plants, steel plants, blast furnaces, saw mills, paper plants, woodworking shops, foundries, upholstering shops and all the rest of his contributing departments. Mechanical handling equipment cuts the cost of Ford cars and tractors at least into half of what this cost would be without it. It is the greatest single contributing cause to his amazingly profitable production.

Ford started with mechanical handling long before the majority of manufacturers thought of it. It may be that he foresaw the coming shortage of crude labor, such as the present day restriction of immigration has brought about. At any rate he is certainly prepared for it. For his mechanical handling equipment at River Rouge, without question, does more work than could forty thousand additional men on the payroll.

But, one may say, "mechanical handling is all right for Ford, with his tremendous quantity production, but how about those who operate on a much smaller scale? Ford methods, profitable as they are, are not applicable to *my* business!" Not on the Ford scale, it is true, but **the *principles* underlying Ford practice are applicable to *any* industrial concern of any size—and most profitably.**

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It is because the methods employed at River Rouge in handling by machinery are so varied, so skillfully applied and so generally useful, that we have centered this special Mechanical Handling Number about a description of this plant from the angle of mechanical transportation. Without question, this great Works is the outstanding example of the most modern and successful application of this new science. And we say without running the risk of exaggeration that the description of its handling methods, presented in this issue, is the most complete practical exemplification of mechanical handling yet made public.

In addition to the permanent value of such a description of actual practice, the pages which immediately follow in this "Directory Section" form an encyclopedia of information relative to the tested and reliable equipment that is available and capable of building profits in your own plant, just as similar equipment builds enormous profits for Henry Ford.

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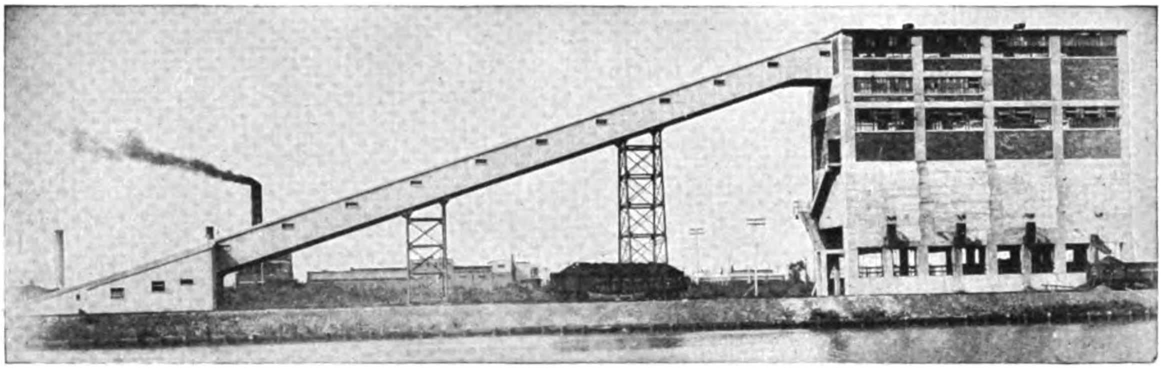

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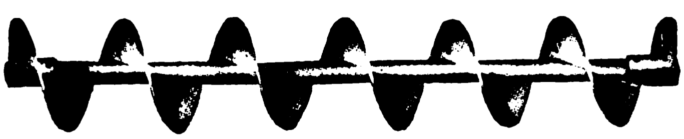

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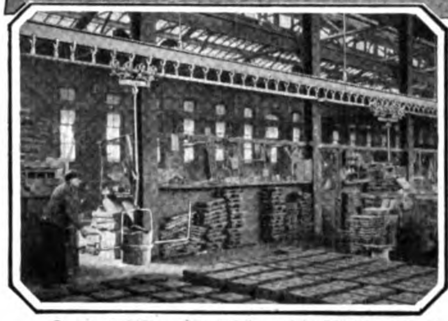
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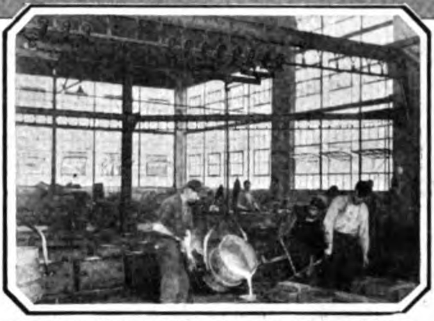
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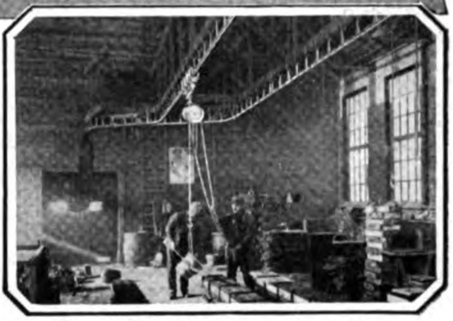
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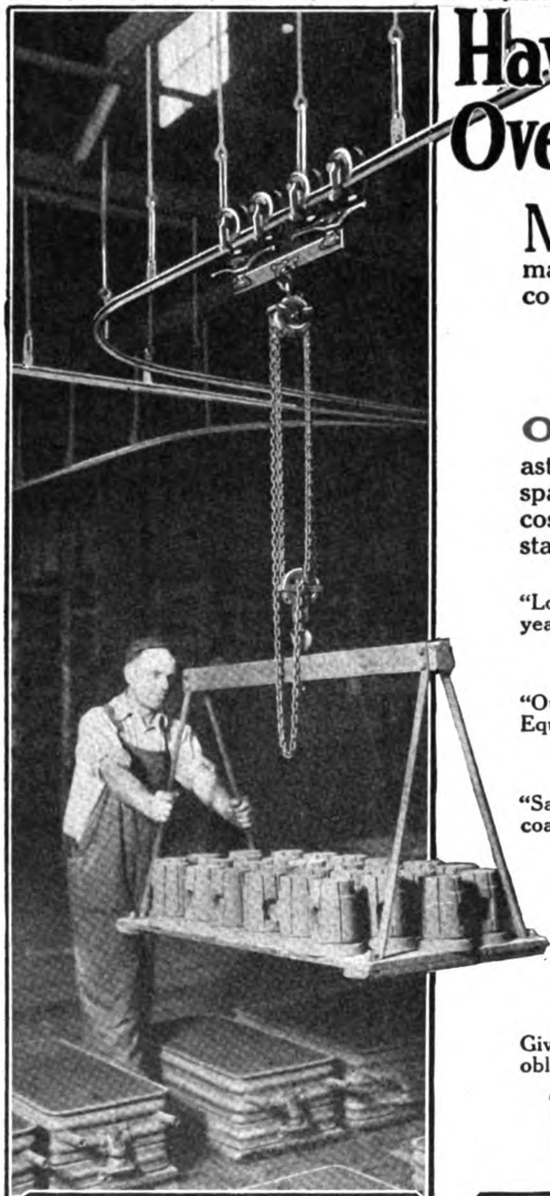

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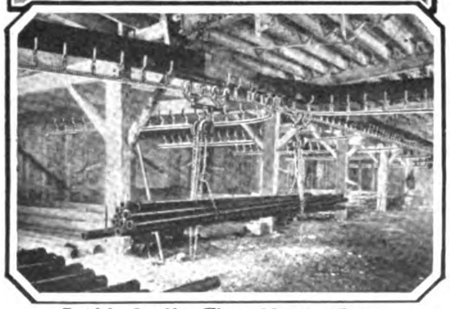
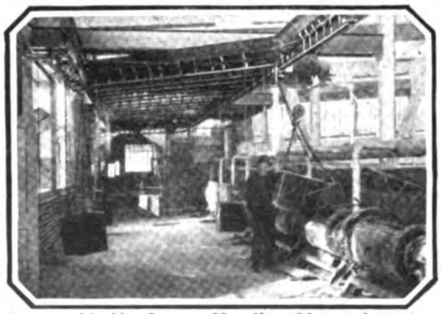
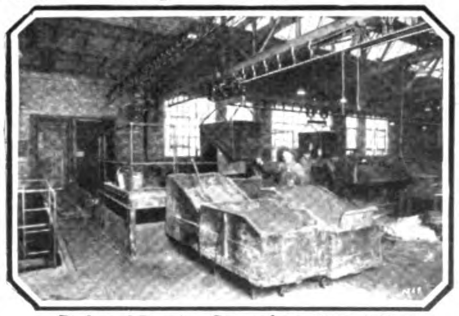
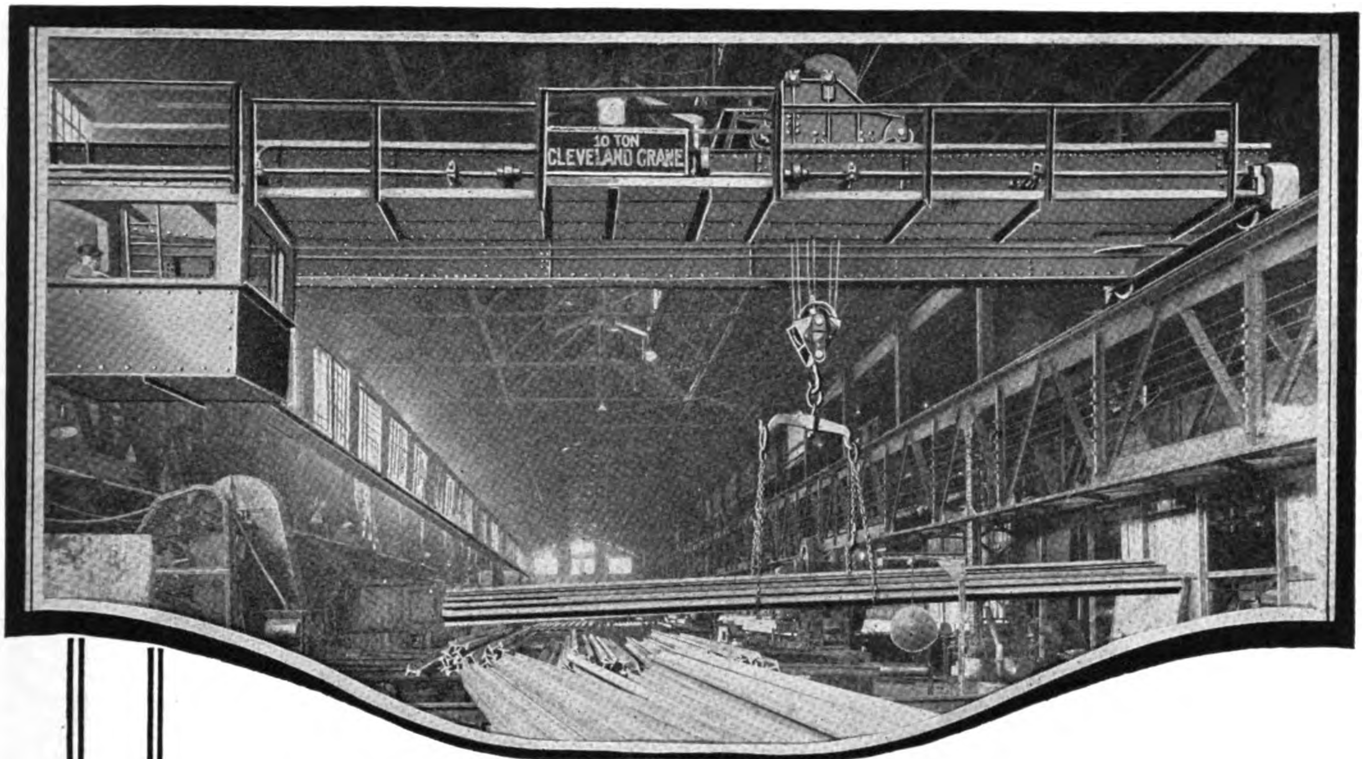

Paid for Itself in Three Months' Time


Reduced Labor Cost on Handling Materials 30%


Reduced Pouring Gangs from 20 to 6 Men



Cranes Built for Their Jobs

It's the heavy loads, high speed, continuous duty, dust, dirt and unbearable heat of the steel mill that tax the ability of the crane builder. This is admittedly the most strenuous work an electric traveling crane is called upon to do—and the class of work that forty per cent of the Cleveland Cranes in operation today are doing.

Every other job has its own particular crane requirements. Each manufacturing plant presents its own problems. Ample strength with a liberal load factor is demanded in every case. The nature of the work to be done also determines the other equally important details.

A Cleveland Crane is one of the most highly specialized machines used in industry. It represents the combined skill and experience of our designing, construction and electrical engineers and each one is built for the particular job it has to do.

THE CLEVELAND CRANE & ENGINEERING CO.

New York City
30 Church St.

WICKLIFFE OHIO.

Pittsburgh
511 Farmers Bank Bldg

CLEVELAND CRANES

Palmer-Bee Material Handling Equipment

Helps Maintain Production Schedules in the World's Largest Industrial Units

Cuts Handling Costs to the *Bone.*

You'll find Palmer-Bee equipment installed in the world's largest industrial units.

There is nothing haphazard or accidental about the choice of Palmer-Bee equipment on the part of the keen, discriminating engineers who lay out and operate these plants. These engineers are quick to recognize the superior features of Palmer-Bee Mill Type Speed Reducers and Conveyor equipment which insure 100% dependability—which reduce costs of operation and maintenance per unit handled to the lowest possible point.

Conveyors

There is a Palmer-Bee conveying or overhead transportation to meet every condition, either vertical, horizontal or inclined—on the floor or suspended—to handle material of every description, bulk or page, manufacturing or assembly of units.

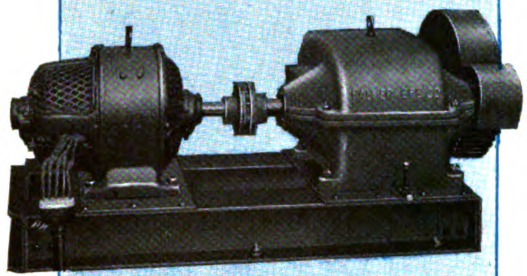
Speed Reducers

Every major feature of Palmer-Bee speed reducer design is an *exclusive* feature. Note these points—instantly accessible—split shaft bearings—through shafts (no overhung studs or shafts)—wide face, coarse pitch, machine cut teeth, involute gears (no gyrating planetary pinions, internal gears, diaphragms or floating discs)—ratios from 2½ to 1 to 4000 to 1—gears interchangeable—ratio may be increased or decreased by substitution of one or more pairs of gears—automatic lubrication.

At Your Service

Let our engineering department help solve your problem. Write us about it, requesting our printed matter. General Catalog No. 240; Overhead Transportation Bulletin No. 241; Speed Reducers, Bulletin No. 242, and Manufacturing Conveyors, Bulletin No. 243.

Palmer-Bee Co., Detroit



Save floor space—reduce accident hazards—eliminate breakdowns and production delays.

The Entire Mechanism can be opened for inspection by simply removing four bolts, then lifting off the cover.

Palmer-Bee High Speed Flexible Couplings. Belt may be renewed without separating the coupling or disturbing the alignment.

Palmer-Bee Mill Type Flexible Coupling for moderate speeds. Driving forces located in single plane of action, eliminating all strains due to Eccentric Loading.

Palmer-Bee Speed Reducers

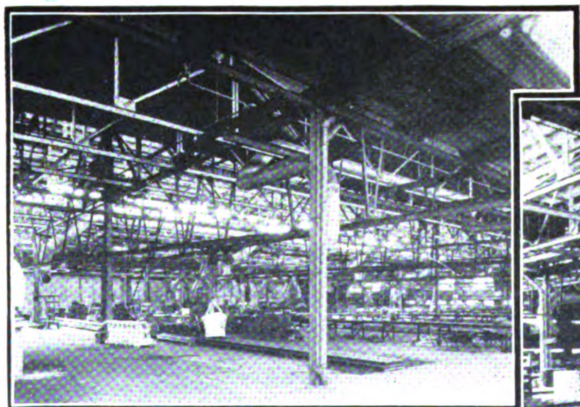
TRADE MARK
MILL P-B TYPE
REG. U.S. PAT. OFFICE

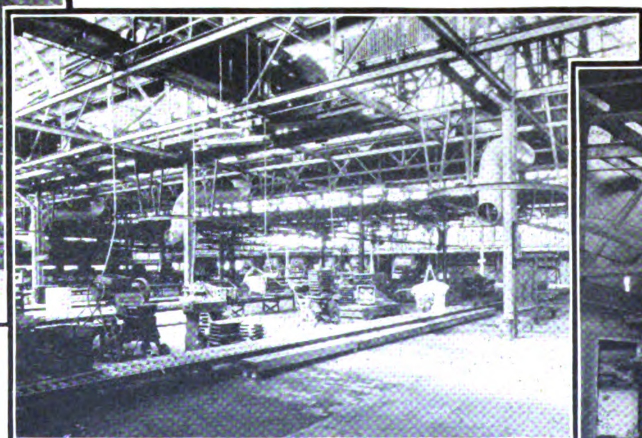
Interlock Your Plant CM Overhead

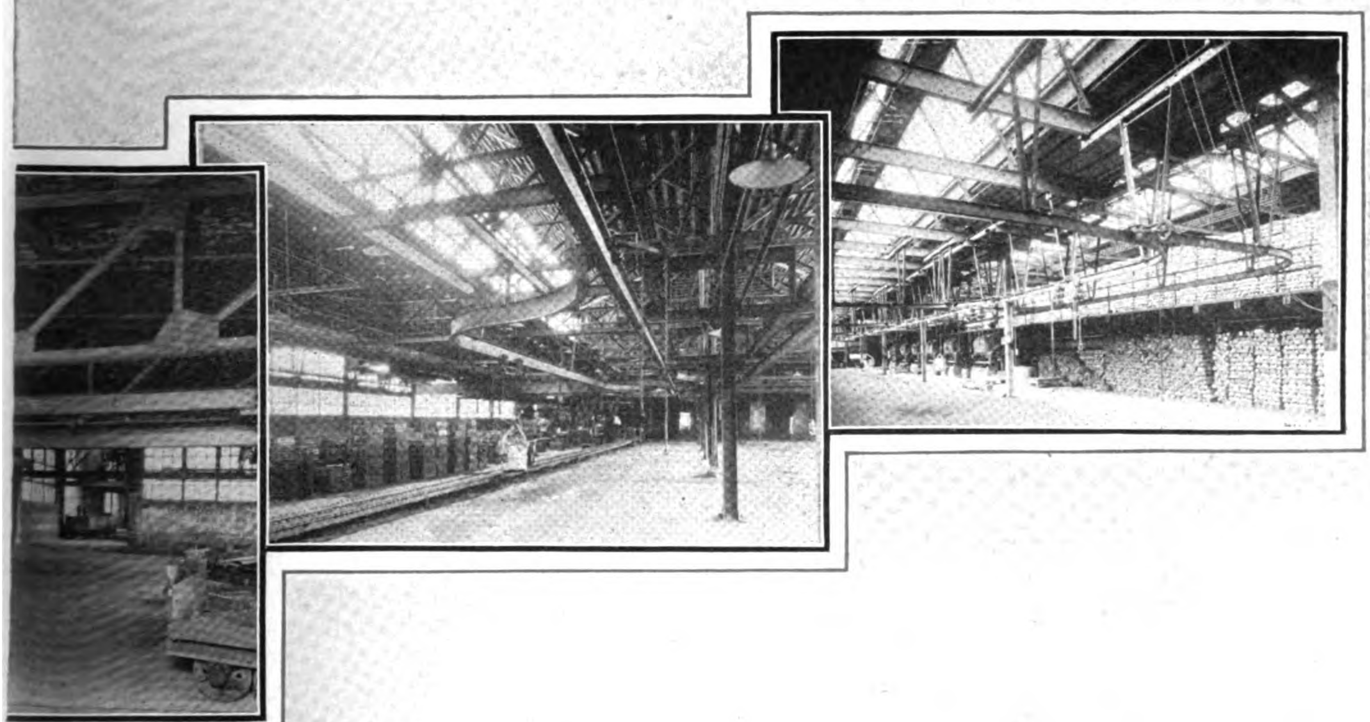
A CHISHOLM-MOORE Monorail System in your plant will interlock all your departments into one smoothly functioning unit. Material must be moved from place to place during the process of manufacture. In a great many cases the time saved by highly efficient machinery in producing material is lost in transporting it from department to department.

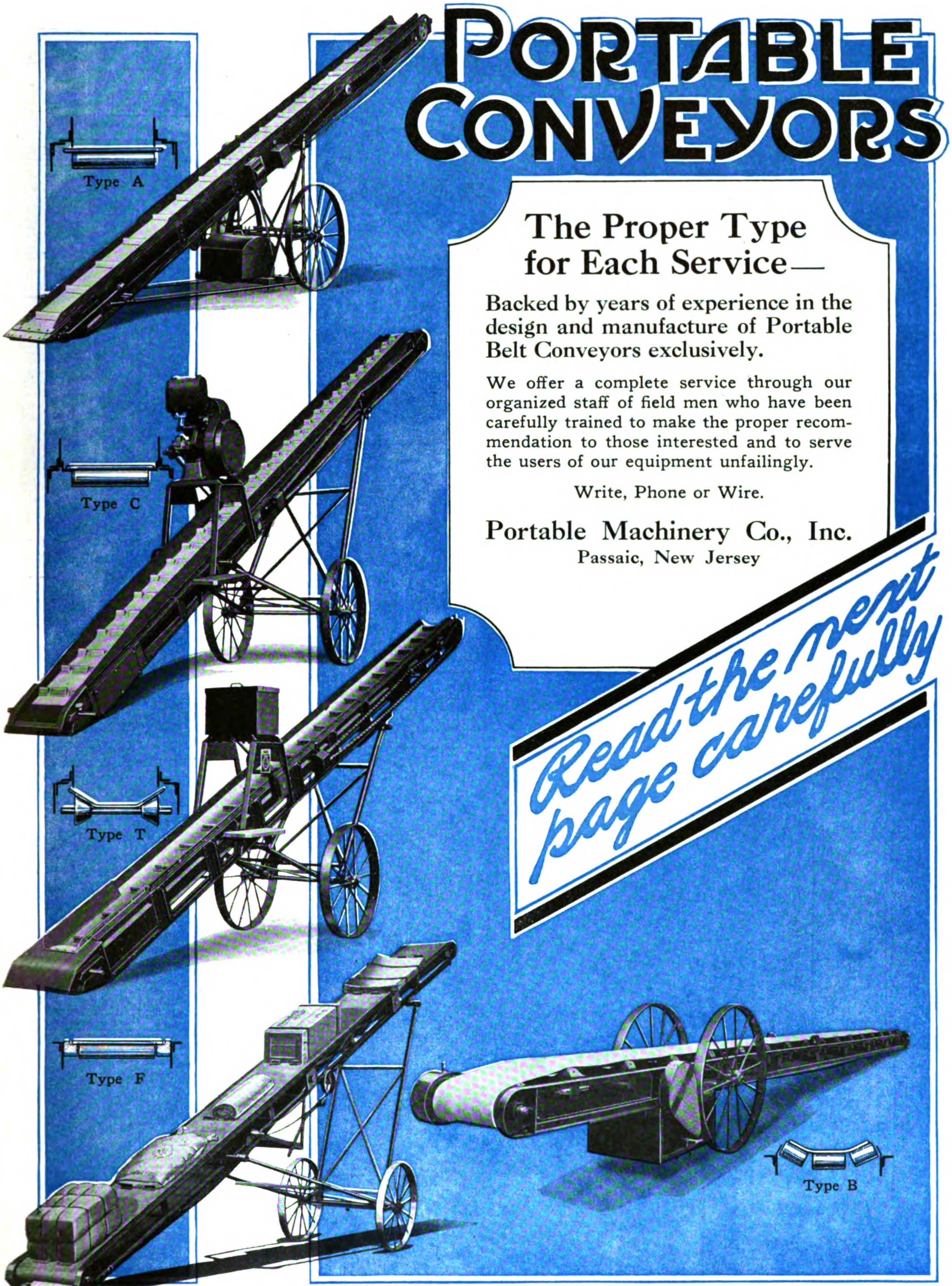
Co-ordination of departmental operations is a vital factor! It is vital because it directly affects the earning capacity of the entire plant. A C-M Monorail System keeps material moving from department to department, or from machine to machine, with a minimum expenditure of time and labor. In addition to this it utilizes otherwise useless overhead space and releases every square foot of floor area for other than material handling operations.

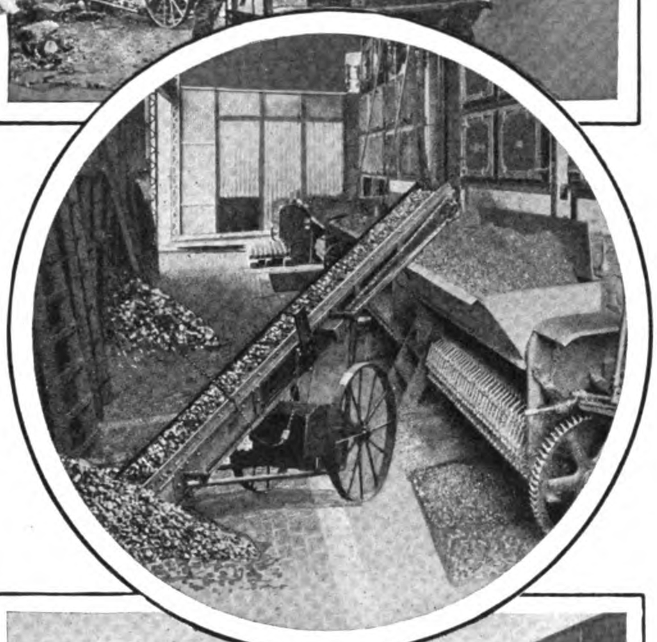
A typical example of what C-M Monorail Systems are accomplishing for Industry is exemplified in a Chisholm-Moore foundry installation illustrated herewith. In this huge plant C-M Straight Tracks, Curves, Switches, Hangers, "Cyclone" Chain Hoists, "Matchless" Trolleys, C-M Cupola Charging Machines, and a large part of the super-structure are Chisholm-

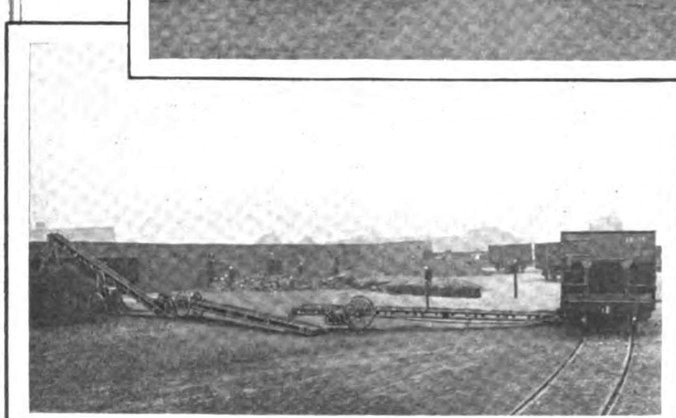






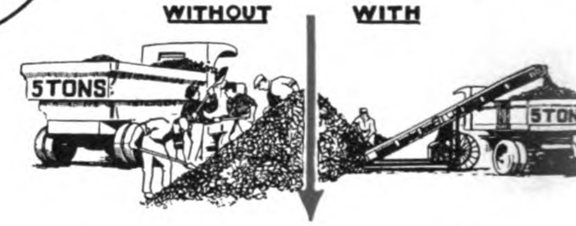

PORTABLE CONVEYORS
The Proper Type for Each Service—
Backed by years of experience in the design and manufacture of Portable Belt Conveyors exclusively.
We offer a complete service through our organized staff of field men who have been carefully trained to make the proper recommendation to those interested and to serve the users of our equipment unfailingly.
Write, Phone or Wire.
Portable Machinery Co., Inc.
Passaic, New Jersey
Read the next page carefully
Type A
Type C
Type T
Type F
Type B





The SC
CONV

COMPARA



Four - - - - - -	Men - - - - - -	One
25 Min. - - -	Time Taken - - -	7 Min.
70c - - - - - - -	Cost - - - - - - -	6c
	Saving—13c Per Ton	

UNDER *average* conditions *two men* and the SCOOP CONVEYOR can load a 3-TON TRUCK in 4 to 5 *minutes*. Average Handling Cost (including *labor, operating* and *upkeep* costs) is between *three* and *four* cents per ton.

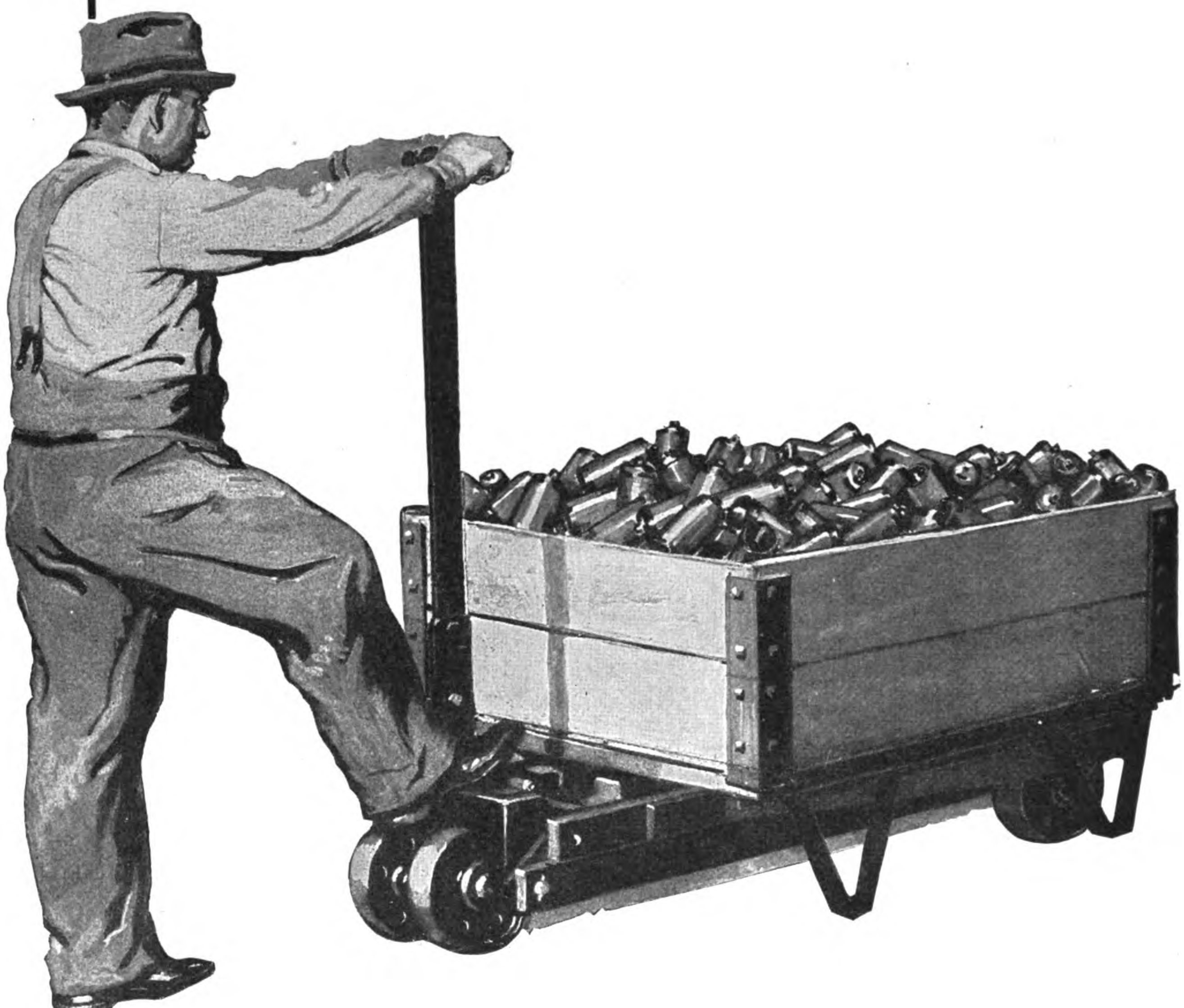
REDUCTION of *idle truck time* by Speedy Loading is a source of great saving. *Two trucks* loaded by the Scoop Conveyor can transfer more material, over a 1 to 2-mile haul, than three hand-loaded trucks. The elimination of *one truck* and *driver* IMMEDIATELY *more than* RE-PAYS the cost of a Scoop Conveyor.

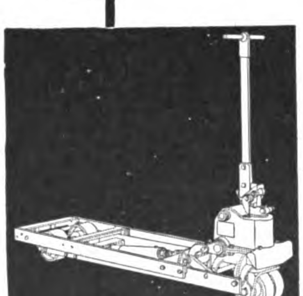
WRITE FOR COM

ask

PORTABLE MACHIN

The Great Automotive





The Stuebing Multi-Lift for use where loads are heavy. Its lifting leverage gives one man the lifting strength of 88 men, and it pulls easily on its Hyatt-equipped wheels

StueBing
LIFT TRUCK SYSTEMS

Industry Adopted Stuebings!

IT is strikingly significant that this great and efficiently systematized industry has almost *universally adopted* Stuebing Lift Trucks and Steel-Bound Platforms as a means to the *safe* economy for which these manufacturers are continually striving.

For the Stuebing System is most ideally fitted to render the distinctive character of service they require.

It meets their demand for *capacity* with a strength of construction exceeding their greatest need.

It meets their demand for *flexibility* with a line of trucks of all types to meet every known and anticipated emergency.

It meets their demand for *economy,* not only by saving money in operating costs but by staying out of the "truck hospital" and *saving upkeep expense,* for Stuebings are inherently free from breakdowns and lay-offs.

Thus, the savings effected in operation are *safeguarded*—they are *net* savings!

So, it is not surprising that Goodyear, for instance, uses 295 Stuebings, and Firestone 89; that General Motors, in their various plants, use 155 Stuebings, Dodge Brothers 60, Willys Corporation 58, Packard 23, Lincoln Motors 22; that Electric Auto-Light Co. uses 51, Delco 21, Kelsey Wheel Co. 17—and so on, through the whole of this highly developed industry.

The need for economy which dictates the use of Stuebings is no greater in the automotive industry than in any other field of industry or commerce where *profit* is essential to business permanence.

Let us tell you more of the story. You'll not be obligated in any way if you write for our 36-page catalog. Send for it today!

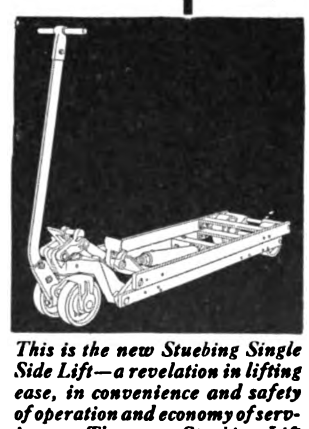
THE STUEBING TRUCK COMPANY

Cincinnati, Ohio — Cornwall, Ontario

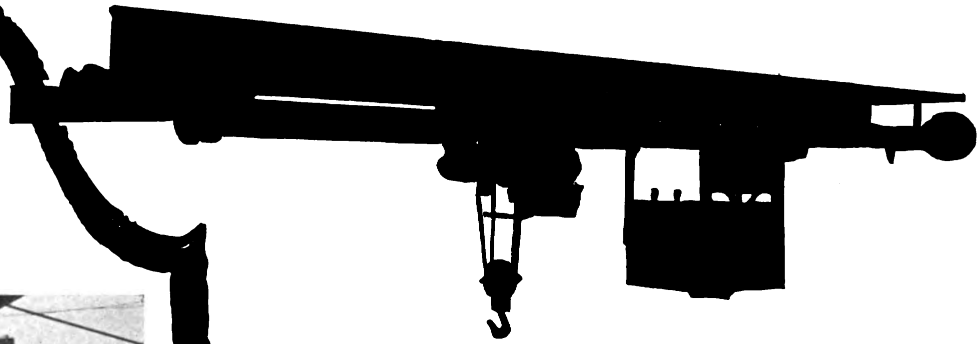
Branch Sales Offices in all Principal Cities

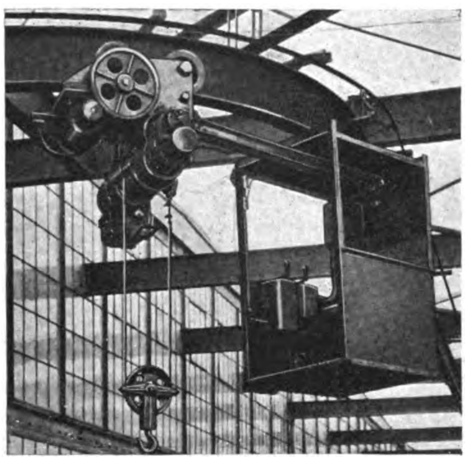
Stuebing

LIFT TRUCK SYSTEMS



This is the new Stuebing Single Side Lift—a revelation in lifting ease, in convenience and safety of operation and economy of service . . . There are Stuebing Lift Trucks of every kind and size to meet every interior hauling need





Faster Handling With Safety and Economy

No matter what materials you handle—what the layout of your plant may be—there is a Detroit Hoist or Crane, Pneumatic or Electric, which will cut your haulage costs, speed the work and operate at a considerable saving to you.

We base this statement on over 20 years experience installing our equipment in plants of every description.

The roll call of Detroit Hoist and Crane users gets a response from every country and every industrial center of the world!

Put your problem up to us. We will solve it.

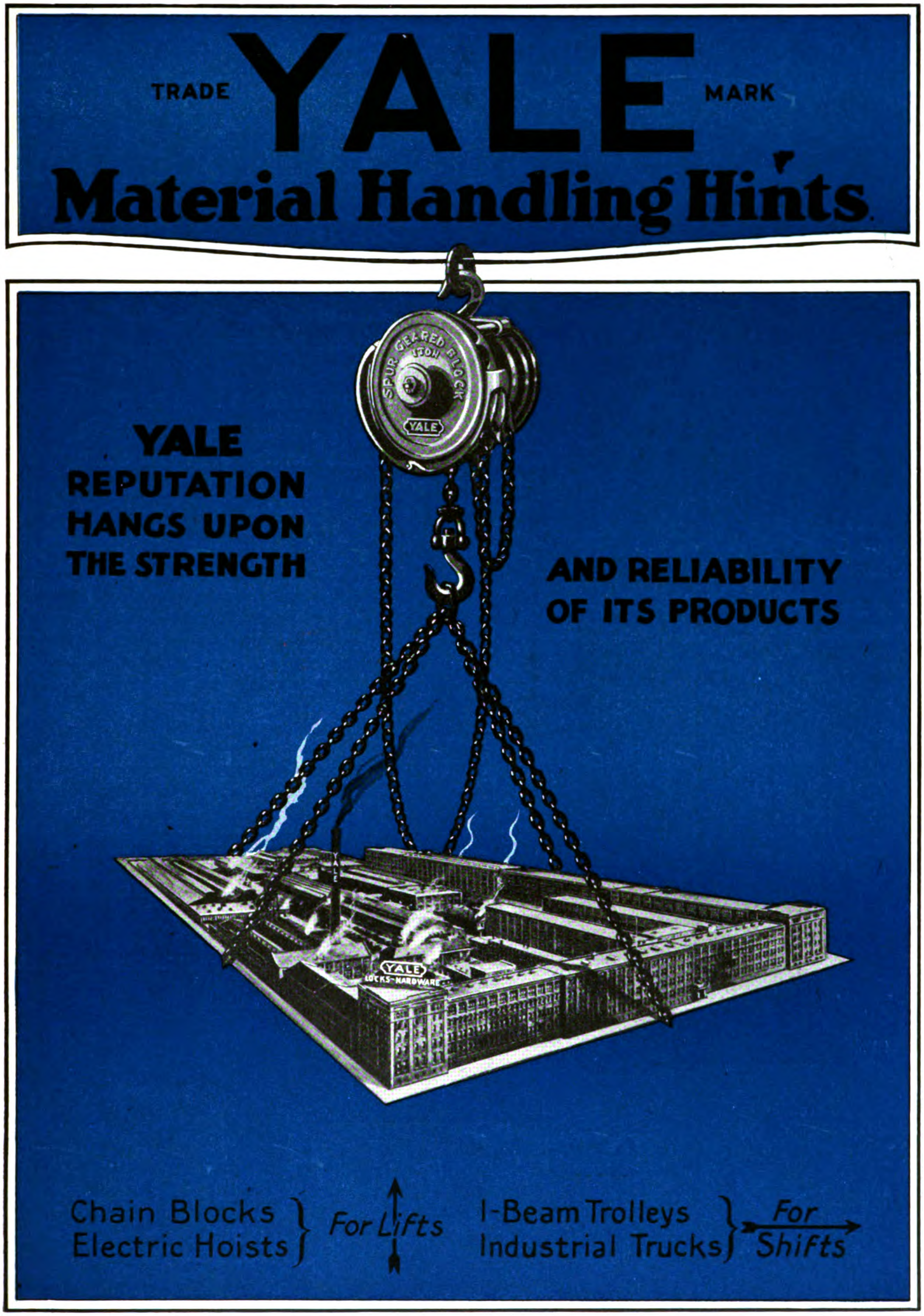
Manufacturers of:

- Electric Hoists Portable, Stationary, Monorail
- Electric Winches Portable and Stationary
- Electric Locomotive Turntable Tractors & Winches
- Electric Travelling Cranes
- Electric Ice Cranes, Dumps, Lifts
- Electric Operated Jib Cranes
- Pneumatic Geared Hoists and Winches
- Pneumatic Stationary Motors and Traveling Cranes
- Pneumatic Operated Jib Cranes
- Pneumatic Locomotive Turntable Tractors and Winches

and many other special applications for labor-saving service

Detroit Hoist & Machine Co.

8201 Morrow Street Detroit, Mich.



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TRADE **YALE** MARK

YALE
Spur-Geared Chain Block

"A Line of Steel from hook to hook"

Yale Chain Blocks,

Standards of Safety,

FOR almost half a century the name YALE has stood for the highest quality in hoisting and conveying equipment. Being the original pioneer, Yale set the standards, and Yale has continued to keep these standards as high as mechanically possible by continuously improving the product to meet the basic changes in the country's industrial requirements.

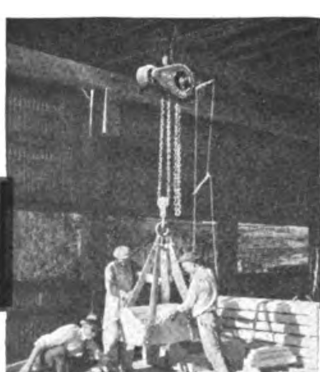
Yale Standards of Safety—

Ample factors of safety, frequent inspections, exhaustive tests of every step in the manufacturing processes, from raw materials to finished products, are Yale checks in producing Material Handling Equipment that is SAFE.

Every Chain Block, Electric Chain Hoist, and Truck is given an overload test 50% greater (in long tons) than its rated capacity, and, although it is not recommended as regular practice, Yale Hoisting and Conveying Equipment can handle loads far beyond the rated capacity.

The Yale & Towne
Makers of Yale Products: Locks, Door
Stamford,

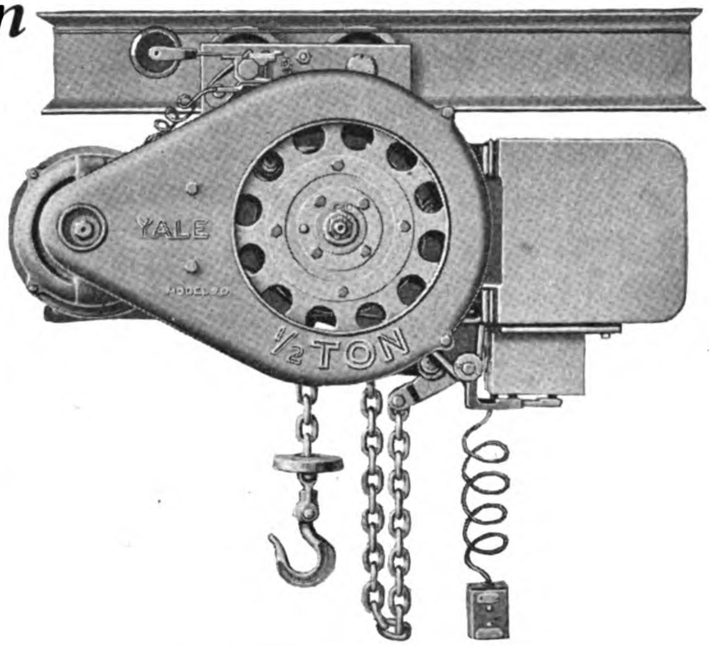
YALE MADE IS



TRADE **YALE** MARK

Electric Chain Hoists, Trolleys

Efficiency, and Design



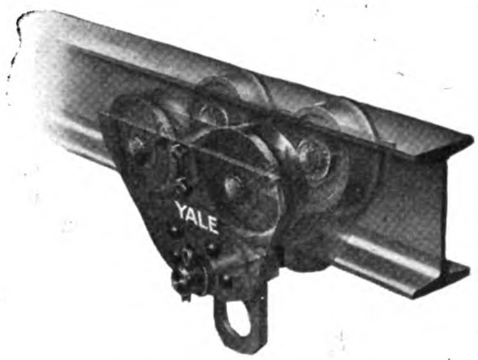
Yale Electric Chain Hoist

Yale Standards of Efficiency—

By introducing roller and ball bearings where they increase efficiency, by introducing superior reduction gearing and by reducing all frictional losses to a minimum, Yale Material Handling Equipment has well earned the title of *Highest Efficiency*. And, the Yale standard of efficiency is the world's standard of efficiency, as applied to devices of this kind.

Yale Standards of Design—

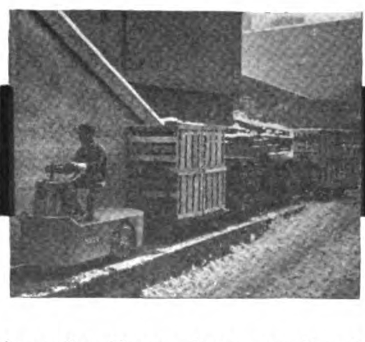
Simplicity, durability, compactness, utility, ease of handling and speed are the result of the detailed study given by Yale Engineers to the design of all Yale products. The design of YALE Material Handling Equipment—Chain Blocks, Electric Chain Hoists, Trolleys, Electric Industrial Trucks, etc., is the cumulative result of years of continuous development work.



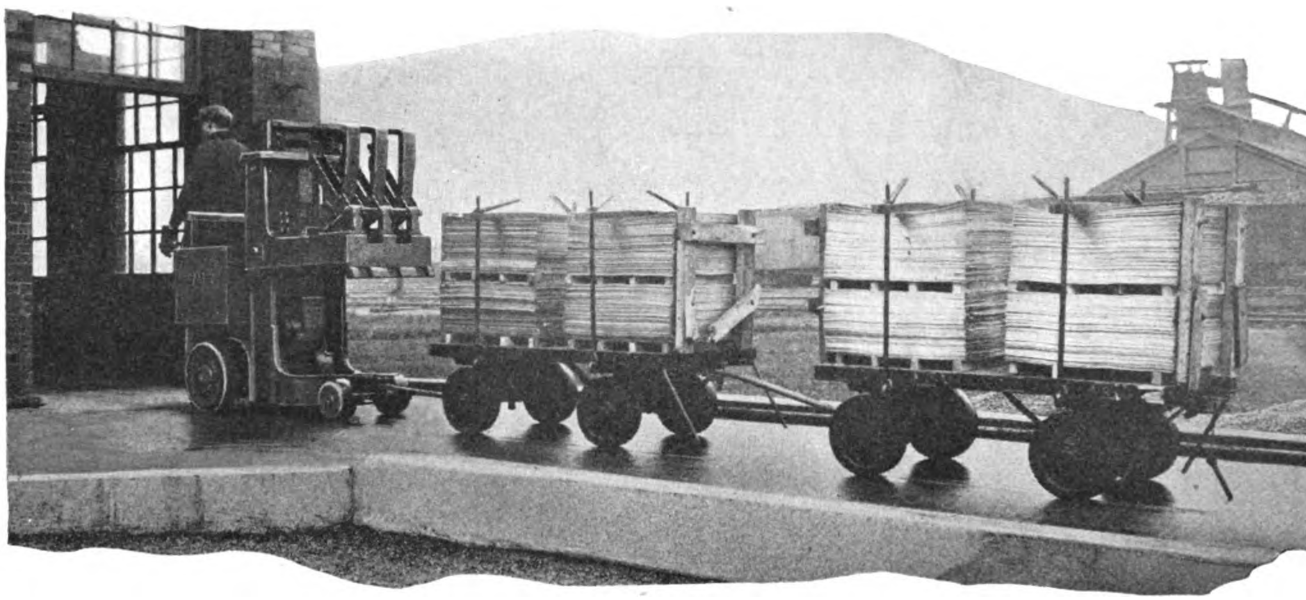
Yale Steel Plate
Roller-Bearing Trolley

Manufacturing Co.
Closers, and Material Handling Equipment
Conn., U. S. A.

YALE MARKED

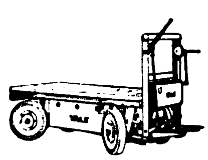


TRADE **YALE** MARK

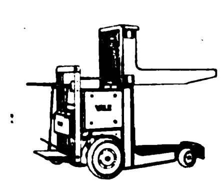


The General Utility Truck of 1924

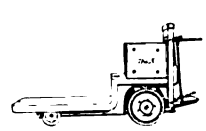
Yale Elevating Platform Truck—Model K22



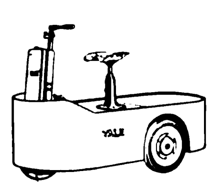
Yale K20 & K21



Yale K22



Yale K23



Yale K24

The Yale Elevating Platform Truck, Model K22, has well earned its title of General Utility Truck, for its inter-plant applications are practically limitless, and the economies it effects are remarkable.

It carries loads up to 4,000 lbs.

Because of its low center of gravity, there is little danger of tipping the K22 over, even when it is loaded to capacity with the platform raised its full height.

This truck combines both high and low lift features, and can be used for stacking or tiering in storerooms, freight cars, steamship holds, etc.

Great economies are obtained by operating in conjunction with skids, or, as shown above, with trailers. *This* K22 takes the place of a freight car. With fork attachment, it loads the trailers, hauls them over half a mile to destination, and unloads. The loading and unloading time is practically nothing.

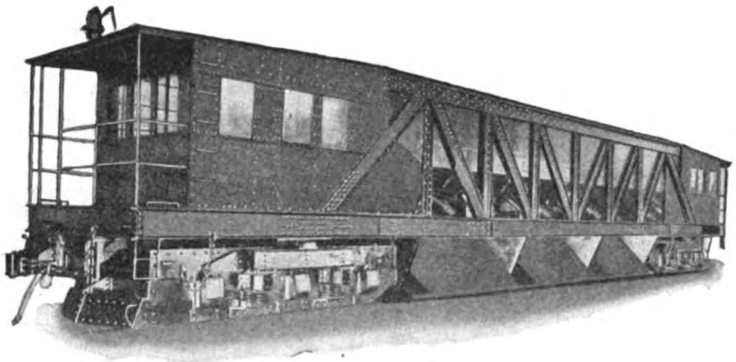
Exceeding every other model, as it does for general utility and elevating purposes, the Yale Model K22 Truck, either standard design, or fitted with auxiliary equipment such as rams, fingers and clamps, etc., will make a profitable addition to your material handling equipment.

A demonstration of any Yale material handling equipment in your own plant, operating under your actual working conditions, is the Yale way of establishing your mechanical handling costs.

The Yale & Towne Manufacturing Co.
Makers of Yale Products: Locks, Door Closers, and Material Handling Equipment.
Stamford, Conn., U. S. A.

YALE MADE IS YALE MARKED

Scale Cars
and
Weighing Cars
of all kinds
Ore Transfers
Indicating Mechanisms
for Scale Cars

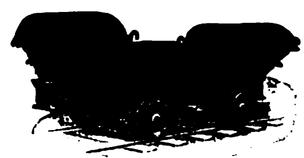


150-Ton Capacity Ore Transfer, Motor Driven, Double End Control

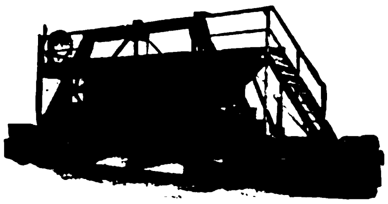
Gable Bottom
and
Rocker Dump
Cars
Tunnel Kiln
Cars
Turntables

Electrically Operated Cars for any Requirement

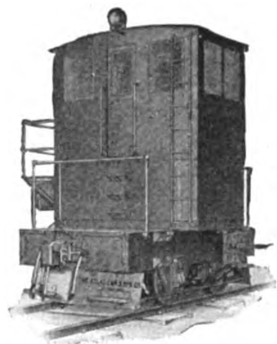
Gable Bottom Dump Car, with trip and brake



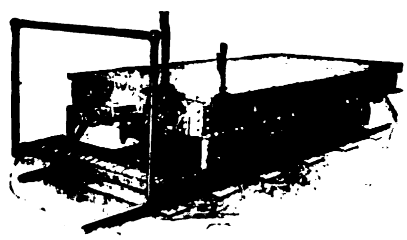
Heavy Duty Quarry Car



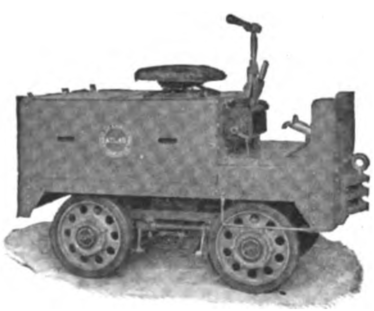
25-Ton Electric Scale Car, Side Delivery



Industrial or Coke Plant Electric Locomotive



5-Ton Capacity Storage Battery Flat Car



Storage Battery Tractor

Industrial Trucks
and Tractors

Electric and Storage
Battery Locomotives

Special Industrial Cars
of every Description

Storage Battery Platform Truck

THE ATLAS CAR and MANUFACTURING CO.

ENGINEERS — 1140 Ivanhoe Road — MANUFACTURERS

CLEVELAND, OHIO

MAEHLER

Maehler Oven Accessory Equipment

SUITABLE equipment for handling materials in and out of the baking process should receive due consideration when investing in new ovens, as it directly affects operating costs and production, as well as results obtained.

Invariably every manufacturing plant has its particular method of handling its product through the baking process. Primarily, the purpose of any method outside of hand loading is to save labor, time and heat. Where high production is desired, the hand loading oven is the most inefficient (although in many cases its use is unavoidable) due to the fact that too much time and heat are lost during loading and unloading. Where mechanical conveyor equipment is not adaptable, trucks or overhead carriers contribute to economy and higher production than is possible in handloading ovens.

Trucks are used extensively for stamped parts, small castings, lacquered sheets, lamps and automobile bodies, and overhead carrier equipment is used to a considerable extent by metal bed, weather strip and flexible tubing manufacturers.

With either method and by locating the oven in correct relation to succeeding processes, the operation of the oven and its output is greatly accelerated. Trucks as well as carrier systems can be run to divergent sections of the factory floor to pick up and keep the product moving.

For complete enameling and baking operations in connection with Maehler Ovens, we build ball bearing steel trucks, erect roller bearing overhead trolleys with I-Beam rail conveyors, and furnish dipping tanks, troughs, supports, racks and ventilation stacking.

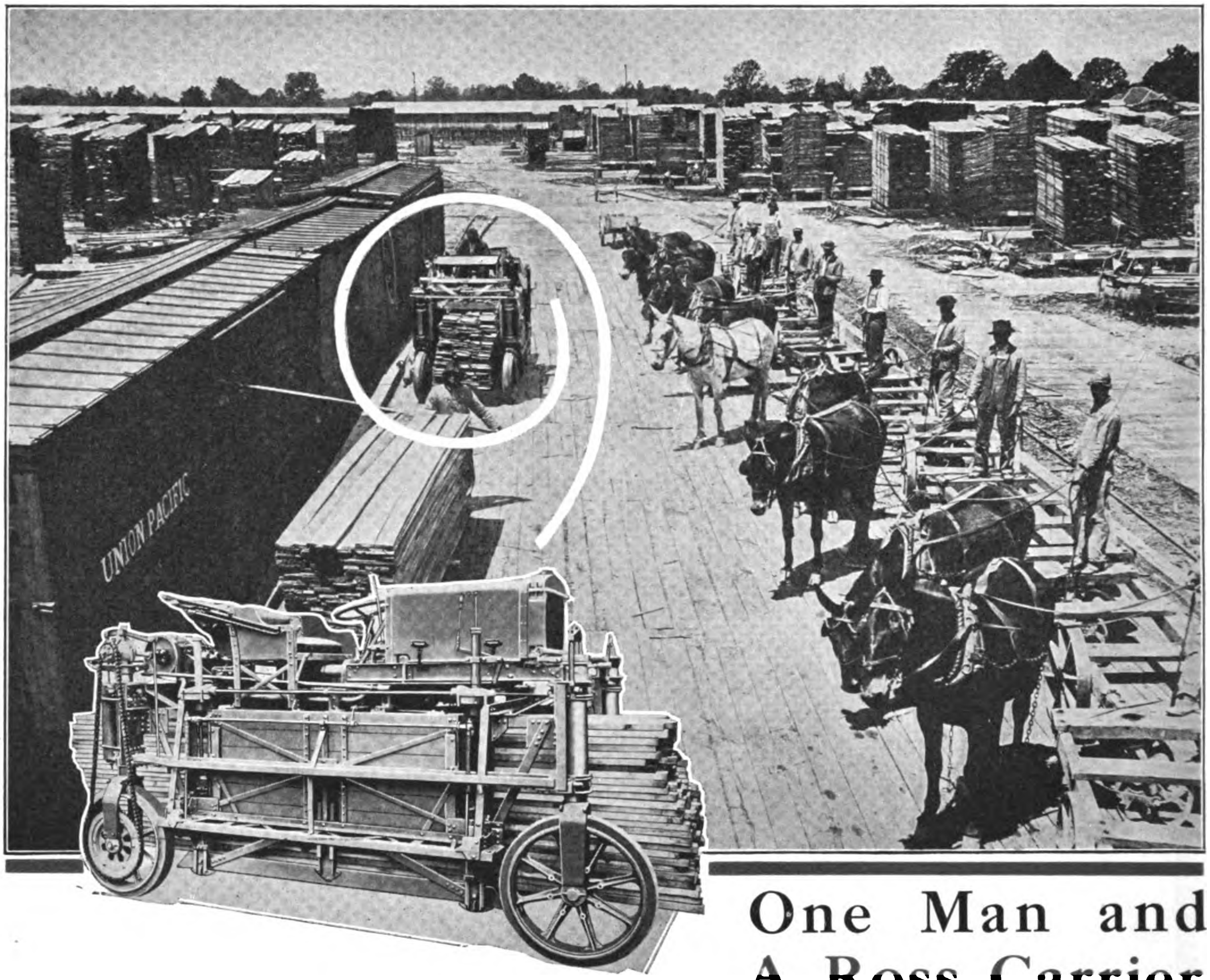
A study of the Maehler catalog or a conference with Maehler engineers on your material handling—baking problems may open the way for further reductions in productions costs.

The PAUL MAEHLER COMPANY

INDUSTRIAL OVEN BUILDERS

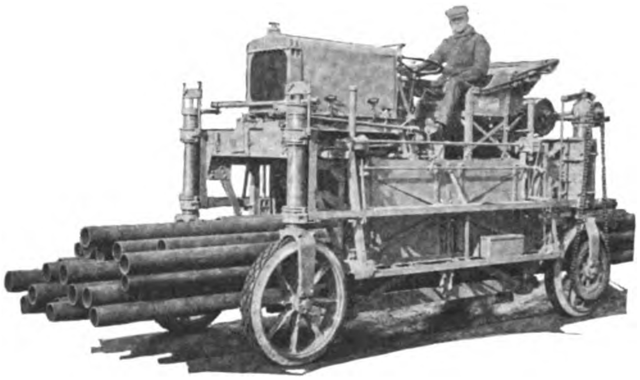
2218 W. LAKE ST. CHICAGO, ILLINOIS

OVENS



One Man and A Ross Carrier

Replace 10 Mules and 10 Men



Lumber and other long materials up to 100 feet are handled with ease with the Ross Carrier. It is without doubt the greatest labor-saving device ever used for handling lumber, pipes, and other long material, which cannot be economically handled by any other equipment.

The Ross Carrier automatically loads and unloads without the driver leaving his seat. The Carrier straddles the load and transports materials to any desired location. Less than 10 seconds required to load or unload—speeds at the rate of eight to twelve miles per hour.

The Ross illustrated catalog will prove to you the efficiency and economy of the Carrier for low cost materials handling.

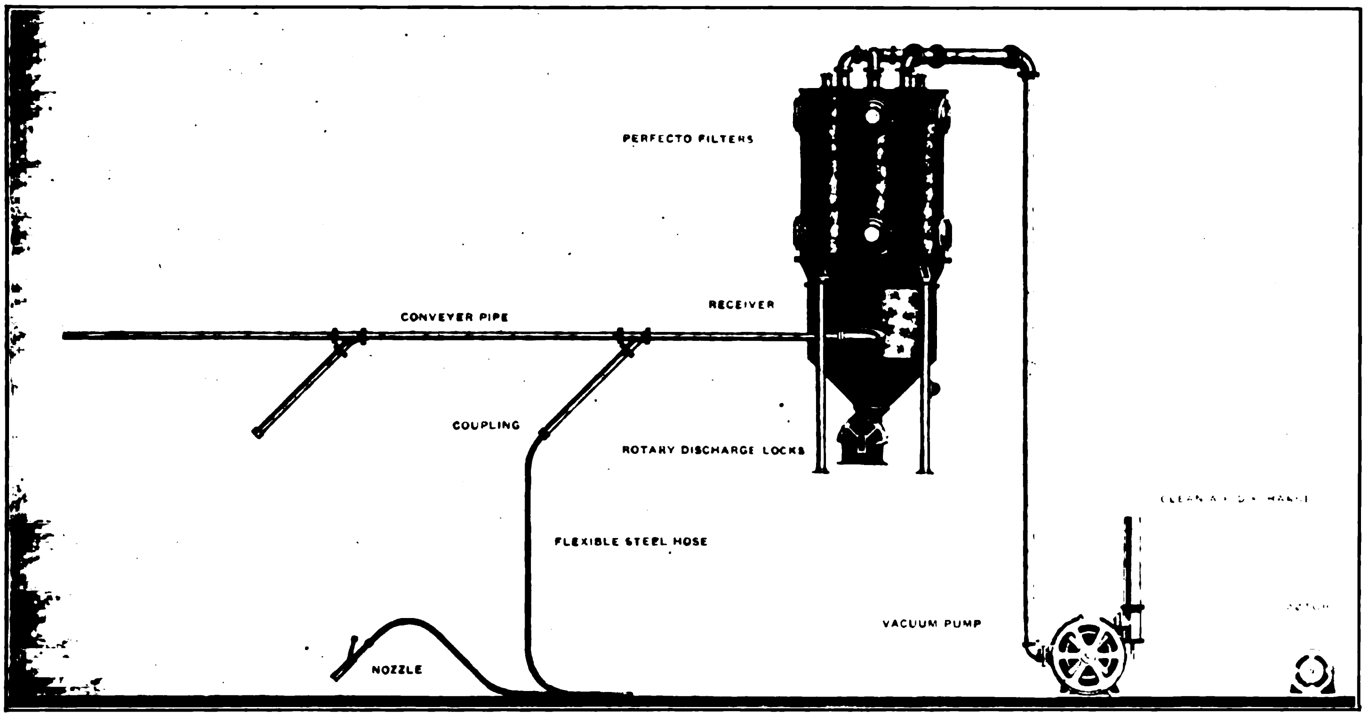
Write for your copy.

The Ross Carrier Company

OFFICE AND PLANT

Benton Harbor, Mich.

Murry Jacobs Co.—Sales Distributor
Seattle—San Francisco—New Orleans



This diagram shows the most complete and modern of efficient systems for handling materials where 100% of the material must be retained and discharged at a single point.

Pneumatic Conveying Now Replaces Hand Labor

Not alone do pneumatic conveyors replace hand labor, but, in the doing, greatly reduce the cost of material handling.

In efficiency, economy, saving of labor, and ease of maintenance,

The Dracco System

is beyond comparison for handling the heaviest as well as the lightest known materials absolutely without dust or loss—collection is 100 percent.

Our literature gives photographs and drawings illustrating how The Dracco System has solved many difficult material handling problems. Yours may be a case parallel to one shown—but whether or not, send for it and find out how the system works and its potential application in your plant.

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

Here a Dracco System Solved a Conveying and a Transportation Problem

Industry now realizes that the most economical way to ship materials such as gypsum, soda, ash, dry sand, cement, clay, grain and similar products is to transport them in bulk in box cars.

But until pneumatic conveying was successfully developed, the handling of dry materials in bags from box cars was a costly and inefficient proposition.

As an example; a large Eastern Plant, who formerly bought large quantities of English Clay with a moisture content of 20% to 25% found a dry domestic clay which was satisfactory and much cheaper.

A Dracco Pneumatic System enabled this concern to use the domestic clay by substantially lowering the handling costs from box cars to distributing bins.

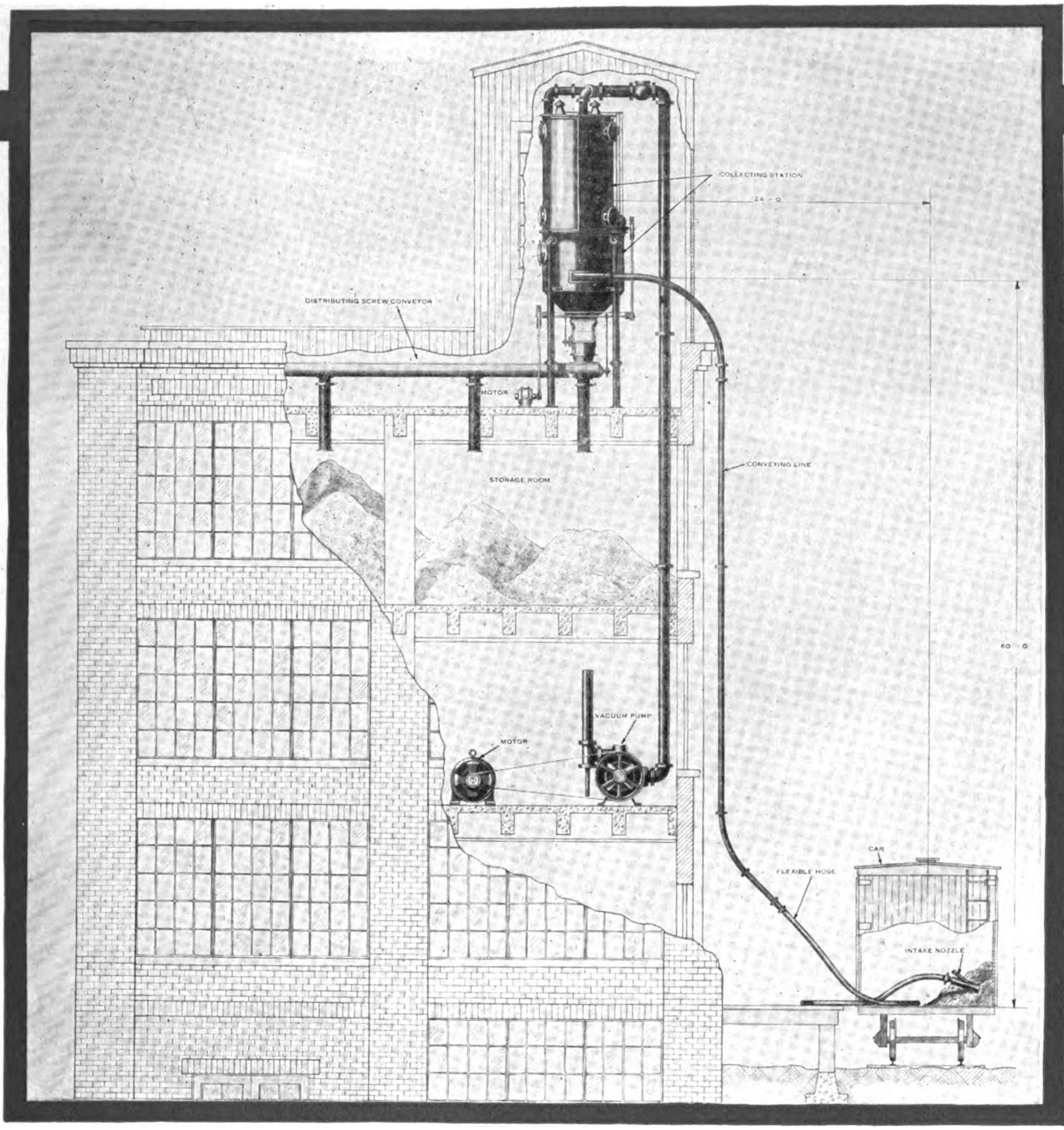
With the Dracco Systems one man is necessary only for unloading and conveying the fine particles of clay. With a 3 inch hose he can unload at the rate of 10 to 12 tons per hour. Two Dracco Systems have been installed here. The successful operation of the first led to the second installation.

Put your conveying problem up to "Dracco," if you have a similar problem or an entirely different one. Write to our engineering department.

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.



From Cars to Storage Bins Direct

The installation above is a Dracco Pneumatic System used for conveying clay from box cars to storage bins. A 3" hose handles 12 tons per hour and every particle of dust is conveyed. Only one man is required for the job. Dracco Systems eliminate costly handling operations injurious to men.

Perhaps "Dracco" will solve your handling problem.

We specialize on Fume Recovery, Dust Collecting and Pneumatic Conveying.

Write for the latest bulletins.

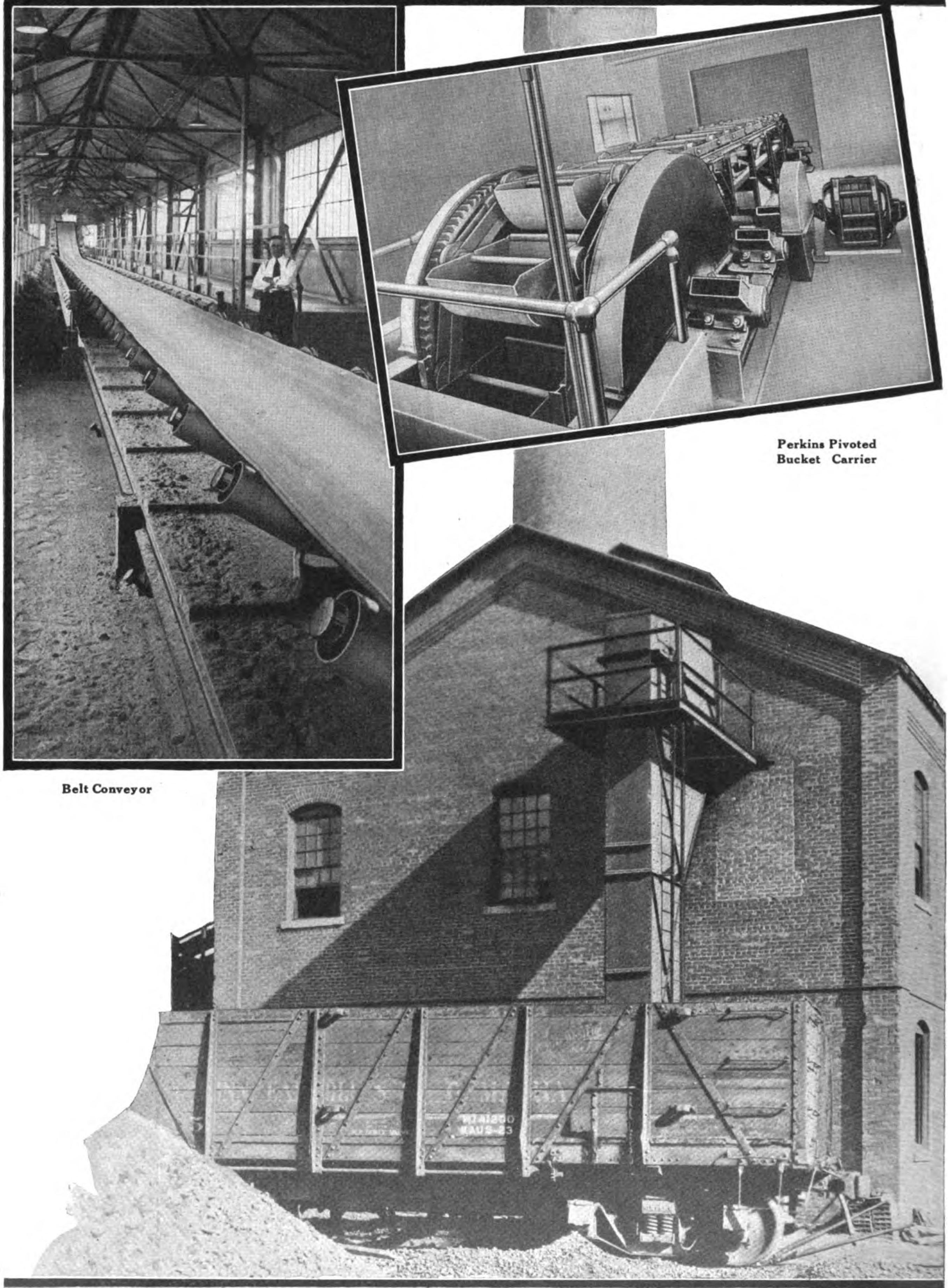
DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

When writing advertisers please mention Industry Illustrated

A Barrett Portable Elevator at the plant of the Buckeye Incubator Co., Springfield, Ohio



Perkins Pivoted Bucket Carrier

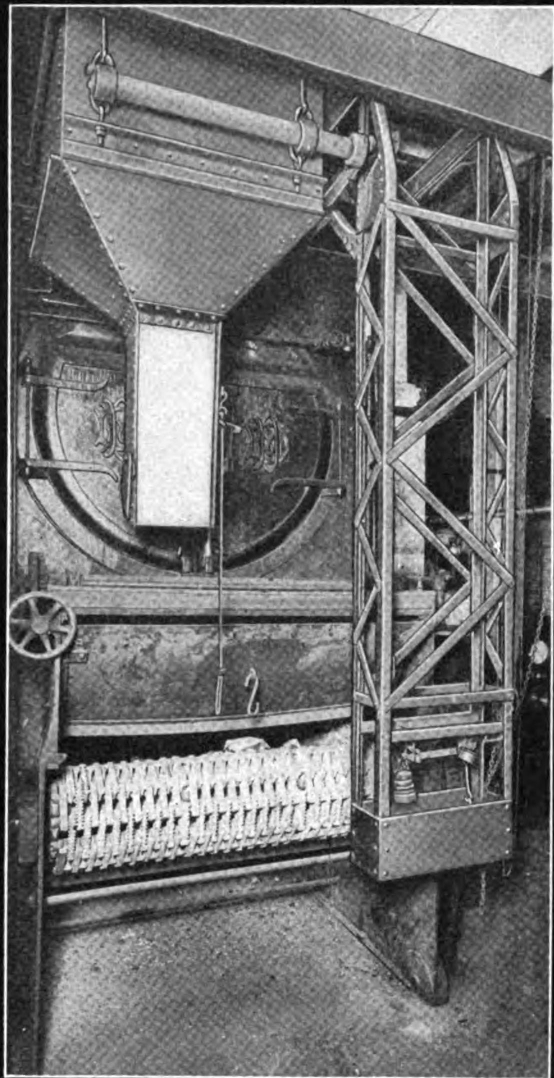
Belt Conveyor

Enduring Satisfaction With WEBSTER Power House Equipment

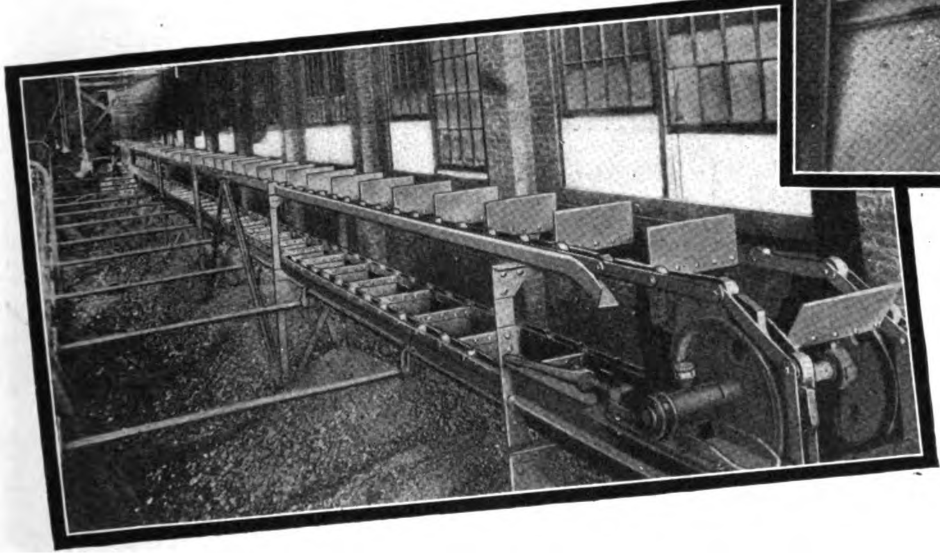
WHEN you provide Webster coal and ashes handling equipment for the power house you get a service of known value. You aren't speculating on unusual, untried construction features of questionable durability and operation.

For nearly a quarter of a century Webster equipment has made good in many of the larger as well as the smaller power houses in the country, and is now recognized as leading machinery for this kind of work. Mechanically correct in design, reliable and dependable in operation, built for years of hard service—that means lasting satisfaction.

Webster engineers have given years of study to the correct handling of coal and ashes in power plants, and can ably assist in selecting equipment to meet your particular requirements. Let them help you.



Traveling Weigh Larry



Flight Conveyor

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

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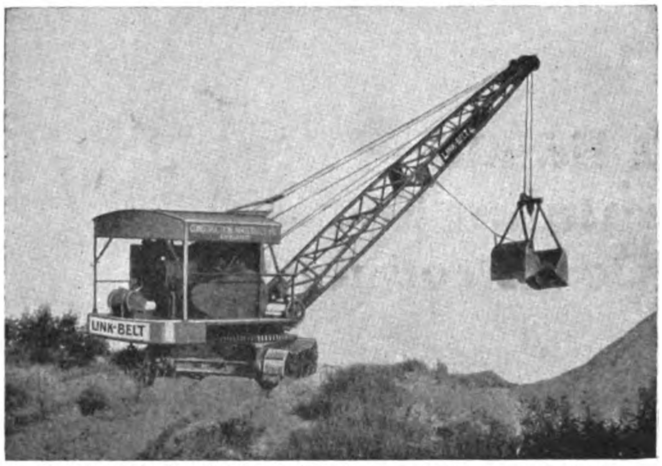
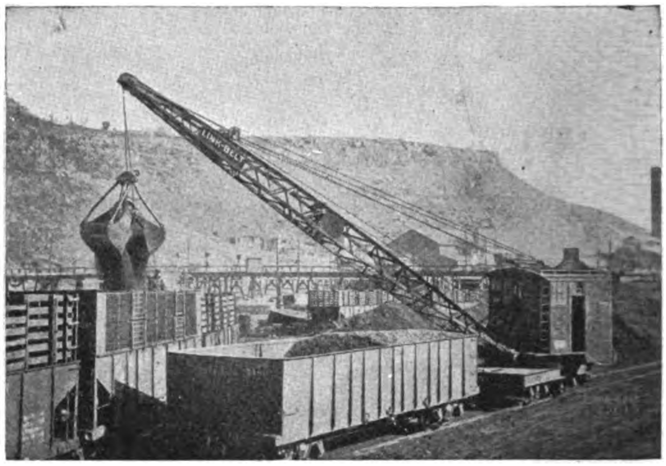
WEBSTER-BRINKLEY COMPANY, 627-669 Alaska St., Seattle, Wash., and 303-305 East Third St., Los Angeles, Cal.
Canadian Factory-Sales Office: WEBSTER-INGLIS LIMITED, 14 Strachan Ave., Toronto, Ont.

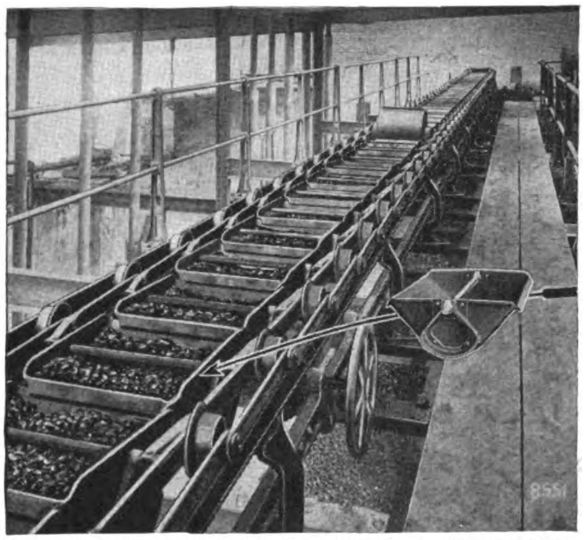


The Link-Belt Crawler Crane lays its own track—goes anywhere. Does the work of 20 to 40 men.



Link-Belt Locomotive Crane performs the service of from 20 to 40 men.

Saving Time, Effort, and Is The Dominant Idea Back

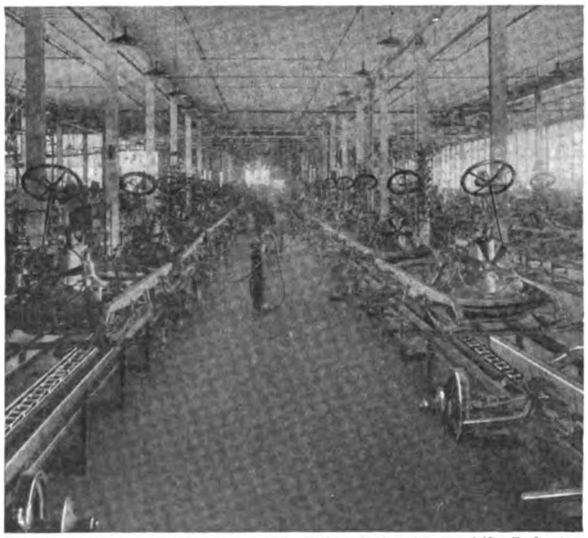


The Peck Carrier. The standard machine for handling coal and ashes in modern power plants.

In *every* industrial plant every step of the manufacturing process, from raw materials to finished products, adds its toll to the cost of handling—a surprisingly large total where labor aiding equipment of the most efficient types is not employed.

To do this handling work, both heavy and light, more quickly, easily, and efficiently—to do more in a given time than was ever done before by any other method—this has been the dominant idea back of all Link-Belt material handling and moving equipment.

The illustrations show but a few of the many Link-Belt products which are successfully accomplishing the purpose for which they were built, in the plants of thousands of users, in practically every industry.

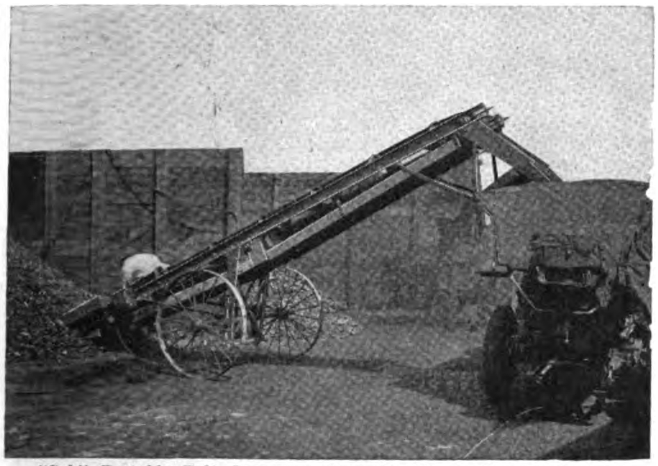


The extensive production characteristic of the Automobile Industry made possible by such conveyors as these. Link-Belt Assembly Conveyors, Willys-Overland Co., Toledo, Ohio.

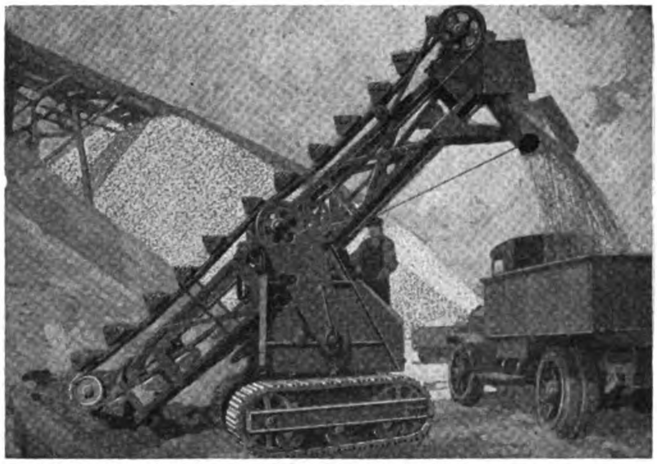
When you buy a Link-Belt product you buy service of a definite kind, guaranteed by the largest (and the recognized pioneer) company, in the conveying, elevating, and power transmission line. Link-Belt elevating and conveying devices today represent the highest development of their respective types, and since we manufacture *all* approved types of such equipment, we employ each, without prejudice, where it serves *best*.

A knowledge of the right use of labor aiding equipment is next in importance to its correctness of design and construction, for if these

LINK-BELT
LABOR-AIDING MACHINERY



"Cub" Portable Belt Conveyor. Capacity 45 cu. ft. per minute. Accomplishes as much as four to eight men with shovels.



Link-Belt "Grizzly"—one-man power-swiveling loader—a loader that swivels, elevates, and backs into the material simultaneously. Does the work of from six to twelve or more men.

Money For Its Users of Link-Belt Equipment

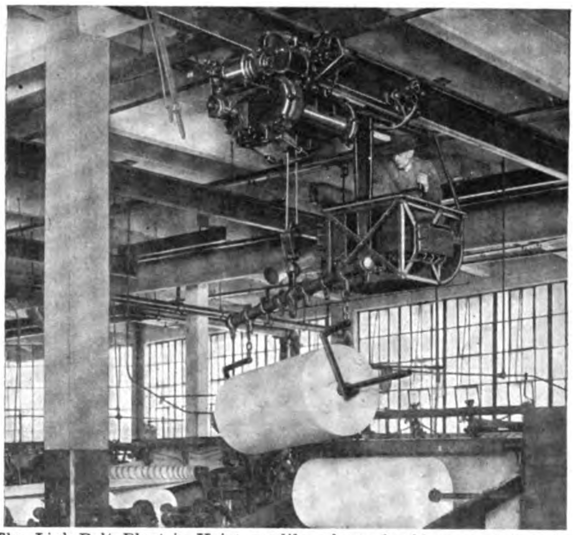
are what they should be, the right use of the equipment will inevitably justify its cost. Therefore, before specifying labor aiding equipment of any kind, its applications should be given thorough study.

Here, Link-Belt engineers can also serve you. Recognizing that their work is not finished when they have designed and constructed a worthy Link-Belt product; that the successful performance and consequent satisfaction of users are almost invariably assured when individual conditions and requirements have been thoroughly studied and analyzed; Link-Belt engineers are always glad to collaborate with your own engineering department, and *prefer* to do so, before recommending the equipment suitable for *your* individual needs.

Thus, there is focussed on your problem—effectively and to your advantage—a knowledge of the best operating practice of thousands of successful users of Link-Belt labor aiding equipment—the cumulative result of 50 years of Link-Belt engineering and manufacturing experience.

To find out if there is a more economical way of handling *your* materials, address the nearest Link-Belt office today.

Link-Belt Belt Conveyor, one of the oldest known conveying devices.



The Link-Belt Electric Hoist readily adapts itself to conditions in almost any plant. A versatile, effective labor-saver.

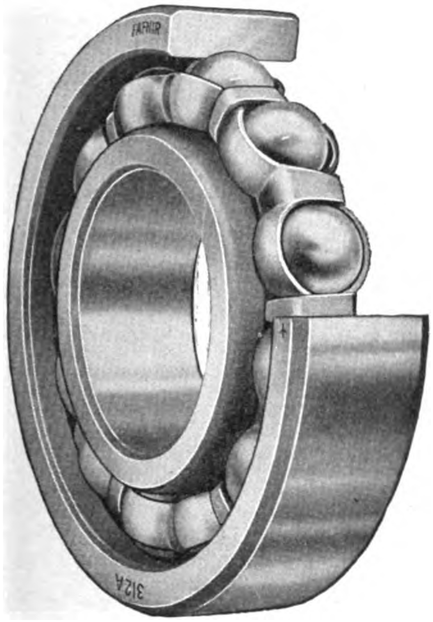
LINK-BELT COMPANY

CHICAGO, 300 W. Pershing Road
PHILADELPHIA, 2045 Hunting Park Ave. INDIANAPOLIS, P. O. Box 346
Offices in Industrial Centers.

1824

LINK-BELT

LABOR-AIDING MACHINERY



FAFNIR

Ball Bearing **EFFICIENCY** is known and universally admitted. Ball Bearing **DEPENDABILITY** is sometimes overlooked.

Power saving in material handling equipment is indeed an important factor but **CONSTANT** and **RELIABLE SERVICE** is vitally necessary.

FAFNIR Ball Bearings are designed for enduring service thru care in the selection of material, thru painstaking workmanship, and last but not least, thru rigid inspection after each operation.

The **MOTORBLOC** illustrated is one of many successful applications of **FAFNIR BALL BEARINGS** to material handling equipment. The armature shaft and the worm are mounted on three single row radial bearings, with a result that frictionless and dependable service is assured.

When you are ready to purchase, specify **FAFNIR DEPENDABLE BALL BEARINGS** in your material handling equipment.

Typical installations are to be found in automatic weighing machinery, in all types of conveyors, cranes and hoists, in elevators, in gasoline and electric locomotives and tractors, in trucks of all types.

There is a FAFNIR BALL BEARING for every bearing purpose

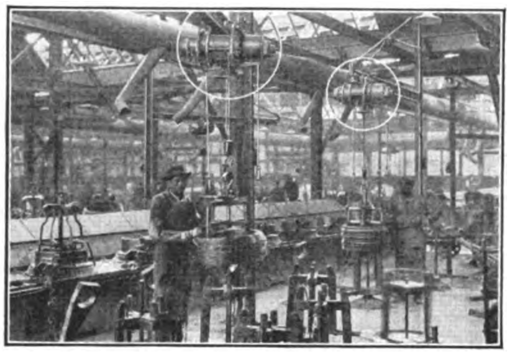
THE FAFNIR BEARING COMPANY

New Britain, Connecticut

Now is the time to

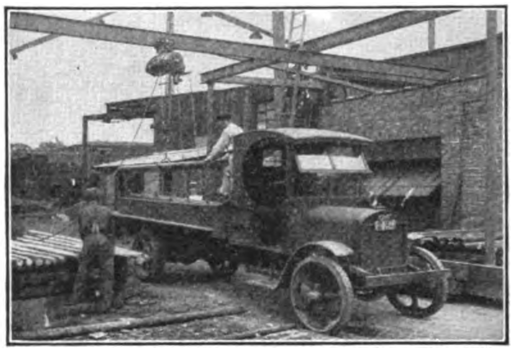
The United States Steel Corporation is spending between $80,000,000 and $90,000,000 for equipment to lower costs. It is one of many corporations who are getting their "houses in order" for big business. They realize that now is the time to prepare for the party.

They know, as every wise business executive knows, that when the new immigration law begins to exercise its full influence, only 150,000 immigrants yearly can be drawn upon for labor instead of 1,500,000, as heretofore. And this new law affects more the countries that supplied most of our unskilled labor than it does those countries which furnished the skilled workmen.



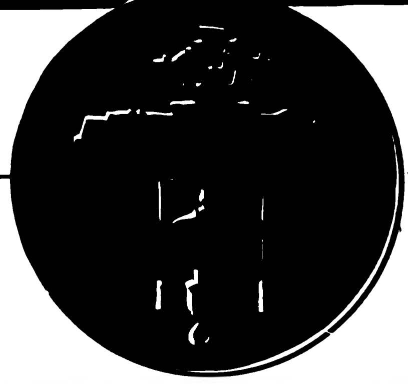
THIS 500 pound capacity electric hoist is the newest addition to the extensive Shepard line. It brings unusual economies to the business that requires lifting and moving of loads of light capacity, as in wire mills for block-stripping, cotton mills as slasher hoist, machine shops, and numerous other places.

THE SHEPARD ELECTRIC LIFTABOUT JR. for 50 loads



THIS hoist is made in ½ and 1 ton capacities. Produced on a quantity production basis, it is exceptionally low in price for the Shepard quality built into it. The LiftAbout "Book of Illustrated Economies" depicts and describes over 60 ways by which it is saving money in many and varied lines. Send for it.

THE SHEPARD ELECTRIC LIFTABOUT



REG. U.S. PAT. OFF.

SHEPARD

America's largest

prepare for the party!

In most every line of commercial and industrial activity lifting and load-moving are big factors in the cost of production and distribution—the jobs that in many businesses now rest with unskilled labor.

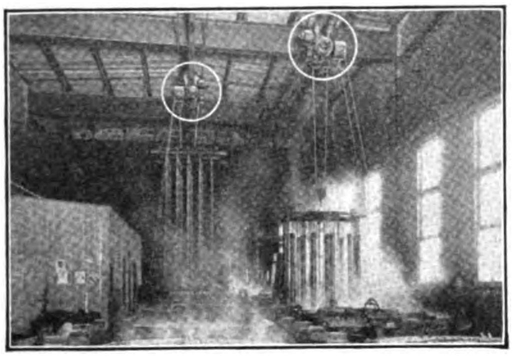
Thousands of business executives carry on their lifting and load-moving at rock bottom cost—they use Shepard Electric Hoists.

These hoists are made in capacities of ¼ ton to 10 tons and are operating in great numbers in practically every known business and industry.

The Shepard Electric Crane & Hoist Company can show you actual dollars and cents savings on every type of Shepard hoist in service. Shepard hoists will save for you. The four general types are shown herewith. Write for information today.

Shepard Electric Crane & Hoist Co., 420 Schuyler Ave., Montour Falls, N. Y.

Branches in Principal Cities *Member Electric Hoist Mfrs.' Assn.*

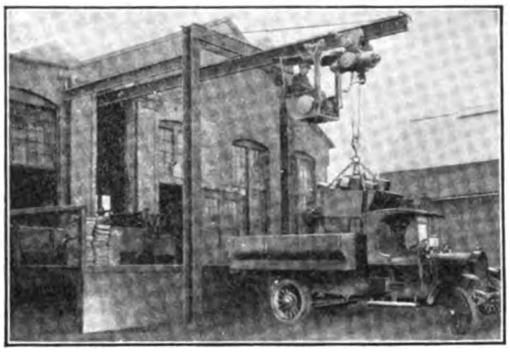


THIS is the standard line of Shepard hoists in capacities to 10 tons. Made in types for application in hundreds of ways. They, *like all Shepard equipment,* are dust-, damp-, dirt- and fume-proof throughout.

With the wide range of hoists which we can supply in this group, and the others, every type of business may have economical load handling machinery.

ELECTRIC HOISTS

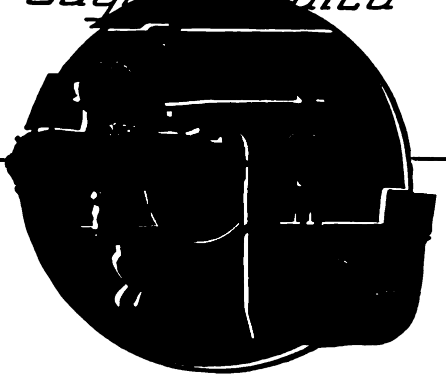
Capaci 10 tons



SHEPARD Cage Operated Electric Hoists are controlled by a man who rides in the traveling cage. An extensive overhead track system may be laid out to carry loads between departments and buildings, thereby reducing handling costs to the minimum. Capacities to 10 tons.

ELECTRIC HOISTS

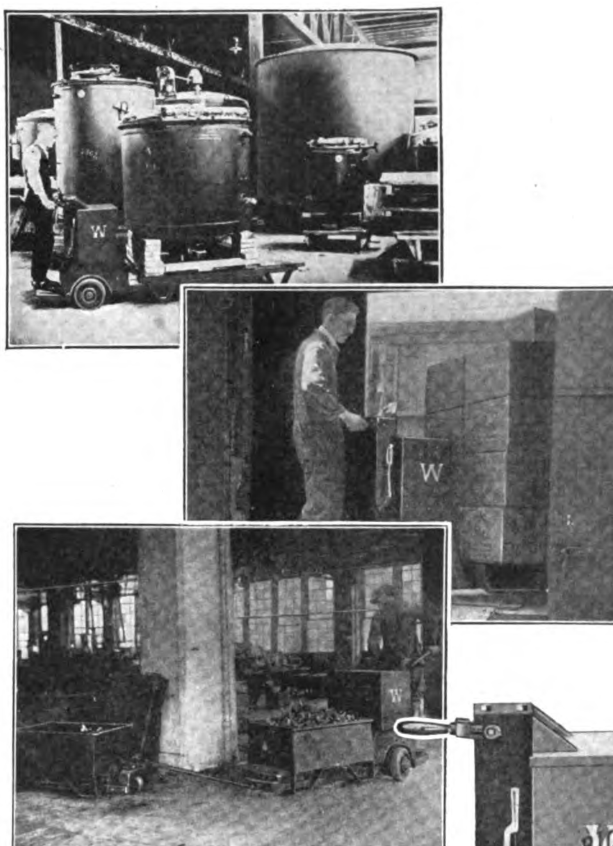
Cag rated



ELECTRIC HOISTS

manufacturer of electric hoists

Wherever You Employ a Hand Lift You Can Use ~ A Wright Electric Lift Truck



Here is the Electric Lift Truck that, because of its small size, can get around sharp corners, through ordinary sized doors, into small elevators and in other places where the average electric lift truck cannot be used.

Your hand lift truck platforms will fit the Wright Electric Truck. Larger platforms are unnecessary with the Wright.

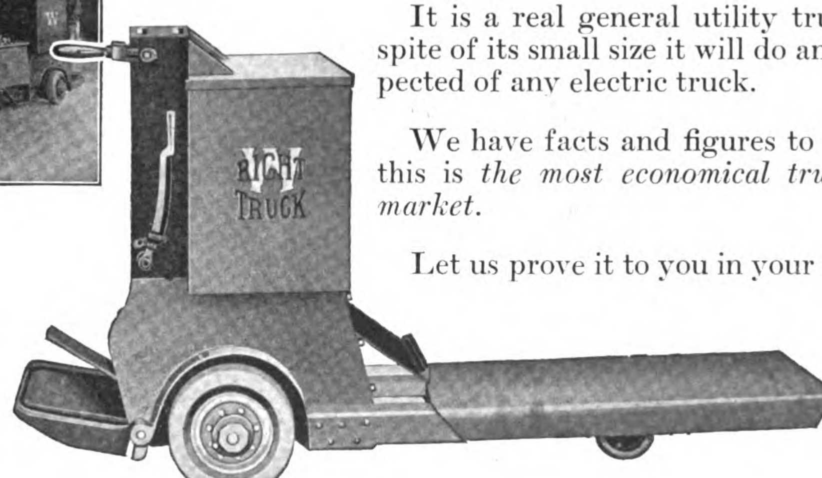
It is the most compact and accessible truck built. And only one motor, instead of two, is used for propelling the truck and for lifting.

It has the shortest turning radius—turns in a circle of 5 ft. (outerwheel). No other truck can turn in such an exceptionally short turning radius.

It is a real general utility truck and in spite of its small size it will do anything expected of any electric truck.

We have facts and figures to prove that this is *the most economical truck on the market.*

Let us prove it to you in your own plant.



Note the places where a Wright Truck can go, which are inaccessible to any other electric.

Wright-Hibbard Industrial Electric Truck Co., Inc.

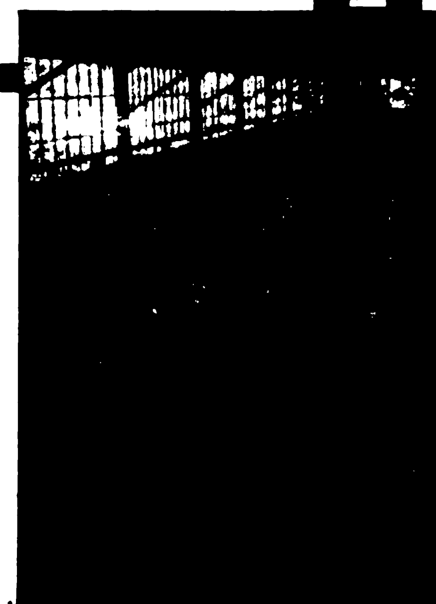
Main Office and Factory

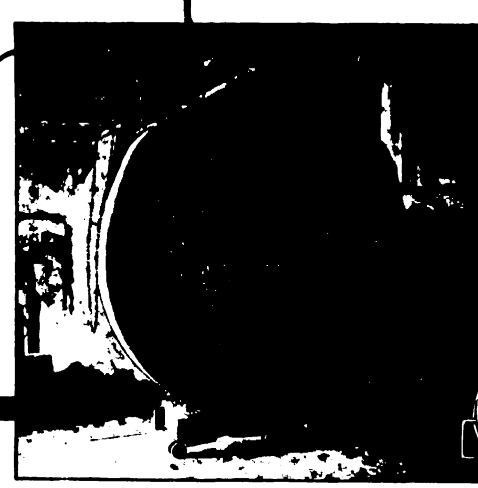
Phelps, N.Y., U.S.A.

The Boston Woven Hose & Rubber Co. is a typical New England Industry

FROM a small beginning, back in 1870, this business has grown until our plant at Cambridge, Mass., as shown in the following pages is today the largest factory in the world devoted exclusively to the manufacture of mechanical rubber goods.

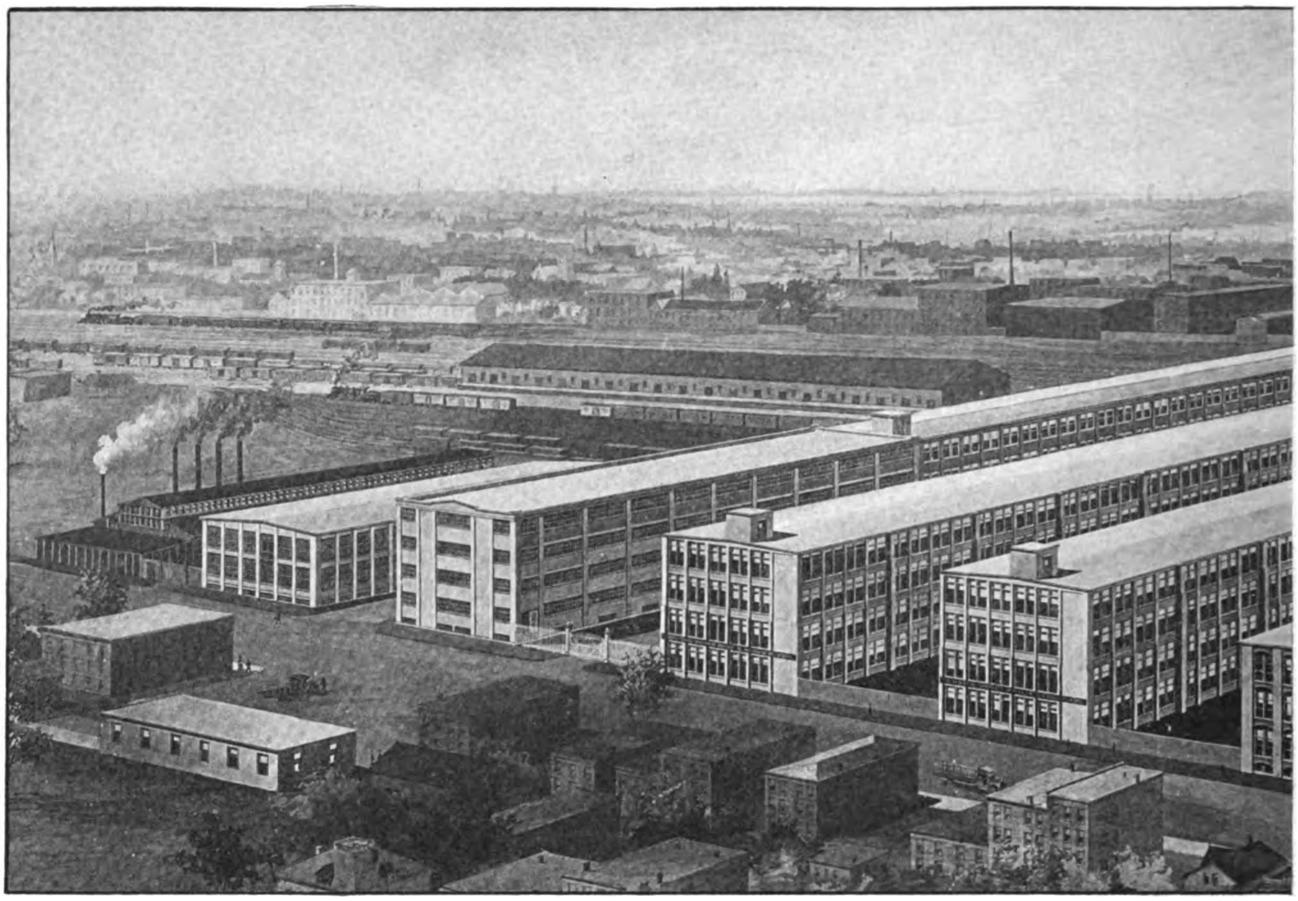
In the field of rubber belting, our facilities for manufacturing include all types known to industrial service, Transmission, Conveyor and Elevator.





Boston Woven Hose & Rubber Co.

Works: Cambridge, Mass. Postal Address, Box 5077, Boston, Mass.

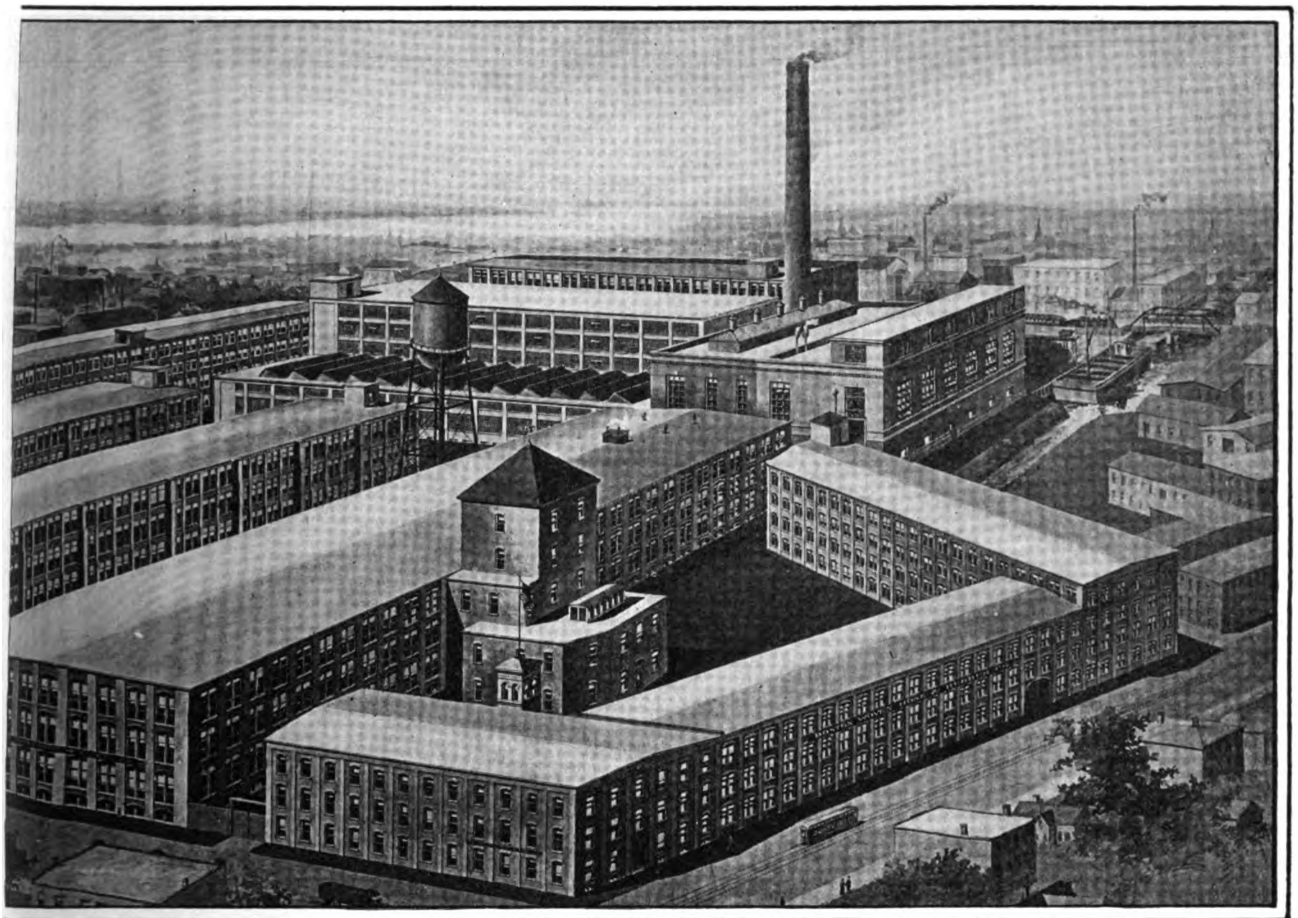


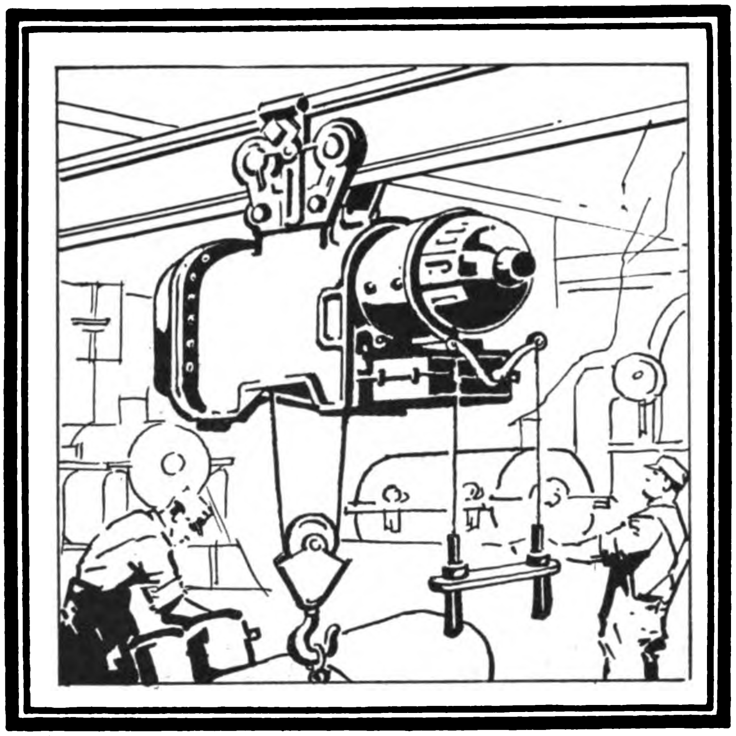
Largest Factory in the W
to the Manufacture of I

CONVEYOR and materials handling belting made to B.W.H.&R. Company's standards and resulting from more than half a century's experience in mechanical rubber goods manufacture may be found in use all over the world.

B.W.H. Conveyor belts carry coal, sand, rocks, ore, gravel, hot substances, barrels, boxes and are found on long and short travel conveyors, on skip

Boston Woven





Freedom from Maintenance Troubles In Overhead Handling

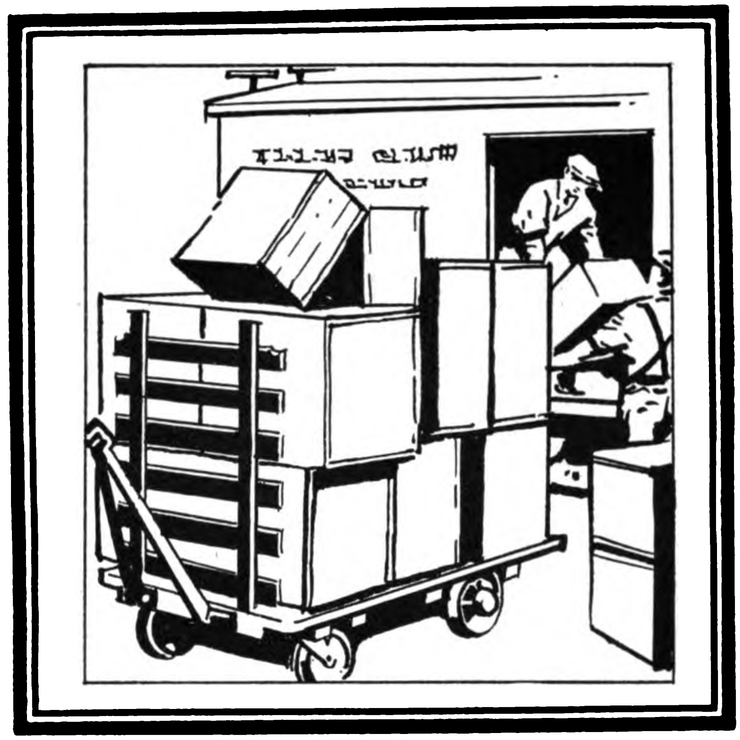
MOST of the ills of overhead handling equipment arise from worn out plain bearings. Their inaccessibility results in neglected lubrication and consequent failure.

Hyatt roller bearings successfully meet the peculiar needs of this class of equipment. Hyatt equipped cranes, trolleys and hoists require lubrication only once every three or four months to render consistently dependable service.

The well known sturdiness of Hyatt bearings successfully withstands abuse and overloading, and adds length of life to the equipment. Their uniformly easy turning insures smooth operation and accurate spotting of loads.

You can give your plant more economical and reliable overhead handling service by specifying Hyatt bearing equipment.

HYATT ROLLER BEARINGS FOR CRANES, TROLLEYS AND HOISTS



Better Service From Better Trucks

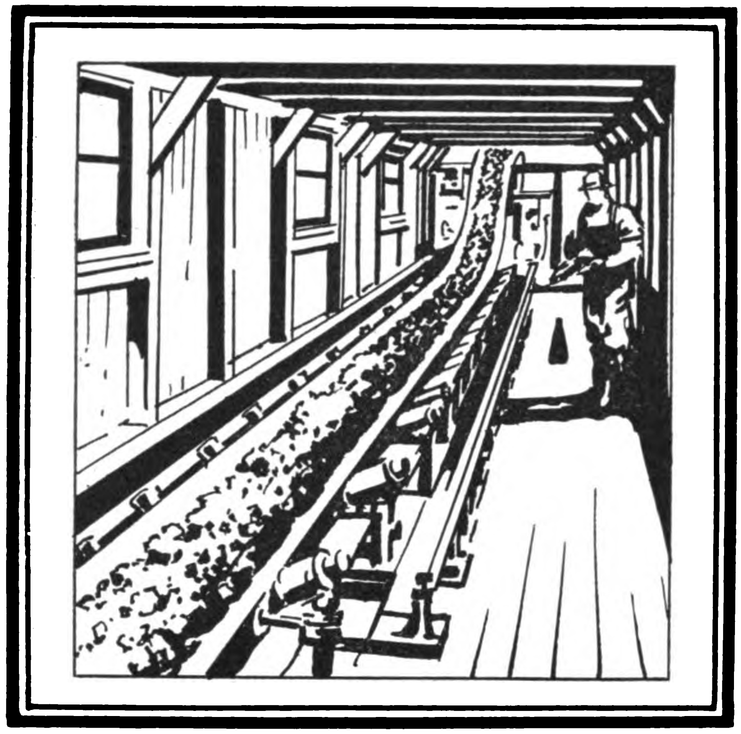
HAND trucks, trailer trucks, lift trucks, elevating trucks—trucks of all types are better investments and render better service when their wheels turn on Hyatt roller bearings.

More loads can be handled per man, per tractor, and per hour when Hyatt equipped trucks are used. These trucks make loads seem lighter, keep truckers more contented, and greatly speed up the movement of material.

The free turning of Hyatt bearings in truck wheels, their positive oil-conserving lubrication and their dependable durability make them the preferred choice for better truck service.

Modernize your trucking methods and equipment and insure better service and economy by specifying Hyatt bearings.

HYATT ROLLER BEARINGS FOR ALL TYPES OF TRUCKS



Uninterrupted Conveyor Operation At the Lowest Cost

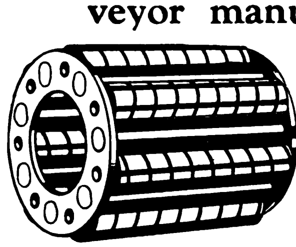
DURABLE bearings that materially reduce friction in belt conveyor pulleys insure uninterrupted service and reduce operating costs.

Hyatt bearings in the idler pulleys and in the head, tail, bend, snub, take-up and tripper pulleys make easier running conveyors and yield these advantages in first cost, operation and maintenance:

Lighter weight belts	Longer belt life
Smaller driving motors	Elimination of hot bearings
Longer single span conveyors	No bearing replacements
Infrequent lubrication periods	Longer pulley life

Power saving of 20% to 50%

Specify Hyatt equipped belt conveyors. Leading conveyor manufacturers are prepared to furnish them.



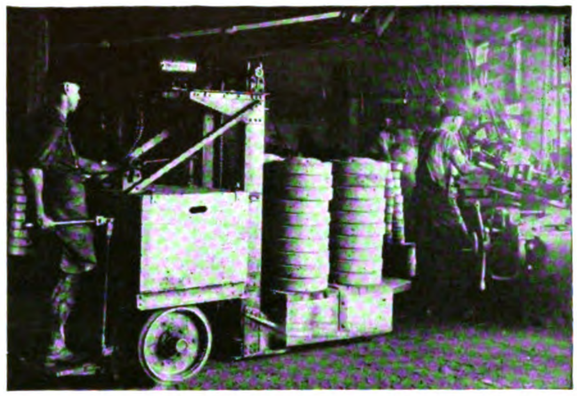
HYATT ROLLER BEARING COMPANY
NEWARK DETROIT CHICAGO SAN FRANCISCO
HUNTINGTON PHILADELPHIA PITTSBURGH MINNEAPOLIS
WORCESTER CLEVELAND MILWAUKEE

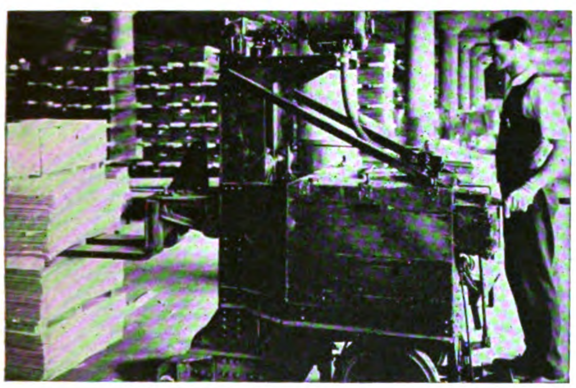
HYATT ROLLER BEARINGS FOR BELT CONVEYOR PULLEYS

50% Is The Reduction in Handling Costs By Using THE TIER-LIFT

Saves over $5000 a year in this Plant

With the Tier-Lift forty fly wheels are carried on each skid. The aisles are clear and the men know that a skid load completed is 40 pieces. Increased production results from men not having to leave a producing unit to go get work. The resultant savings are over $5,000 a year.





No Skids Needed to Carry This Load

The fork attachment makes it possible to handle sheets, boxes, bales, etc., without using skids. This Tier-Lift is handling 2,000 lbs. loads of sheet metal. Each load on two-by-fours, providing plenty of room for the steel fork to pick up the load.

Send for This New Book

It illustrates the application of the Tier-Lift in a way that will bring to mind at least one daily operation in your plant, the cost of which can be substantially reduced by the Tier-Lift.

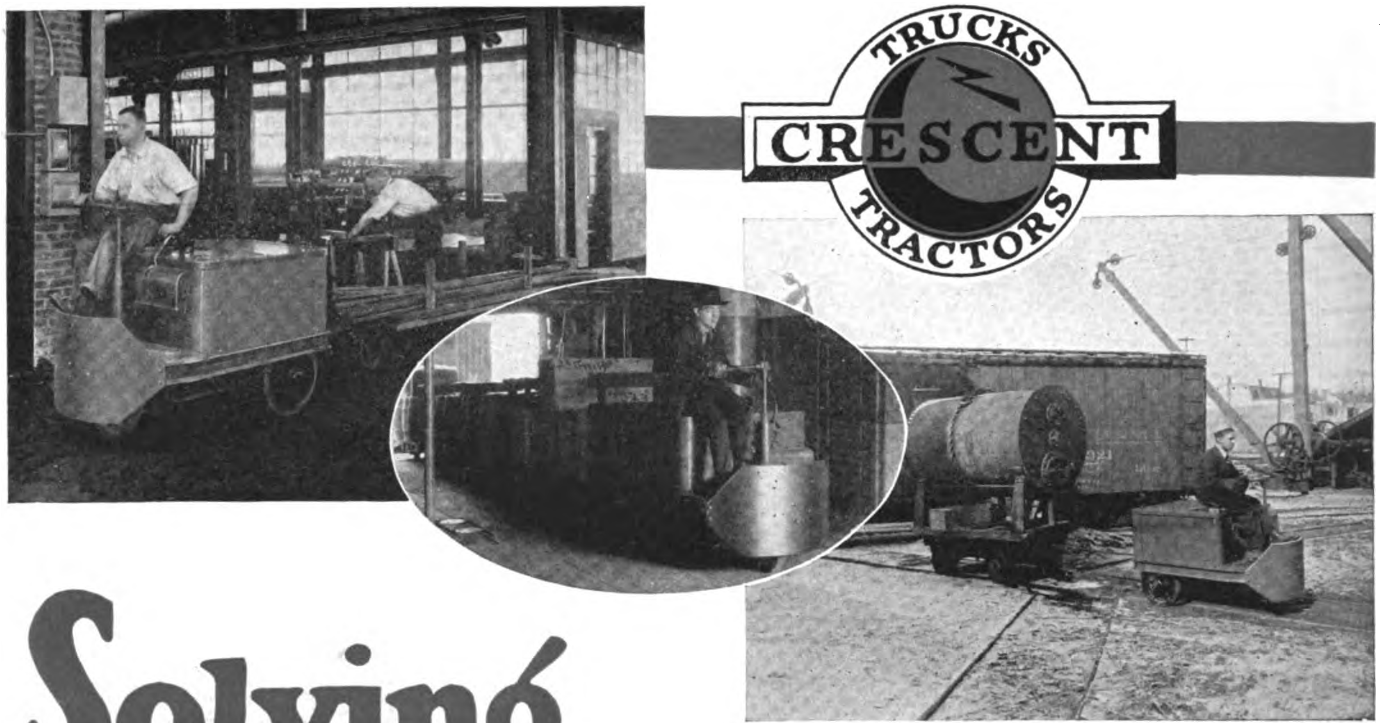
The use of the Tier-Lift not alone lowers the cost of handling, but nearly doubles storage capacity. In fact, it raises heavy loads to heights heretofore prohibitive. *The Tier-Lift in many cases saves 50% of handling costs.*

This new booklet "Snap Shots of Sensible Savings" suggests many economies—Send for it.

THE LAKEWOOD ENGINEERING CO.

ORIGINATORS AND PATENTEES OF THE TIER-LIFT

CLEVELAND, OHIO



Solving

Your Material Transportation Problems

The cost reducing features of Crescent Trucks, their versatility and adaptability to every condition make them a necessity in the well balanced organization.

The list of well known firms who have fleets of Crescent Trucks—two, three and many more—is a veritable who's who in industry.

Let our engineers study your plant and make recommendations. Their services are available upon application, and without obligation. Let them demonstrate the economy and added efficiency of Crescent Trucks.

IT PAYS TO "CRESCENT-IZE"

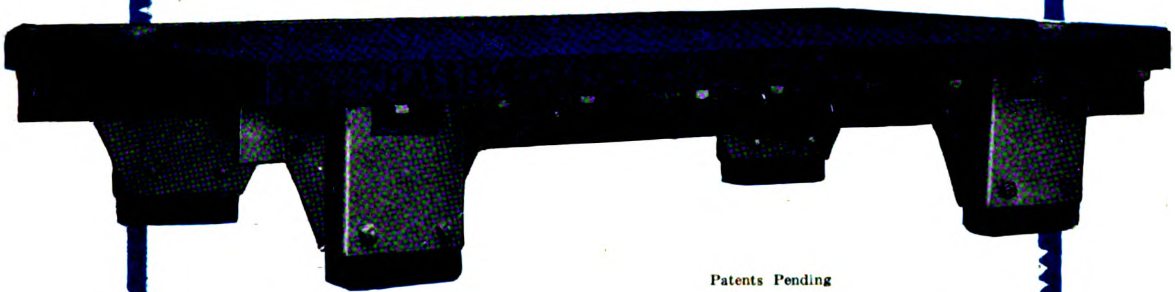
Every Engineer and every executive should have a copy of our catalogue in their file.

CRESCENT TRUCK CO.
165 North 10th Street
Lebanon - - - - - - - Pa.

HALLOWELL

STEEL LIFT TRUCK PLATFORMS

Why not Standardize on "Hallowells"?



Patents Pending

"Hallowell" parts are manufactured in large quantities, but they are assembled into complete platforms only as orders are received; for the reason that conditions of each individual installation are taken into consideration and a suitably constructed platform recommended.

The same specially designed steel leg holders, and the same method of attaching them to the runners—both of which are outstanding "Hallowell" features—are employed in all of our platforms, but as the size, load to be carried, and severity of conditions increase, so the sections are made heavier and larger.

Thus, every "Hallowell" is built exactly to your requirements and in accordance with the conditions in your plant. Yet, because of quantity production, the price of a "Hallowell" is comparatively low.

Give the "Hallowell" a trial—you'll then know why so many large and prominent concerns throughout the country have adopted it as their standard.

A Few of Our Other Specialties

"Pioneer" Steel Shaft Hangers

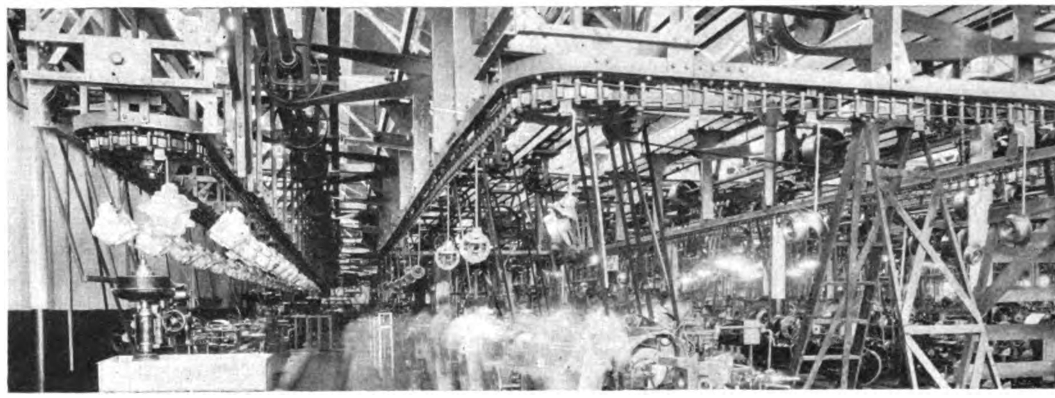
"Hallowell" Steel Bench Legs

"Standco" Hollow Set Screws

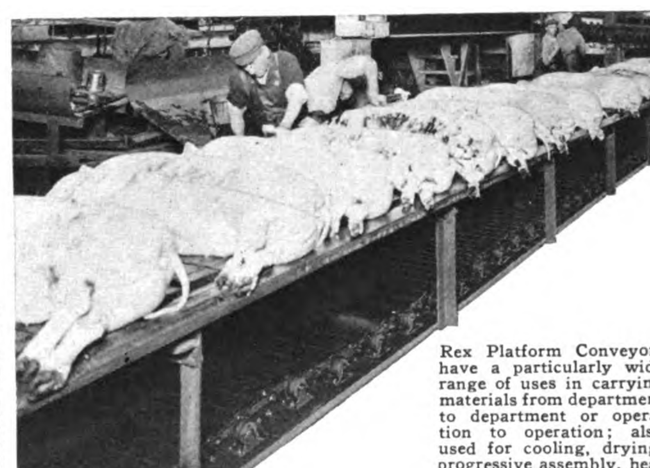
STANDARD PRESSED STEEL CO.

JENKINTOWN, PA.

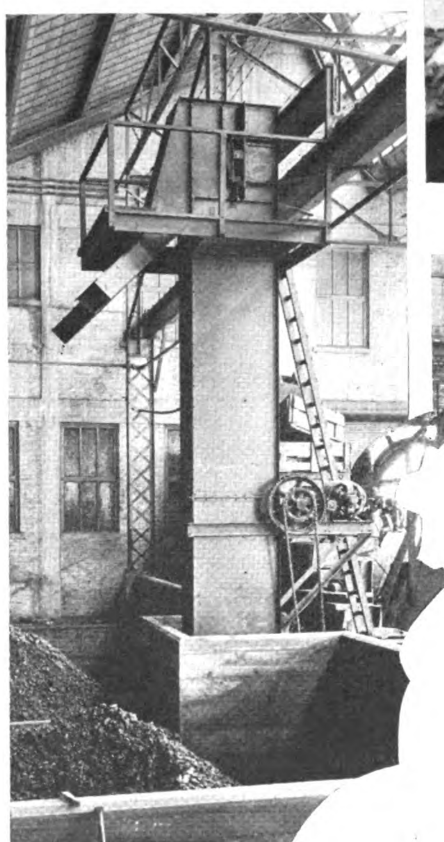
Approved by



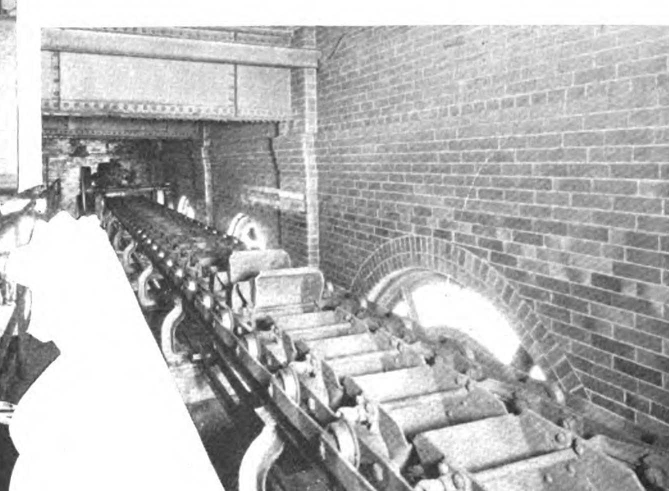
Overhead Trolley Conveyors, equipped with Rex Griplock Chain,—carry parts from operation to operation or through drying ovens.



Rex Platform Conveyors have a particularly wide range of uses in carrying materials from department to department or operation to operation; also used for cooling, drying, progressive assembly, heat treating, etc.



Rex Bucket Elevators are generally used for handling bulky materials, such as coal, ashes, coke, cement, sand, fertilizer, etc.



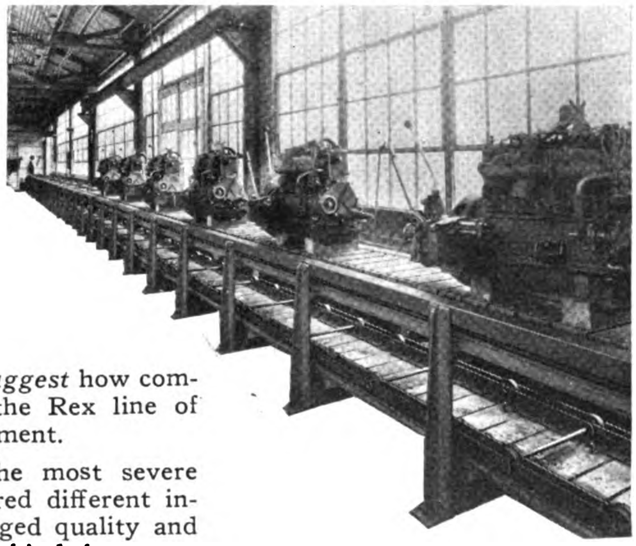
Rex Pivoted Bucket Carrier for handling coal, ashes, ore, cement, stone and other bulky materials.

REX

100 Industries

Rex Escalators (inclined loading conveyors) enable workmen to handle a great deal more tonnage with less fatigue and make possible a big saving in shipping costs.

Rex Progressive Assembly Conveyors. This type of conveyor, highly developed in the automotive field, is largely responsible for America's outstanding industrial achievement—quantity production at low cost. They are adaptable for many other industries.



These photographs can only *suggest* how comprehensive and complete is the Rex line of elevating and conveying equipment.

Thousands of tests under the most severe service conditions, in a hundred different industries, have proved the rugged quality and sound engineering principles behind these conveyors.

Years of experience in every major industry have equipped Chain Belt Company engineers to cope with practically any material handling problem. They can analyze your particular needs, design and build the conveyors, and when so desired, erect them in your plant ready to run.

What Rex Conveyors have done to speed up production and lower costs in hundreds of other plants they can do in yours. Write today for the Rex Handbook on Chains and Conveyors. It contains 512 pages of valuable engineering data.

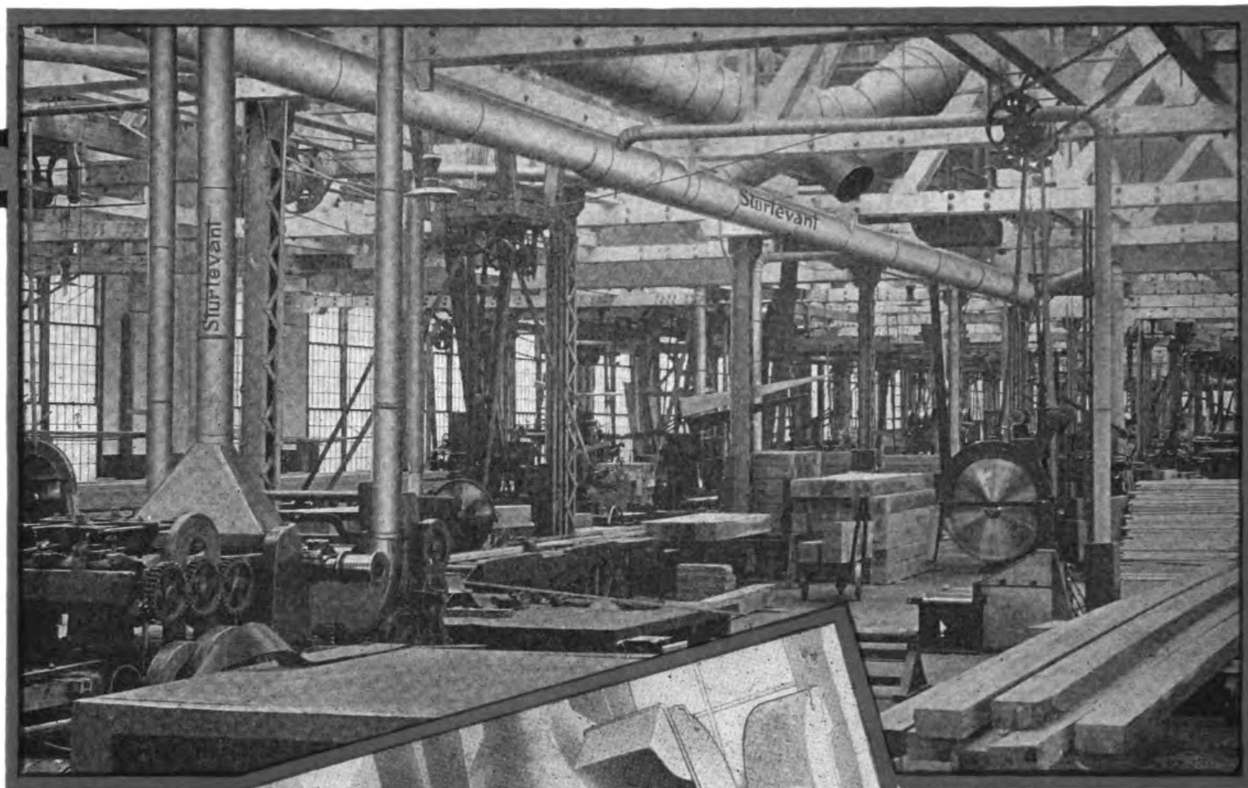
Among the major industries served by Rex Conveyors are:

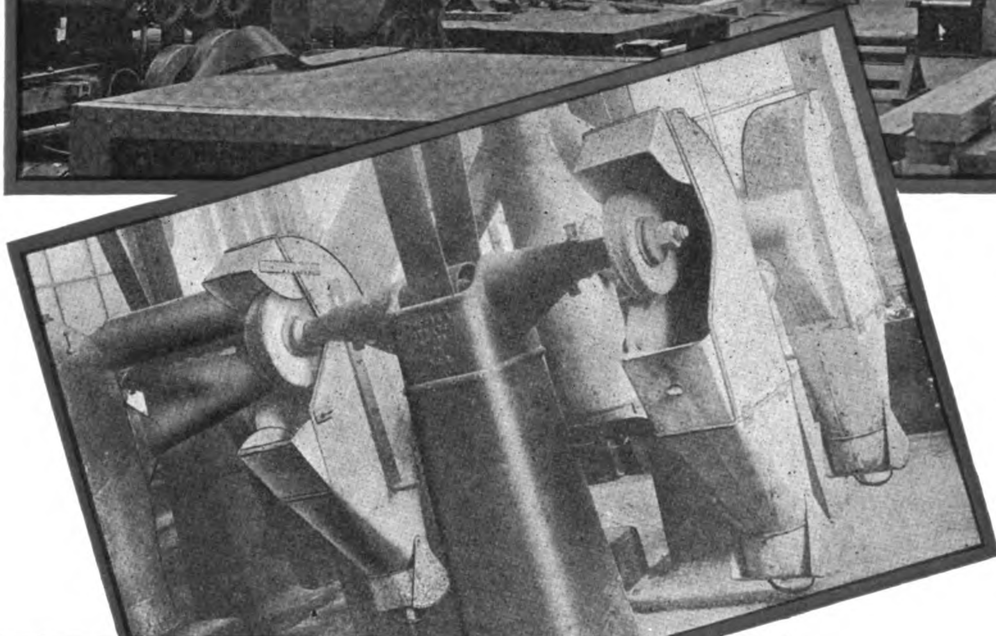
Automotive
Steel
Cement
Fertilizer
Canning
Glass
Tire
Power Plants
Warehouses
Flour
Grain Elevators
Packing
Railroads
and
Many Others

CHAIN BELT COMPANY

Milwaukee, Wisconsin

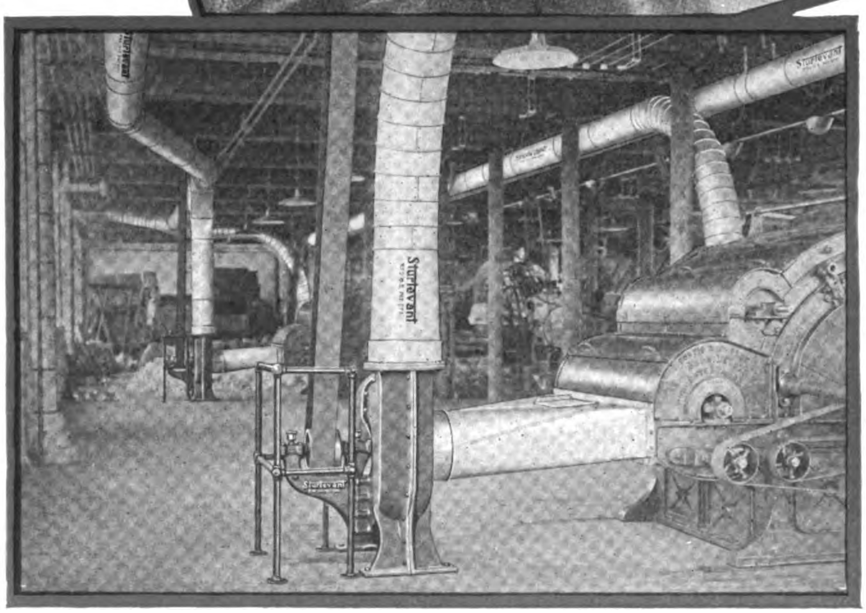
CONVEYORS



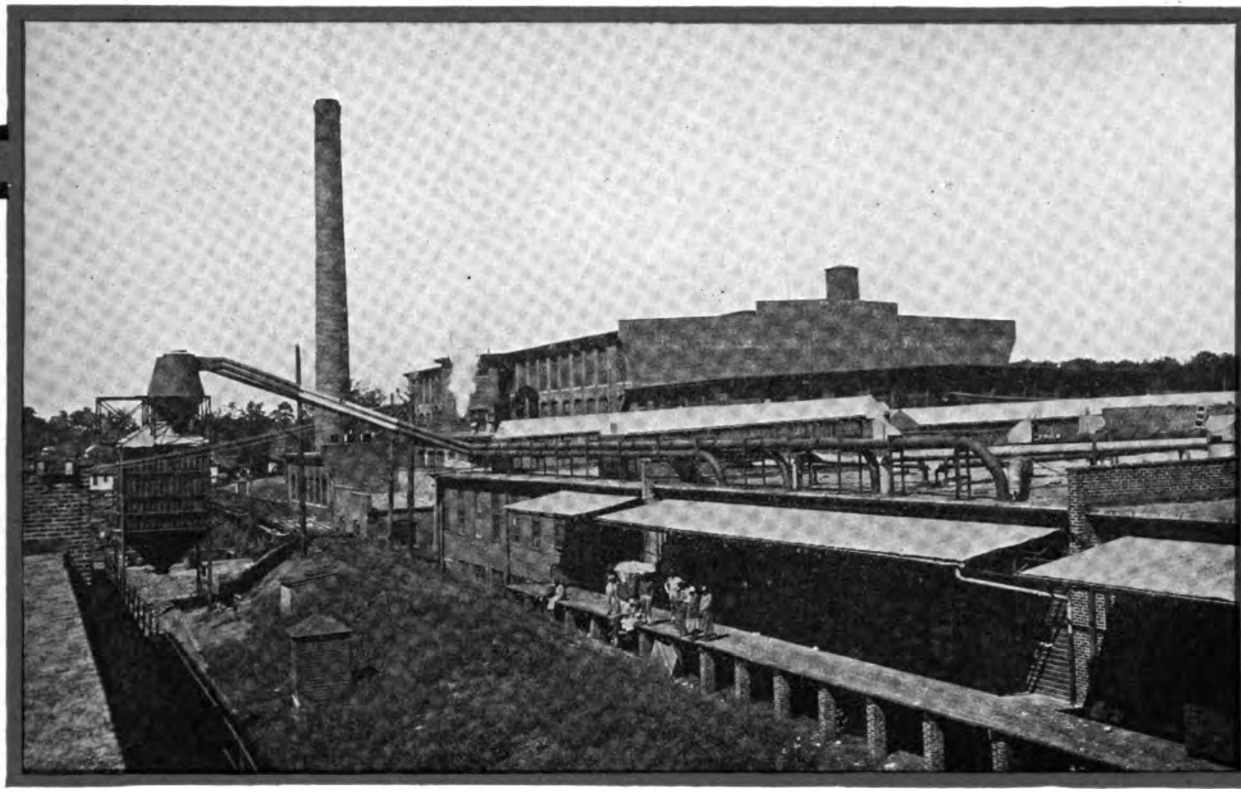


Pneumat

Here are a few applications of Sturtevant Pneumatic Systems in a wood-working plant, grinding and polishing room and sand blast.



Sturtevant Pneumatic Conveyveying Systems are largely used on materials, such as: Wool, cotton, hair, flax, hemp, jute, rags, shoddy, chips, cork dust, shavings, waste paper, pulverized fuel, jute bagging, grain seeds, coffee, cereal, wood or paper pulp, tan bark, etc.



ic Conveying Saves Labor Costs and Eliminates Dust Hazards

THE Sturtevant Pneumatic System of conveying materials has solved many and varied difficult problems. It is rapid and economical, avoids a great deal of labor and protects the product in transit. Every particle is conveyed—no loss at any point.

Examples of the tremendous savings effected and the efficiency of Sturtevant Pneumatic Systems are apparent in many industries.

At one plant—a textile mill—a Sturtevant system handles 15000 lbs. of waste per 10 hour day. The material is conveyed to overhead bins from which wagons are loaded. Three hand truckers have been eliminated.

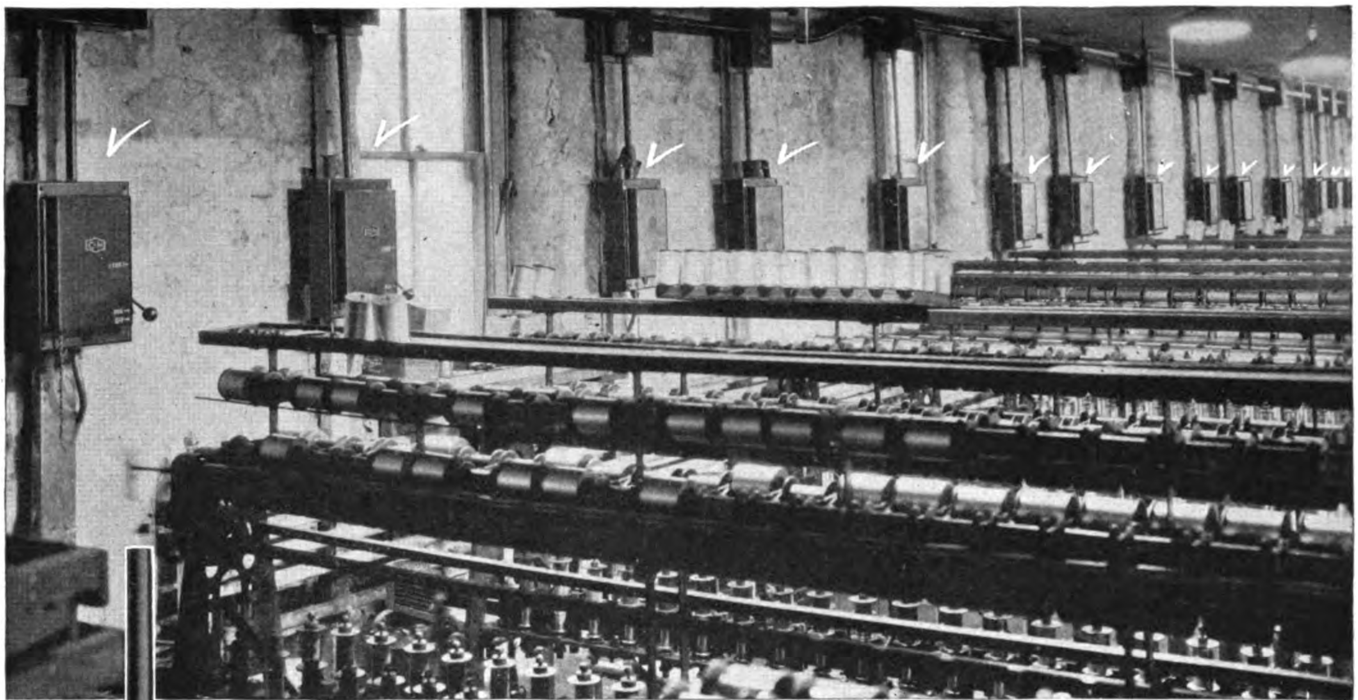
And the Sturtevant System has eliminated dust particles floating around the air from all workrooms.

Our engineers will gladly look over your plant without obligation. Perhaps a Sturtevant System is the logical solution to your conveying problem. Write and have them call.

Sturtevant
PUTS AIR TO WORK

HYDE PARK
BOSTON
MASS.

1061



Spinning Frames—driven by 3 H. P. motors started by Cutler-Hammer 9116 Enclosed Starters. Fourteen used in this room—Twentieth Century Silk Corp., Bethlehem, Pa.

Simple Safety Starters

Each of the fourteen 3 H. P. squirrel cage motors used in this high speed spinning room is started by simply throwing up the handle of the C-H Enclosed Starter.

No need for opening up the front panel of the case—in fact except for occasional inspection or replacement of a fuse there is no necessity for ever looking inside the case.

As a further safety precaution, the panel is interlocked so that when lowered to expose the interior, the contacts are thrown to the "off" position and therefore the exposed parts are dead.

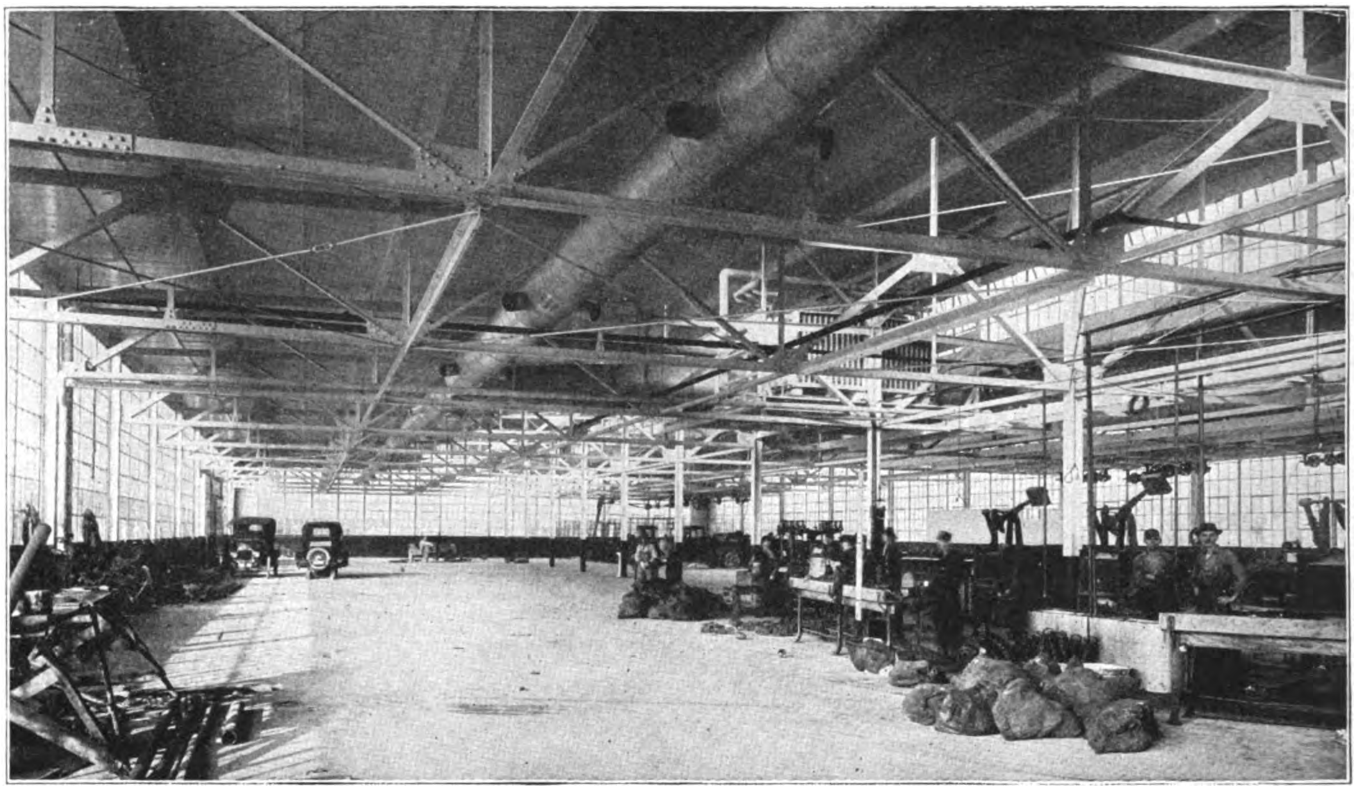
Starting and Speed Regulating Control for All Motor Applications

During the last 30 years of widened use of motor drive, Cutler-Hammer engineers have developed the most extensive line of motor starting and control equipment. The experience of C-H is at your disposal.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Elec. Co., Ltd., Canada

C-H

CUTLER-HAMMER

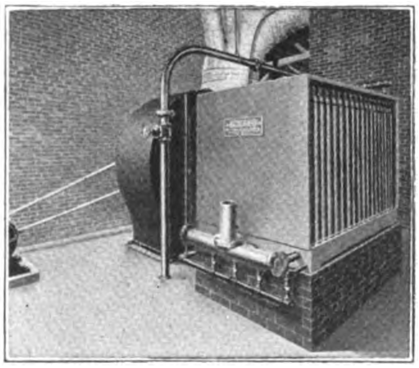


Conveying Warm Air Through Ducts Is the Modern Economical Method of Heating

By G. C. Polk

There's one fundamental principle behind American Blower heating systems employing forced circulation that gives them a big economical advantage over radiators.

Warm air is literally manufactured in a central plant instead of in a hundred smaller plants (radiators) scattered throughout the factory. This central plant has a much higher efficiency than scattered units, and produces heat at lower cost.



The warm air thus economically produced is distributed through ducts throughout the building.

The fans used for this purpose force the air over heating coils making each square foot of radiating surface deliver as much as five times the heat possible with natural circulation, thus reducing the necessary amount of radiation.

The initial and operating costs of a plant of this kind are lower than with a system of radiators. More usable heat is delivered per pound of coal. Temperatures are uniform everywhere because of more perfect air distribution. Rapid heating in the morning makes possible low night temperatures. In summer the plant can be employed for ventilation alone without heat.

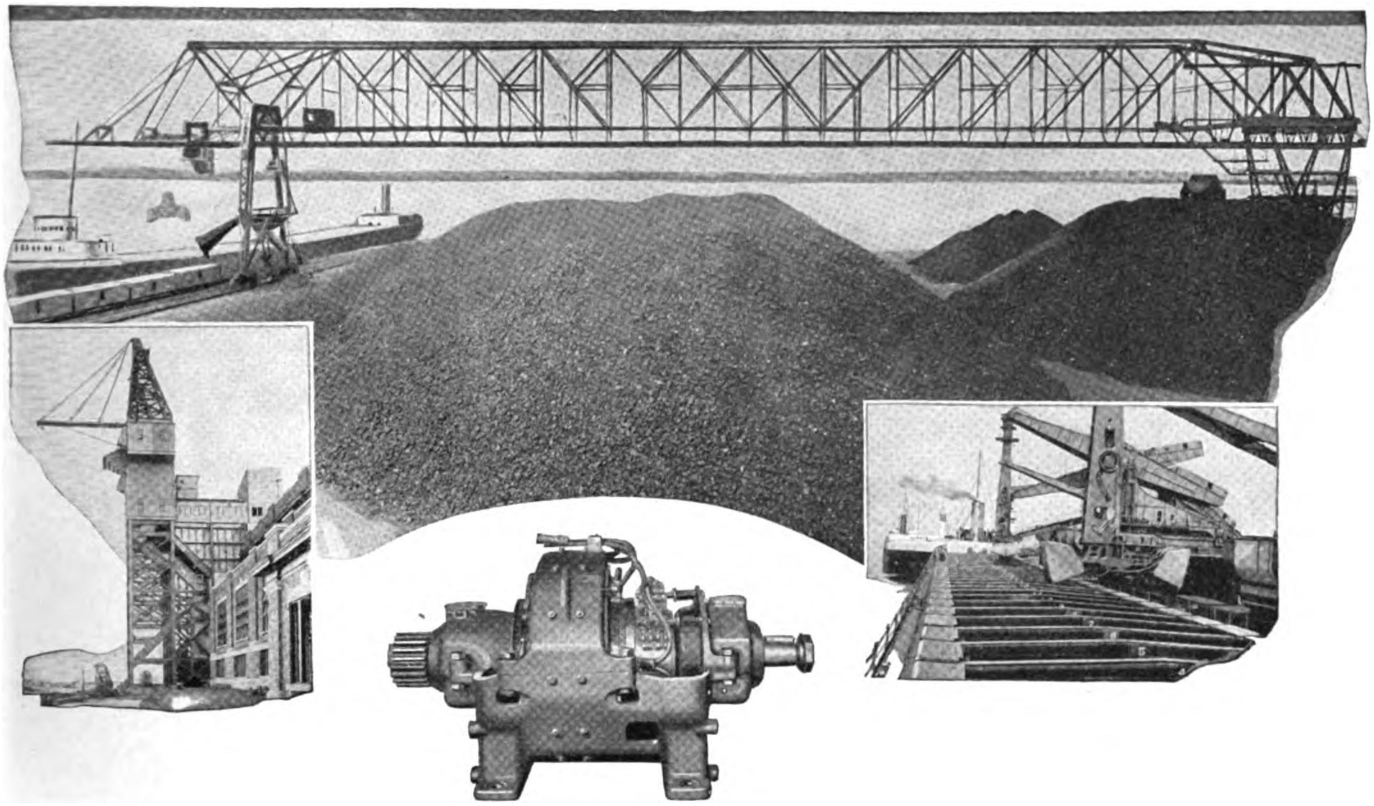
The savings made possible by these systems are described in detail in our heating bulletins. Write for them.

AMERICAN BLOWER CO., DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO CO., LIMITED, WINDSOR, ONT.

606

American Blower

"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
Manufacturers of all Types of Air-Handling Equipment —— Since 1881



The right motor for the big jobs

Coal and Ore Bridges, Coal Unloading Towers, Hulett Unloaders—all kinds of grab-bucket handling machinery require the strongest, yet most practical type of electrical equipment. G-E Motors and Controllers are pioneers in this severe service.

Twelve tons at a bite is the way 4 G-E Motors handle the bucket of the 712-ft. coal bridge pictured at the top of this page.

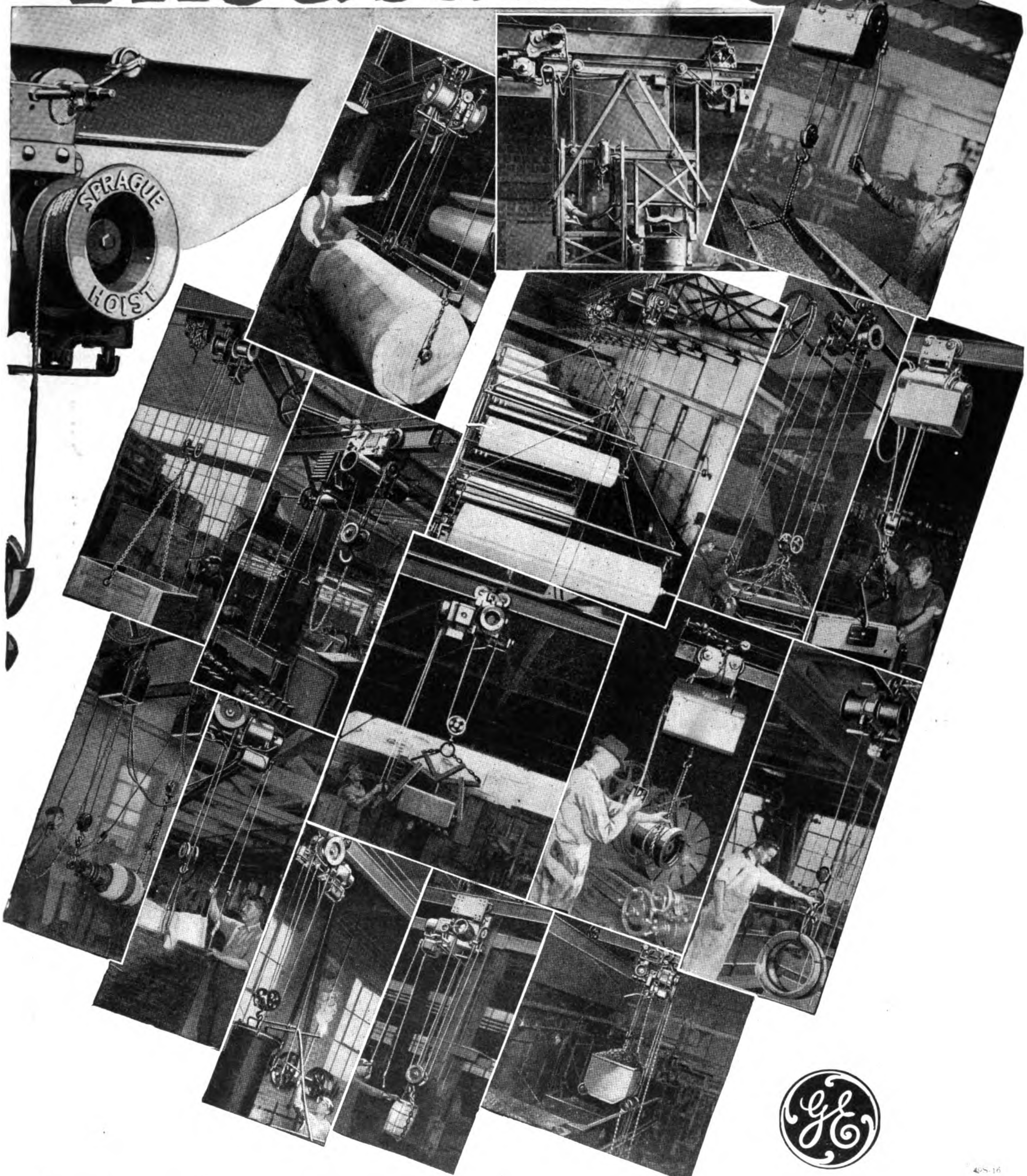
In the coal unloading tower pictured here, G-E Equipment operates its 12-ton digging buckets and 6-ton clean-up buckets—handling 880 tons an hour. This tower makes about two round trips per minute over a hoisting distance of approximately 280 feet.

Since the earliest steps in the development of bulk material handling machinery, the General Electric Company has been called upon to develop and manufacture the electrical apparatus for driving and controlling the mechanical appliances of this class. Applications of G-E equipment to such service are portrayed in Bulletin 48026, mailed on request.

General Electric Company
Schenectady, N. Y.
Sales Offices in all Large Cities

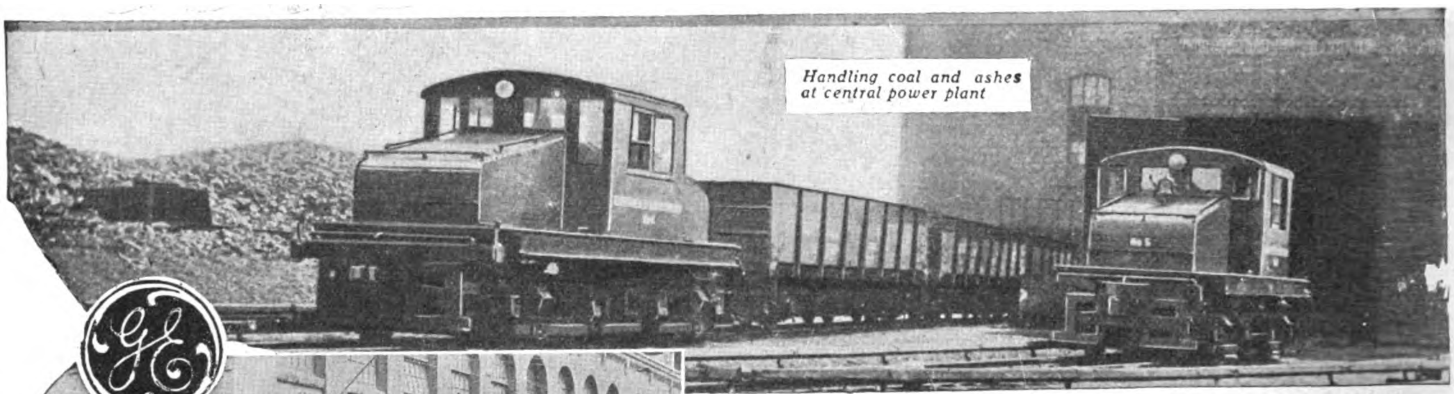
GENERAL ELECTRIC

Thousand Uses

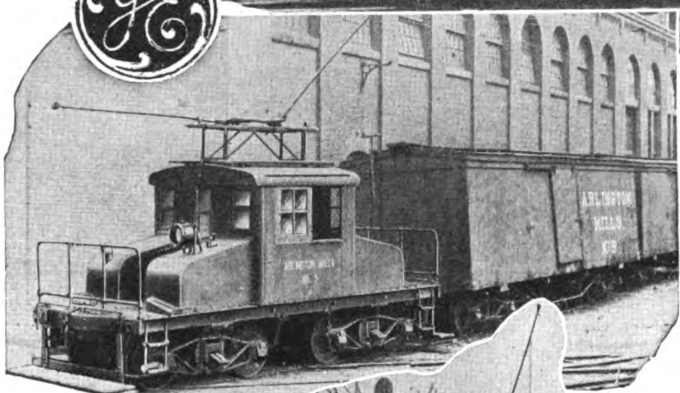


ELECTRIC

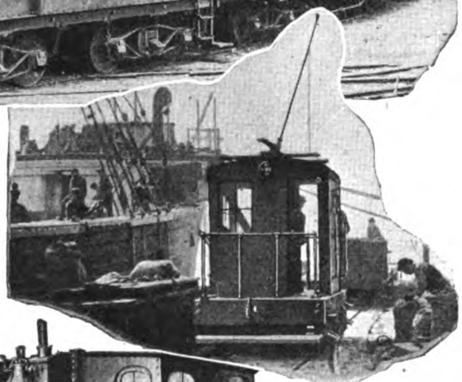
For Every Industrial Haulage Need



Handling coal and ashes at central power plant



Switching standard freight cars in textile plant



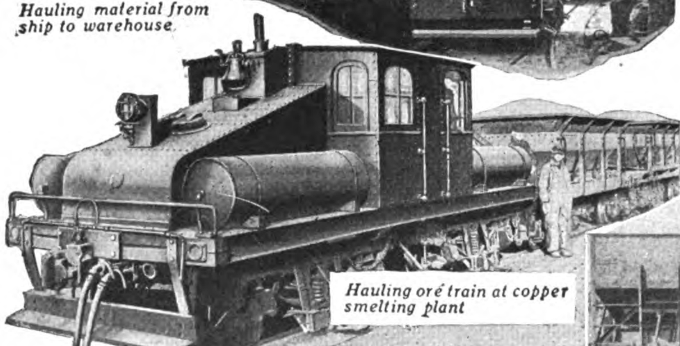
Hauling material from ship to warehouse

For Trolley Service and

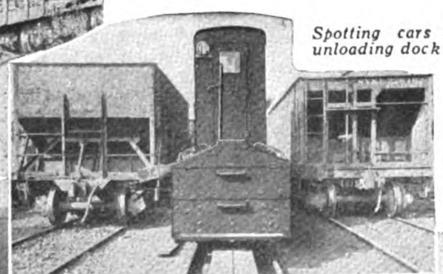
The power for pull is electricity. That it is the better way to haul is evidenced by the increasing use of electric locomotives wherever industry moves materials.

When *you* buy haulage service—consider what over thirty years' experience in building complete electric locomotives can produce to exactly meet your requirements. Back in the early nineties, the first G-E Locomotive was put in operation. Every year since has recorded increased use of G-E Electric Locomotives—keeping pace with industry's needs for haulage equipment is the reason.

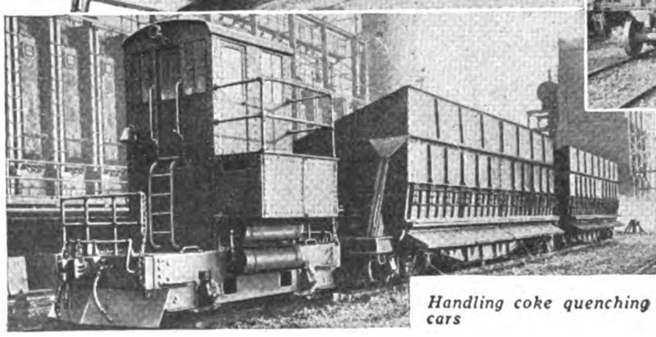
The General Electric Company builds complete locomotives—to insure well balanced design, both electrically and mechanically. G-E Locomotives of standard design are available for general industrial



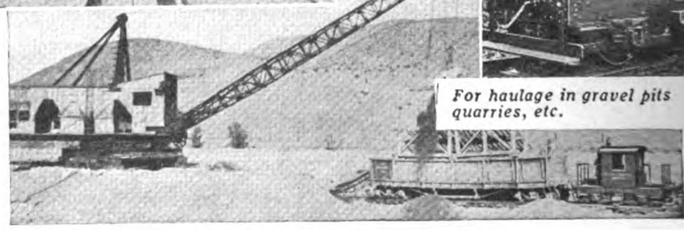
Hauling ore train at copper smelting plant



Spotting cars at ore unloading dock



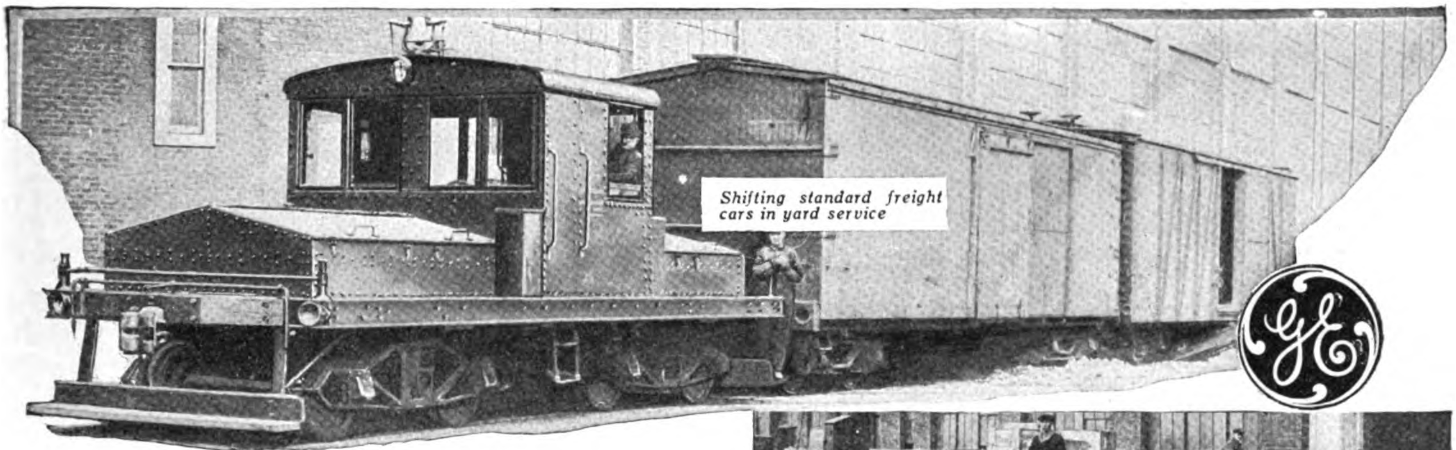
Handling coke quenching cars



For haulage in gravel pits quarries, etc.

GENERAL

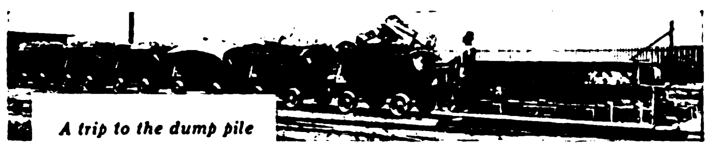
There is a Suitable G-E Locomotive


Shifting standard freight cars in yard service

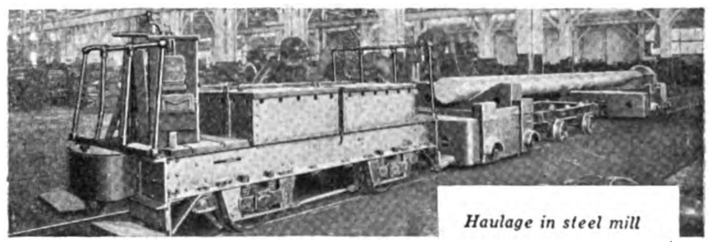
Storage Battery Uses


Haulage between buildings

haulage conditions—and are easily adaptable to special requirements due to able engineering and ample production facilities.

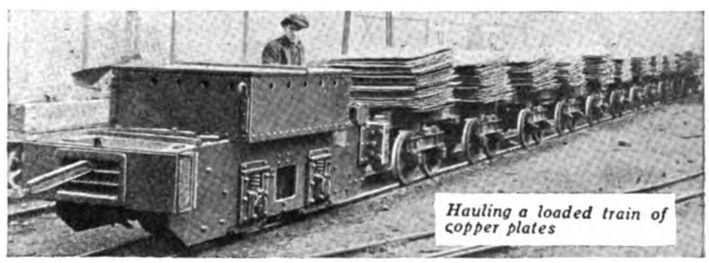

A trip to the dump pile

Whatever you require for long heavy hauls—continuous peak load traffic—shifting at terminal—incoming and outgoing freight—short hauls between buildings, etc.,—there are suitable G-E Locomotives. You have but to submit the required duty and G-E engineers select the proper locomotive for the work.

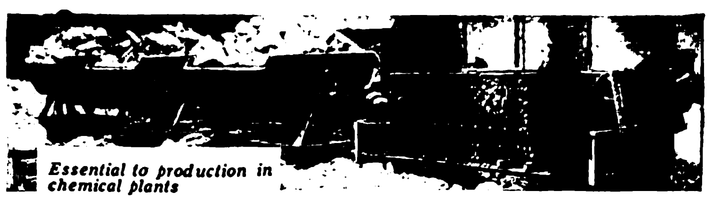

Haulage in steel mill

The G-E Locomotives shown here are of the Trolley, Third Rail, Storage Battery, and combination Trolley and Storage Battery types. More than views—they are evidence of the success with which G-E Locomotives meet, efficiently and economically, every industrial haulage need.

General Electric Company
Schenectady, N. Y.
Sales Offices in all Large Cities


Hauling a loaded train of copper plates

Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in *Bulletin No. 44251* which will be mailed you free upon your request. Write for it today.


Essential to production in chemical plants


Incoming and outgoing freight at big factory


Used successfully in lumbering

ELECTRIC

"What can you do for me?"

Your equipment is individual — your methods are individual — your needs are individual. And when you need conveyor belts you want conveyor belts that will do the best work on your installations. You want a scientific and intelligent study of your equipment needs.

That is precisely what Goodrich supplies. Goodrich conveyor belt recommendations are always governed by *individual* working conditions. A Goodrich engineer will study your installation and recommend the belt you need.

We will be pleased to have you consult us for a solution of your conveyor problems.

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio

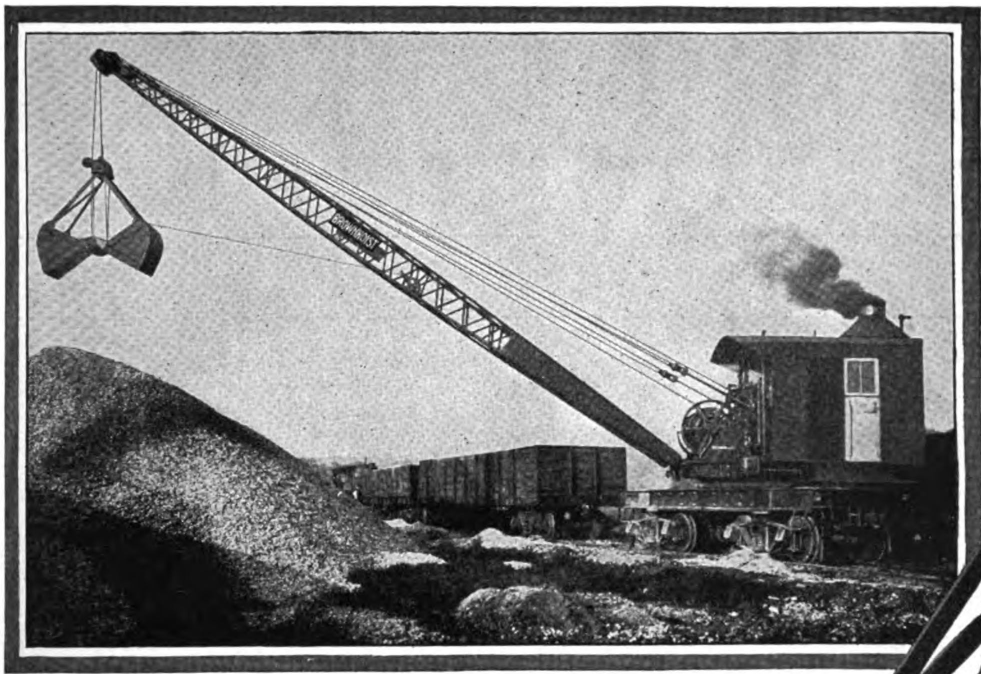
Goodrich

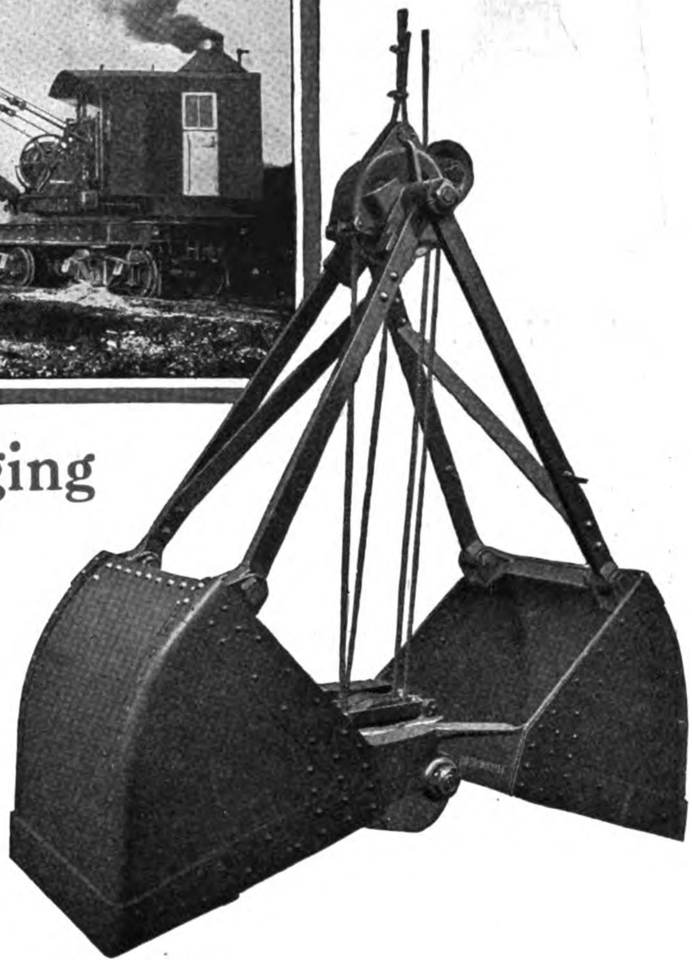
TRADE MARK
LONGLIFE

"LONGLIFE" Conveyor Belts

"Best in the Long Run"

When writing advertisers please mention Industry Illustrated





"Never saw such a digging bucket"

—Says the Engineer of the Chicago Fire Brick Co.

The 1¼-yard Brownhoist Clamshell owned by the Chicago Fire Brick Company was purchased for use with a Brownhoist crane to handle sand and other loose bulk materials. Recently the bucket and crane were put to work cleaning up the basement of a wrecked building at the company's yard.

The wreckage consisted mostly of broken brick—a difficult material for any bucket to handle—yet the Brownhoist Clamshell handled it easily. The company's engineer says concerning the performance of the bucket on this work,

"I never saw such a digging bucket. It digs bricks like sand."

Service of this kind is typical of Brownhoist Clamshells. They are designed and constructed in every part to stand the severe usage that a general handling bucket must meet.

Let us tell you more about these better buckets.

The Brown Hoisting Machinery Co., *Cleveland, O.*

Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans, London, Eng.

Brownhoist Clamshell Features

Manganese steel noseplates. Extra large bronze bushed bearings. Ropes fully protected from material. Straight rope leads. Large size sheaves. Capacity from ¾ to 2 yards.

BROWNHOIST

Clamshell Buckets

Mail This Coupon →

We are interested in further informatio[n] and prices on a Brownhoist Clamshel[l] of ¾-yd.☐ 1-yd.☐ 1¼-yd.☐ 1½-yd.☐ 2-yd.☐ capacity for use on a ________

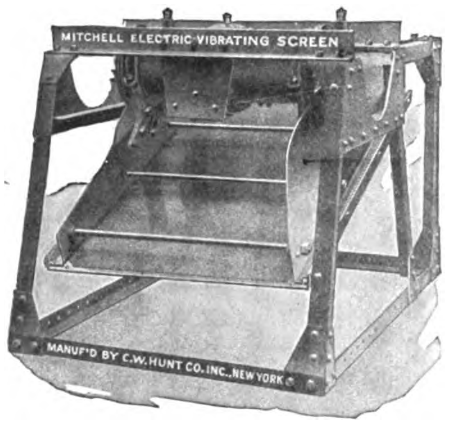
________ to handle ________

Name ________

Street ________

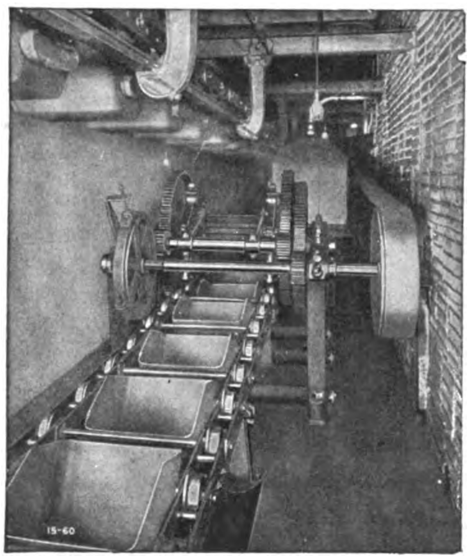
City ________ ***State*** ________

HUNT COST-CUTTING EQUIPMENT



MITCHELL ELECTRIC VIBRATING SCREEN

Adaptable to the screening of any granular or crystalline material, such as coal, slag, ore, rock, limestone, sand, gravel, sugar, salt, etc. Equally efficient in coarse as well as fine screening; wet or dry material. Any standard type of feeding device can be used. Occupies little floor space and operates noiselessly.



The above illustration shows a Hunt Pivoted Bucket Conveyor handling coal in the power plant of a large manufacturing concern in New York City. An especial feature is the twist of about 30 degrees on the vertical run; made possible only by a pawl-driven chain of which the Hunt is the only type existent. This equipment has been in operation many years and continues to give excellent service.

for Handling Bulk Materials

FROM the bucket conveyor underground to the skip hoist overhead; from the man-pushed car to the electrically operated industrial locomotive; from the gravity railway that works automatically to the railway driven by cable; Hunt Cost-Cutting Equipment runs the gamut of useful apparatus for making the movement of bulk materials safer, less laborious, more rapid and less expensive.

Over a half century's experience has taught us the pitfalls that beset many materials handling systems. We have profited by the knowledge gained from an intensive study of every phase of materials handling and have built, or have adapted some type, or combination of types of Hunt Cost-Cutting Equipment to meet many peculiar situations.

Therefore, Hunt Cost-Cutting Equipment for handling economically and efficiently coal, ashes and similar bulk material, is the logical solution of low-cost production.

Designed and built upon the most advanced principles of engineering practice and improved to meet the exigencies of today, Hunt Coal and Ashes handling apparatus has been giving genuinely economical service for over half a century in every branch of industry.

Hunt Engineers with this half century experience behind them, supplemented by an immense amount of reliable data accumulated from numerous sources, will handle your problem in a thoroughly practical manner and plan a bulk materials handling system suitable to your specific requirements.

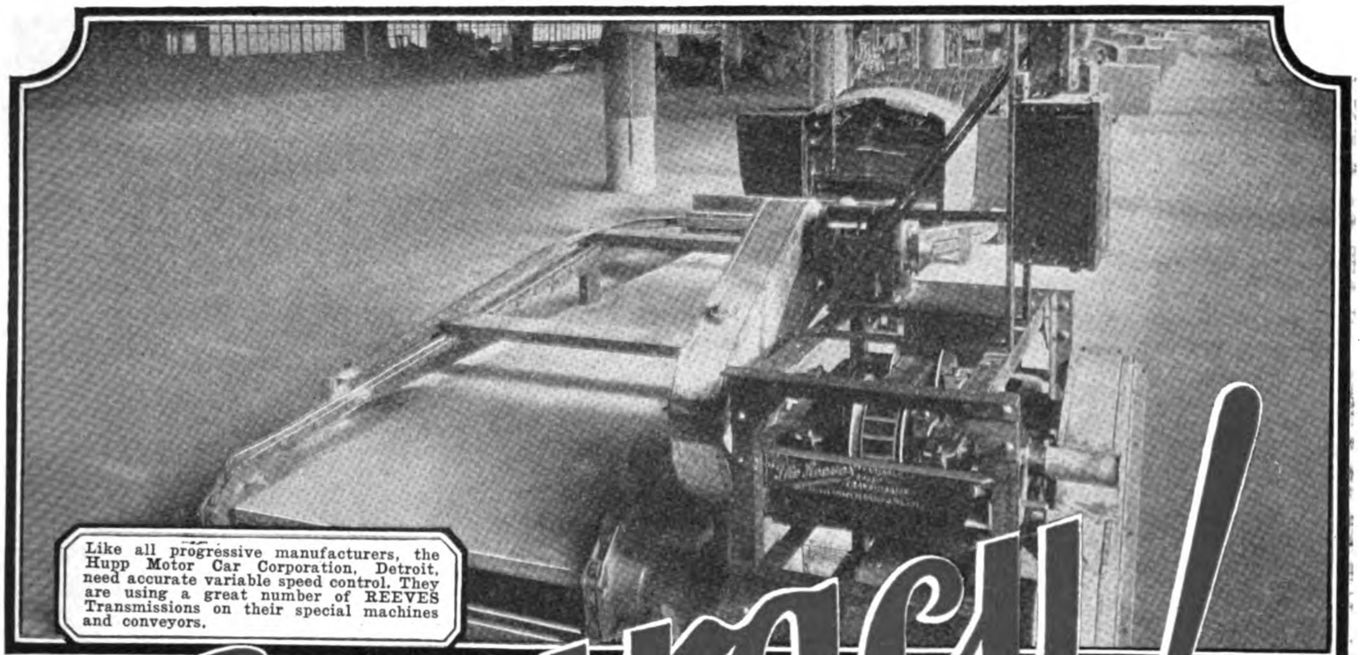
C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc.
431 South Dearborn St., Chicago, Ill.

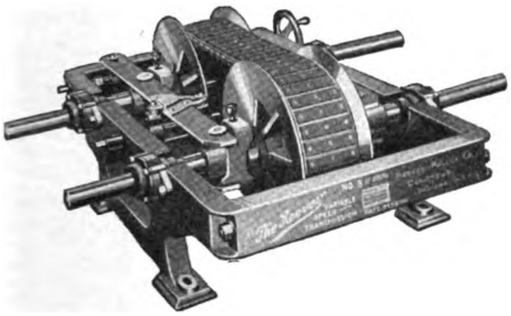
ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.



Like all progressive manufacturers, the Hupp Motor Car Corporation, Detroit, need accurate variable speed control. They are using a great number of REEVES Transmissions on their special machines and conveyors.

Accuracy!

In Variable Speed Control



"The Reeves"

VARIABLE SPEED TRANSMISSION

"THE REEVES" Variable Speed Transmission is a compact mechanical device which receives power at a constant speed and delivers it at any speed desired to any machine or group. It will maintain that speed indefinitely, or it may be changed as often as desired. Furnished with hand-wheel, sprocket and chain, remote push-button, remote mechanical or automatic controls. Complete ball-bearing equipment throughout.

GET rid of the inaccuracy in your variable speed control! Be able to set any machine or conveyor at *any* desired speed and depend on it running at that speed, steadily and evenly, until changed by the operator.

That's the kind of speed control "THE REEVES" Variable Speed Transmission is giving in industrial plants all over the world. And that's what you need in *your* plant! "Make-shift" devices won't do. Modern production methods demand *unfailing accuracy*. And "THE REEVES" Transmission is the only dependable means of securing it.

Since 1897, over 30,000 REEVES Transmissions have been manufactured and installed, and are giving accurate and faithful service to their owners. In your plant, as in every modern industrial plant, you need such accuracy in variable speed control on many machines and conveyors. And you can't afford to take a chance on "make-shift" and "untried" devices.

Write today for Nielsen Report No. 30 and see how "THE REEVES" Transmission paid 41% return on the investment for one of the largest automobile body manufacturers in the United States.

REEVES PULLEY COMPANY

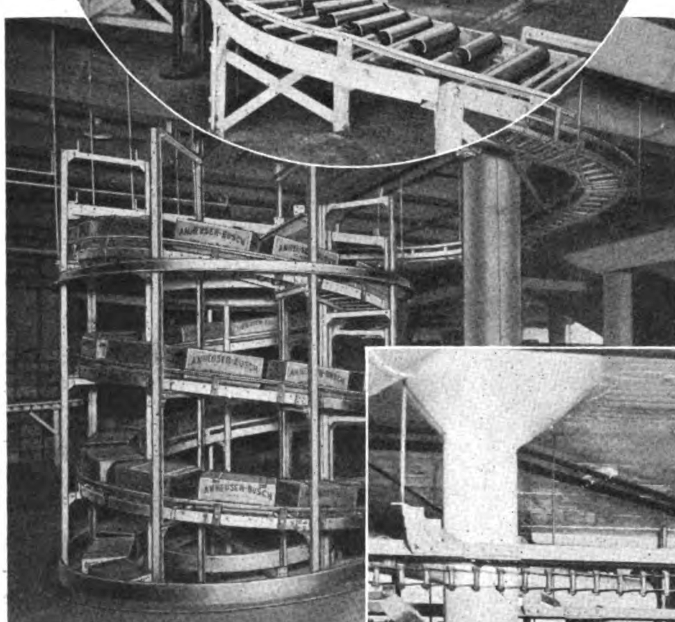
***Established* 1887**

Columbus, Indiana

Chicago office: Reeves-Bond Sales Co., 39 So. Clinton St.
Detroit office: Reeves Pulley Co., 135 High St., W.

INDUSTRY COMES TO REEVES FOR ACCURATE SPEED CONTROL

Why pay Dollars when Machinery



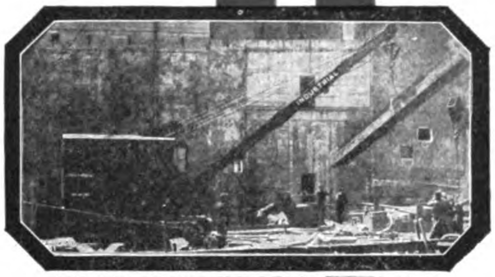
INCREASING labor costs today are vital in every industry. Wages are high—and are still rising. The new Immigration law has drawn the lines tighter and the outlook is for a still greater scarcity of unskilled labor.

The scarcity of reliable move-men and porters in factories is acute and often greatly impedes production. The high wages commanded by such labor is a serious factor in costs.

This situation can be met by the substitution of machinery for doing much of the work that has been done by man-power. It saves wages and releases labor for more profitable tasks. It will bring material to the worker in a steady stream—and carry it away when finished.

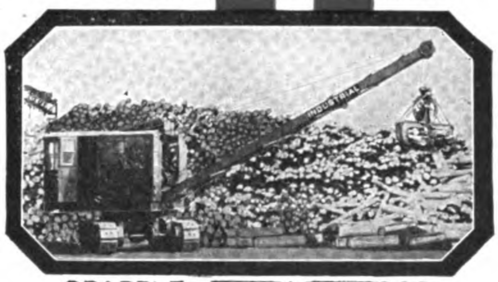
When the movement of materials is automatic. Production is increased. Costs are reduced. Drudgery is eliminated. Labor problems are answered.

ELECTRO-MAGNET HANDLES ALL FORMS IRON AND STEEL.

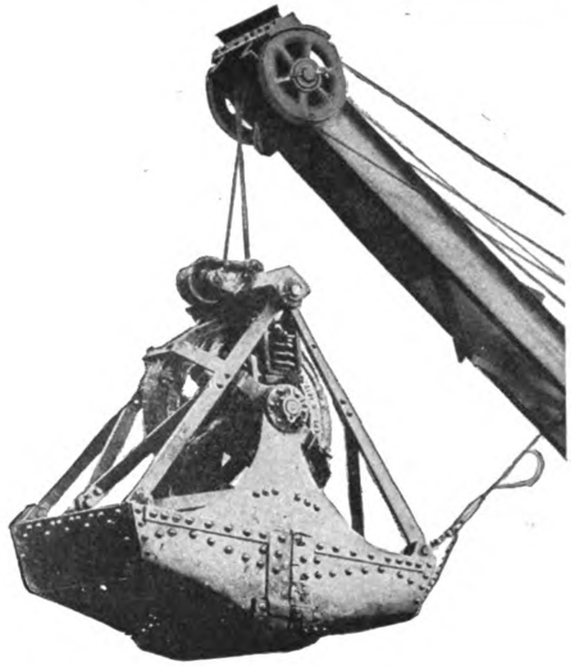


HOOK AND BLOCK HANDLES ALL HEAVY UNIT LIFTS.

DRAGLINE DREDGES, DIGS, BACKFILLS AND EXCAVATES.



GRAPPLE HANDLES LOGS, TIES, SLABS AND PULPWOOD.

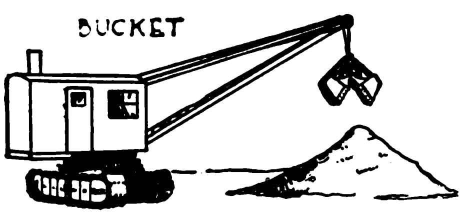


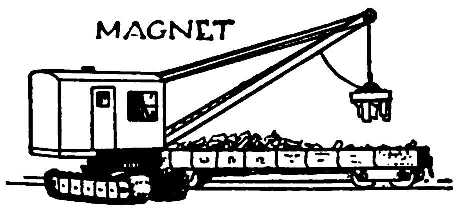
A 50-man-power masterpiece

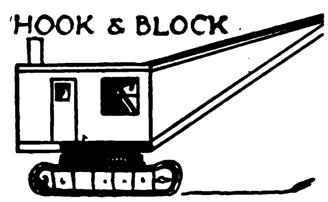
THIS latest INDUSTRIAL crawling tractor locomotive crane is producing 50-man-power results in handling the heavy loads of industry. It is cutting deep into the high costs of manual material-handling and recovering a buried treasure of non-productive dollars.

The new type D is a masterpiece of design and construction. Its outstanding superiority is guaranteed by America's pioneer crane builders. Over fifty years of untarnished business integrity and highly specialized skill and experience form its background.

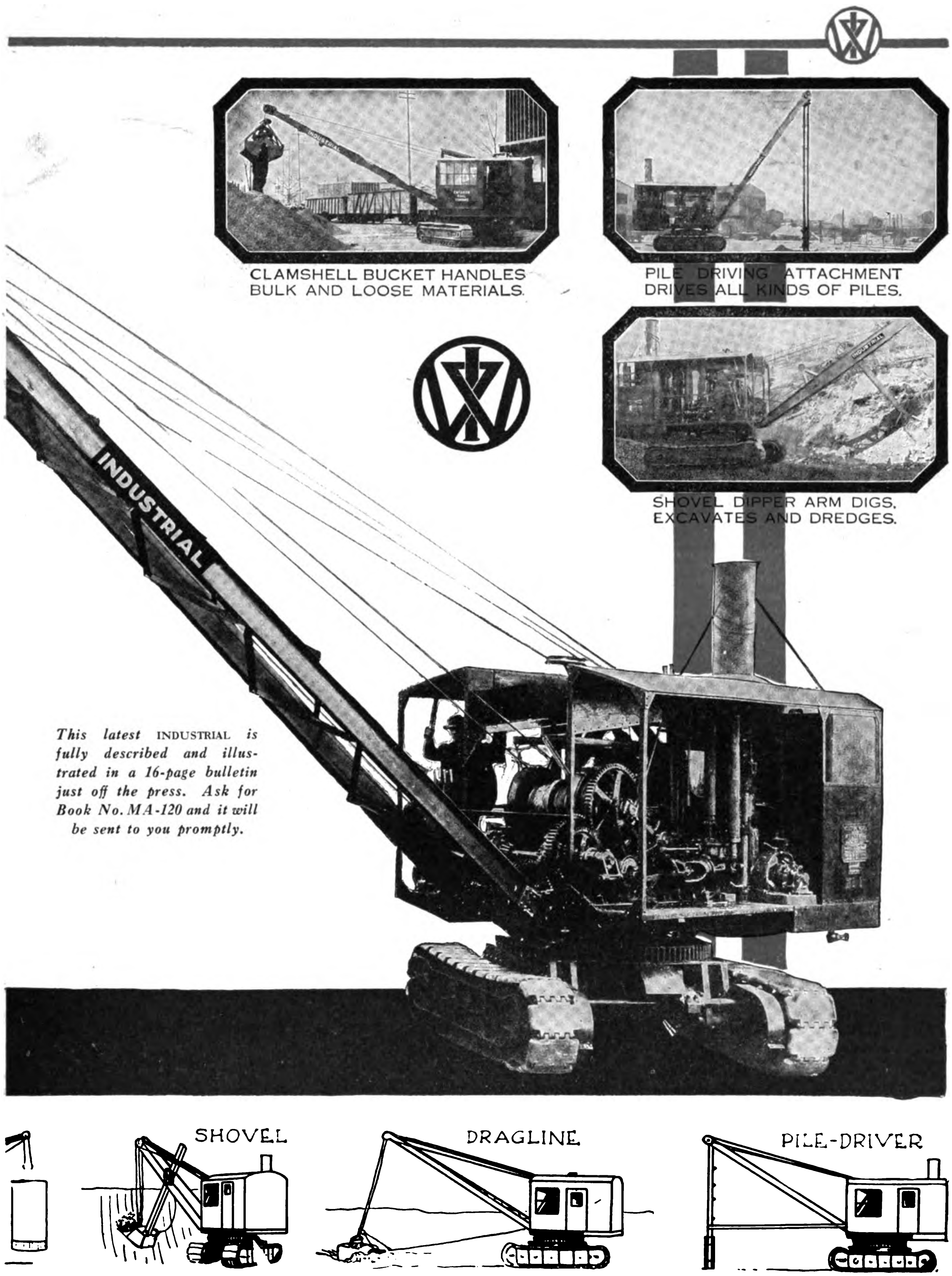
This newest INDUSTRIAL has a greater field of usefulness in industry than any other material-handling equipment on the market today. As a crawling tractor it goes everywhere. With its accessories, including clamshell bucket, electro-magnet, hook and block, shovel dipper arm, dragline bucket, wood grapple and pile driving leaders, it will conquer any material-handling problem at a tremendous saving in time and labor.







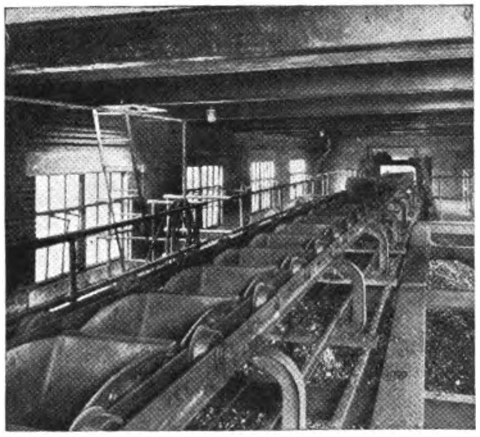
INDUSTRIAL WORKS



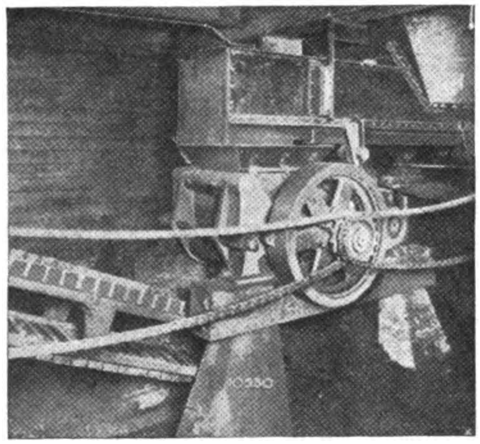
This latest INDUSTRIAL *is fully described and illustrated in a 16-page bulletin just off the press. Ask for Book No. MA-120 and it will be sent to you promptly.*

BAY CITY, MICHIGAN

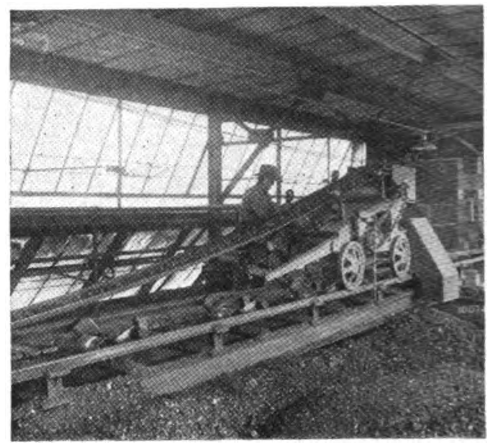
Why Do Industrial Leaders Select



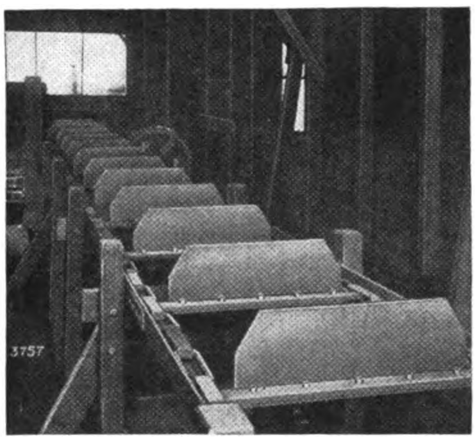
Pivoted Bucket Carrier—Handles both coal and ashes, combining the work of at least one elevator and two conveyors.



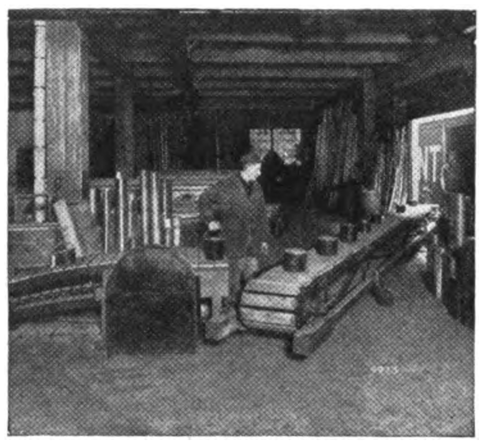
Showing Plate Feeder, Single Roll Crusher and Steel Apron Conveyor—This Crusher insures a uniform and constant supply of stoker-sized coal.



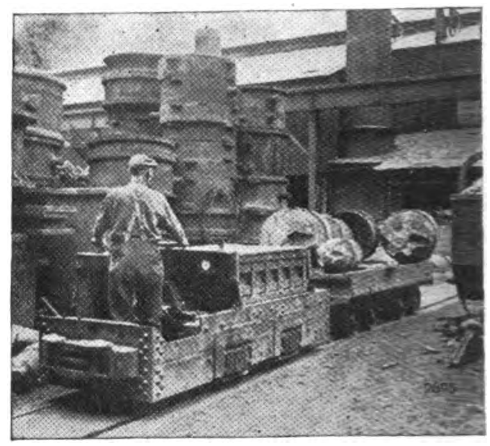
Belt Conveyor and Tripper—Especially adapted for distributing coal and other materials over long storage spaces.



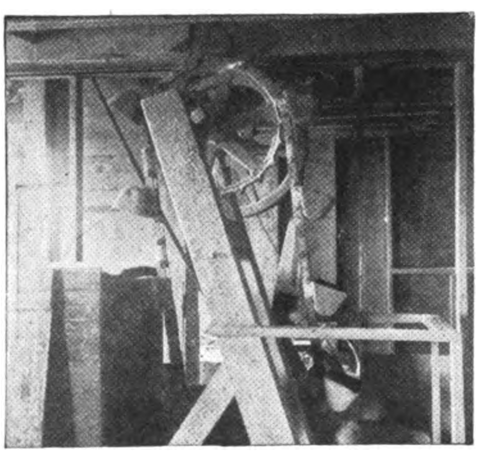
Scraper Type Conveyor—Simple Construction —Easy to Repair.



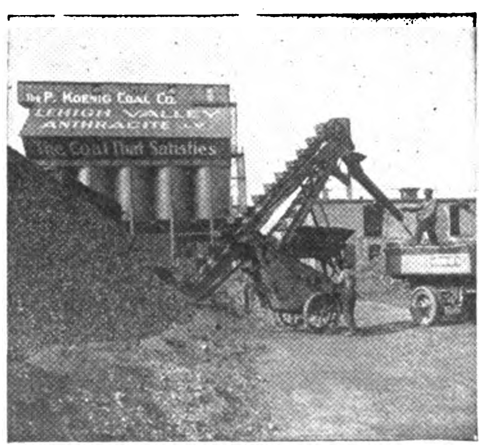
Wood and Steel Apron Conveyors—A wide range of application for handling bulk and package materials.



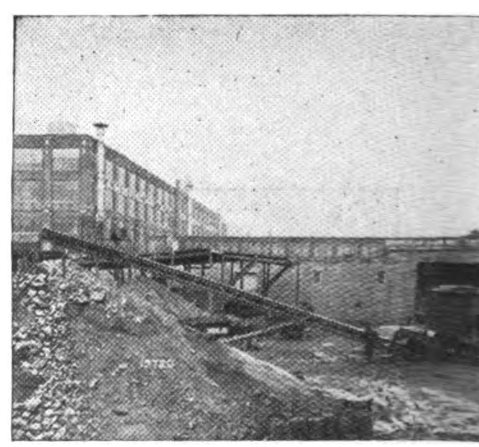
Industrial Locomotives—Safe and Low Cost Haulage in and around industrial plants.



Bucket Elevators—More than 50 Standard sizes, with capacities ranging from 6½ to 80 tons per hour.

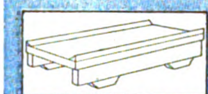


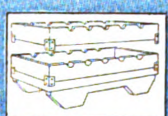
Portable Bucket Type Loaders, that will do the work of 5 to 10 men in handling coal, sand, gravel, crushed stone, and other loose materials.

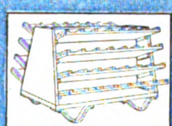


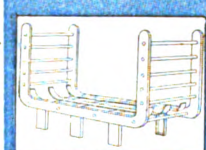
Portable Car Unloader—Loads coal from hopper-bottom cars to storage or truck, at low cost, saving demurrage charges.

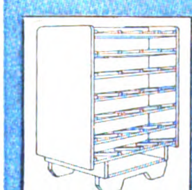
JEFFREY

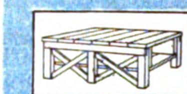


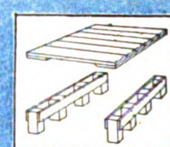


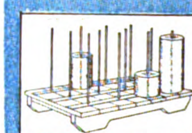


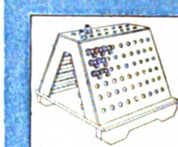


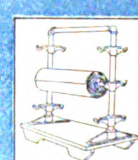


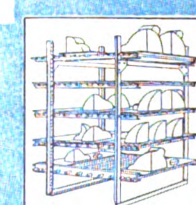












TRIPLE THE SAVING

Here is the ELWELL-PARKER Low Type Electric Lift Truck

to handle the goods platforms now moved by hand lift trucks.

The electric will haul all your material in one-third the time. It travels three times as fast as a trucker walks.

By utilizing a motor and the electric storage power the trucker delivers 4,000 pounds in two-thirds less time—while he rides.

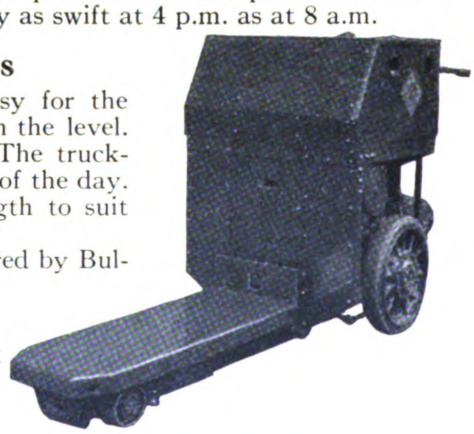
Aisle traffic is speeded up, no lagging at the day's end when electric runabouts pick up, transport and place the loaded platforms. Set a mechanical pace for your factory as swift at 4 p.m. as at 8 a.m.

Other Advantages

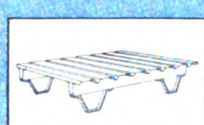
Incline hauling is just as easy for the Elwell-Parker Electric Lift as on the level. Rubber tires reduce floor wear. The truckers are not dead tired at the end of the day.

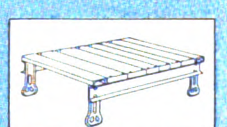
Truck height, width and length to suit practically any style skid.

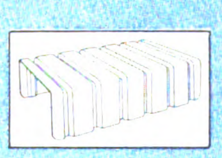
Request further details covered by Bulletin 43.



THE ELWELL-PARKER ELECTRIC COMPANY
Cleveland, Ohio







Sauerman "Crescent" power scraper, made of curved plates—reinforced. Light weight. Great strength. Pulls easily. Fills perfectly. Dumps cleanly.

SAUERMAN

Handling coal in storage

Power Drag Scrapers

SAUERMAN Drag Scrapers are perfect units of economy in first cost, operating expense and labor requirements.

They are adaptable for storing, reclaiming and loading coal, ores, salt, foundry sand, sand and gravel, crushed stone, clay and shale, silica (glass) sand; or

For moving and loading waste material such as ashes, mine waste, sawdust and chips, furnace refuse, burned foundry sand, clay products.

Requires but one man to operate efficiently. Write for full details of this time and money saving scraper.

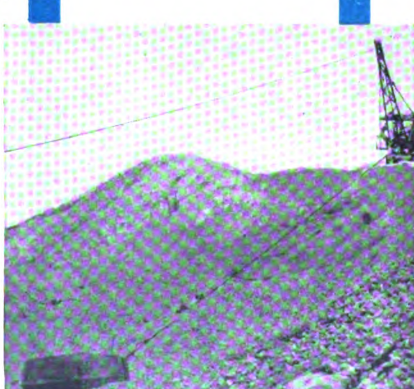
Scraper delivering material to top of plant structure

SAUERMAN BROS.

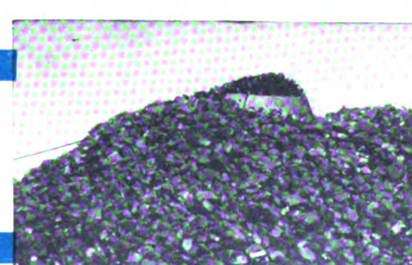
Power Drag Scrapers
Slackline Cableway Excavators

480 So. Clinton St., CHICAGO, ILL.

Cableway delivering material to top of plant structure

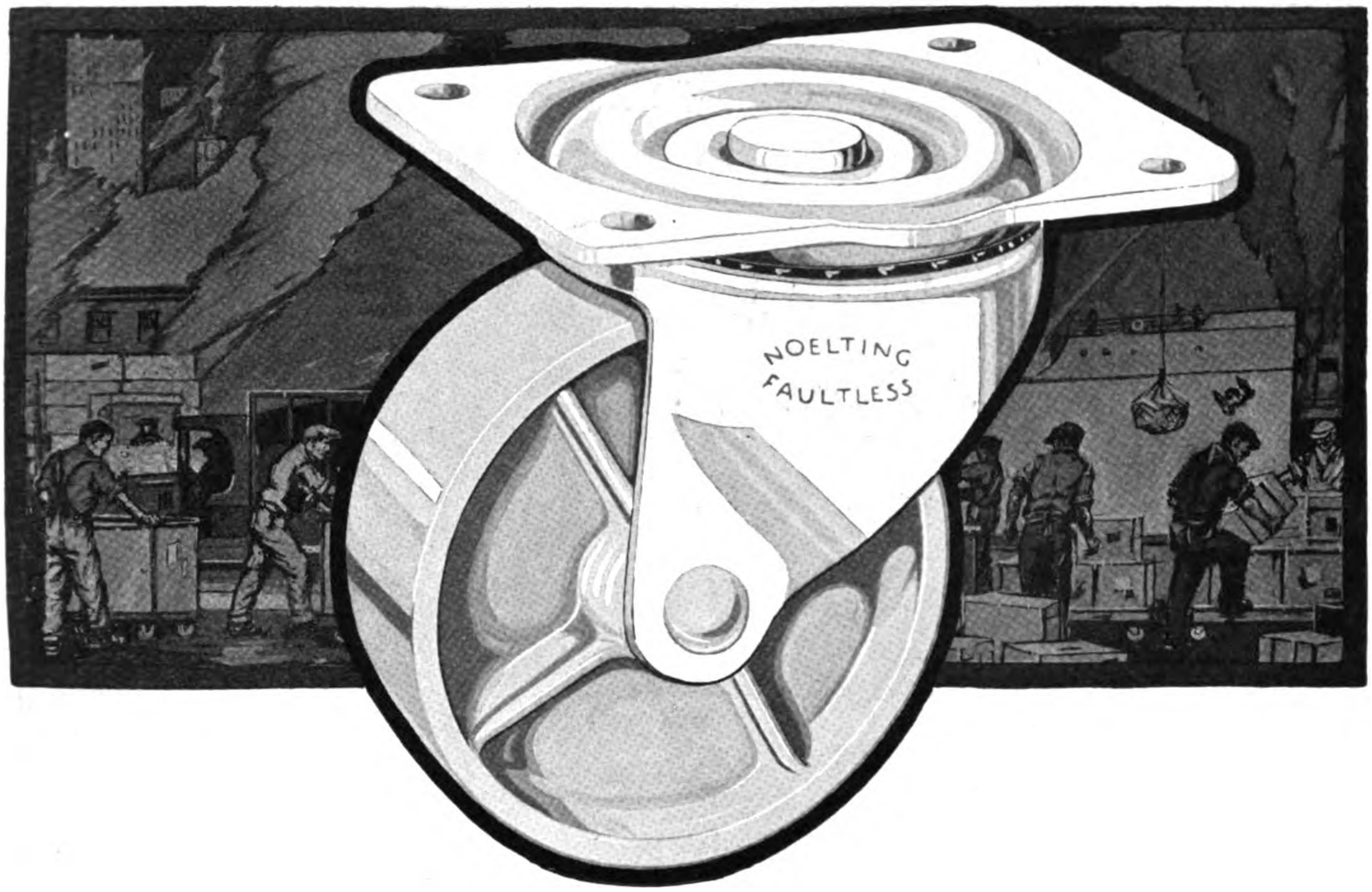


Use of scraper with locomotive crane



Handling coal without degradation

When writing advertisers please mention Industry Illustrated



What are your truck casters costing you a year? Are your replacements running high? It ought to be worth-while looking over the engineering information given in the Noelting Truck Caster bulletin illustrated below. Have you received your copy. Drop a postal for it today!

PRESSED from heavy gauge steel—generously proportioned to give great strength—heavily embossed to give extra stiffness—equipped with solid steel, ground and lapped ball bearings—wheeled with extra heavy tread—Faultless Truck Casters give miles of sturdy service.

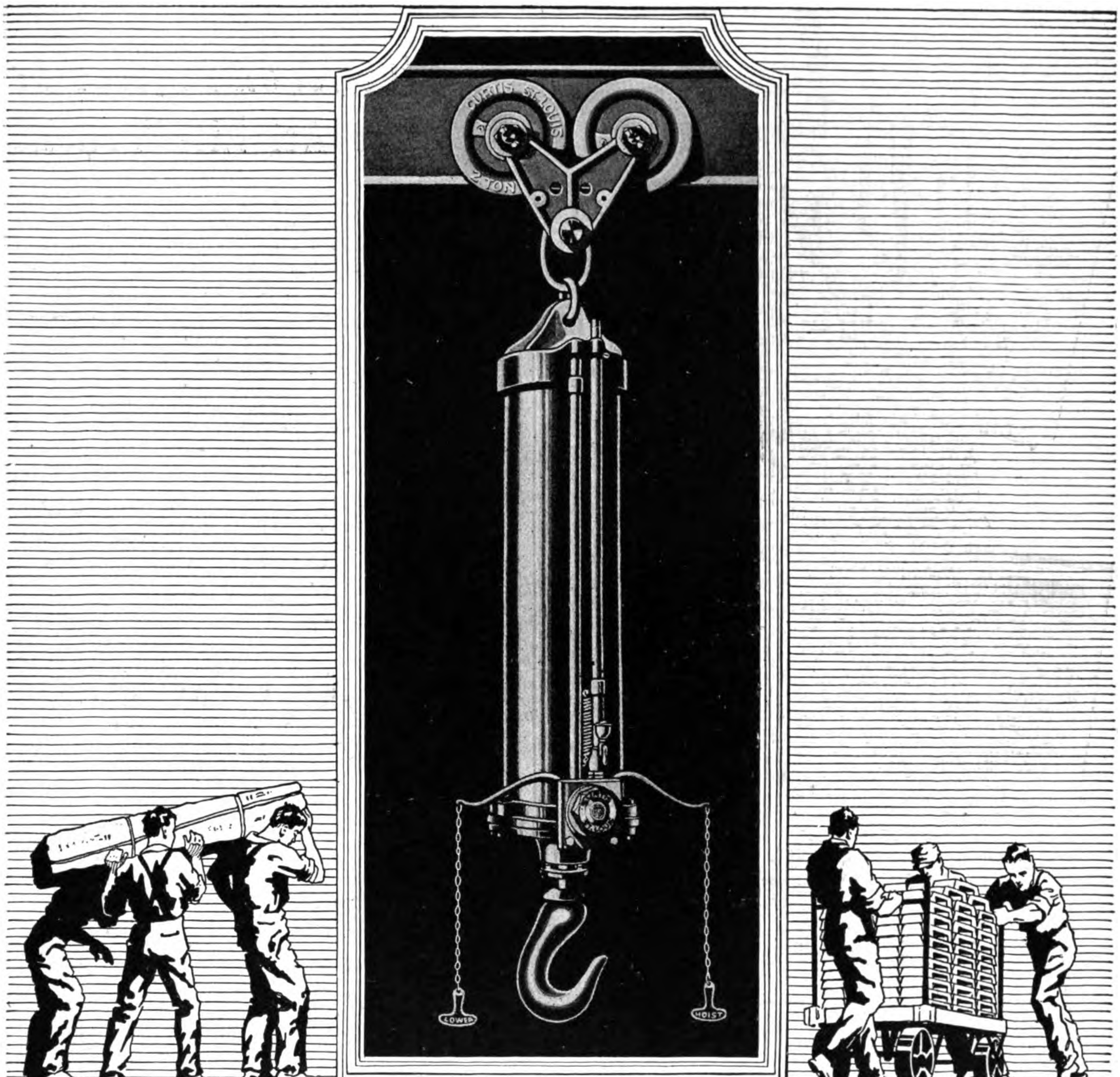
They are made in both the rigid and swivel types, and are furnished with cast iron, rubber or felt wheels.

Faultless Caster Company

Evansville Indiana

NOELTING
FAULTLESS · CASTERS

Makers of Quality Casters for a Third of a Century



CURTIS AIR HOISTS and TROLLEYS

Curtis All-steel, One-man Air Hoists are the perfected results of 70 years' manufacturing experience. They are simple, safe, light in weight, low in first cost and unusually economical for lifting light and medium loads. Capacities 800 to 20,000 lbs.

Curtis Flexible Roller Bearing Trolleys have self-equalizing steel side frames and large inclined wheels. They are shock absorbing, easy to start—easy rolling and long lasting. Adjustable to many beam sizes.

Curtis equipment is cutting handling costs in hundreds of leading industrial firms. Write for complete details and illustrated literature.

CURTIS PNEUMATIC MACHINERY COMPANY

1668 Kienlen Avenue ST. LOUIS, U. S. A.

Branch Office: 536-S Hudson Terminal, New York City

Truscon Boxes for Material Handling

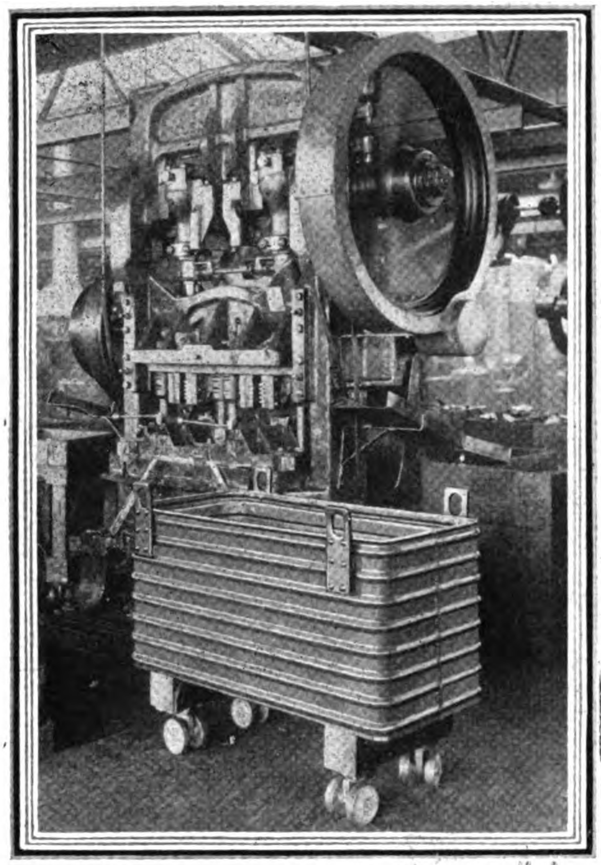
These crane-handled steel boxes have greatly increased the efficiency of material handling in many plants. They literally bring the stock room into actual contact with the production line at any point. Boxes may be stacked in tiers increasing the storage capacity of the stock room.

Truscon Steel Boxes are manufactured in a variety of types and sizes to meet production requirements of any plant. They are also furnished as tote boxes, compound boxes, scrap boxes, formula scoops, conveyor flights, etc.

No matter what your material handling needs, get Truscon suggestions and estimates.

TRUSCON STEEL COMPANY
Youngstown, Ohio

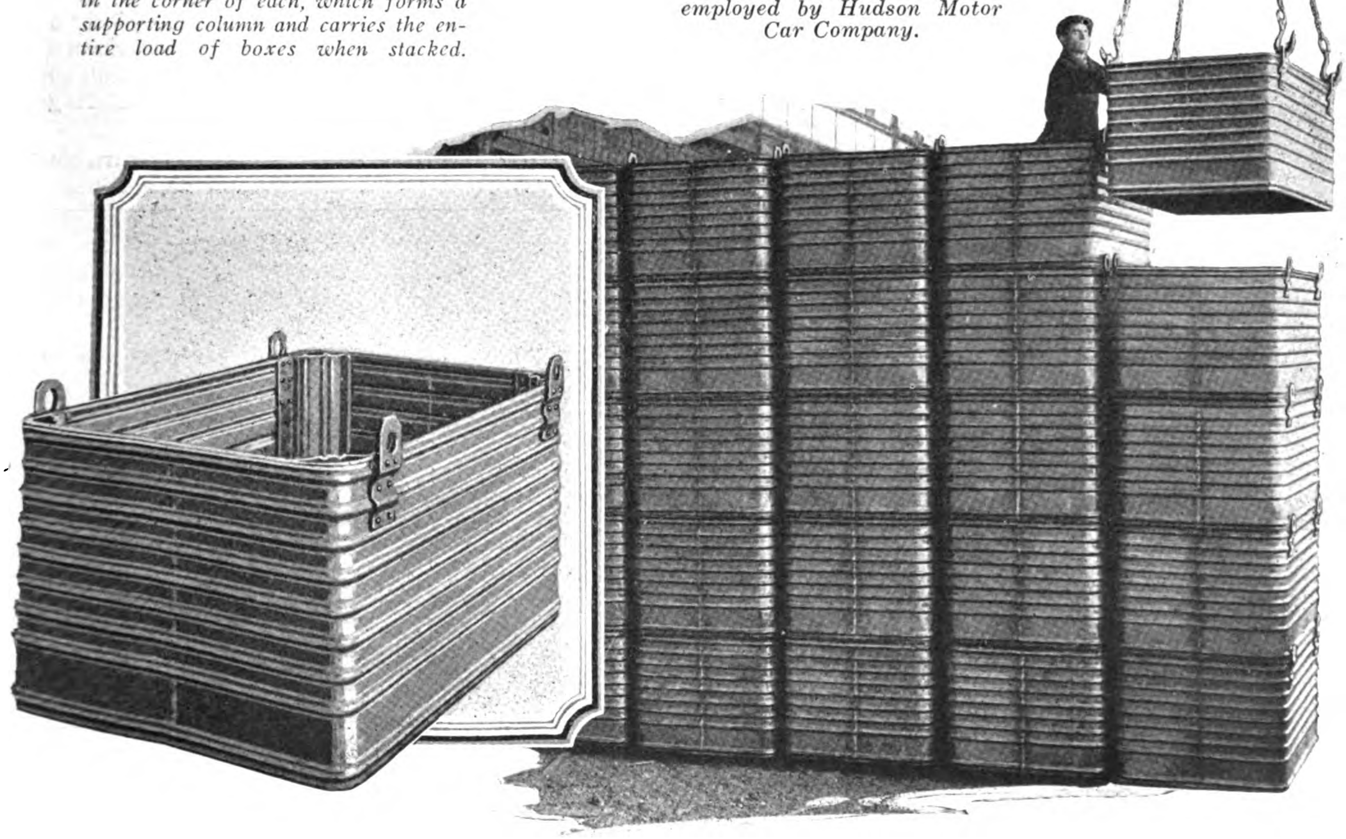
Special Platform and Box Representatives in New York, Philadelphia, Chicago, Pittsburg, Cleveland, Buffalo, Detroit, Boston, St. Louis and Cincinnati.

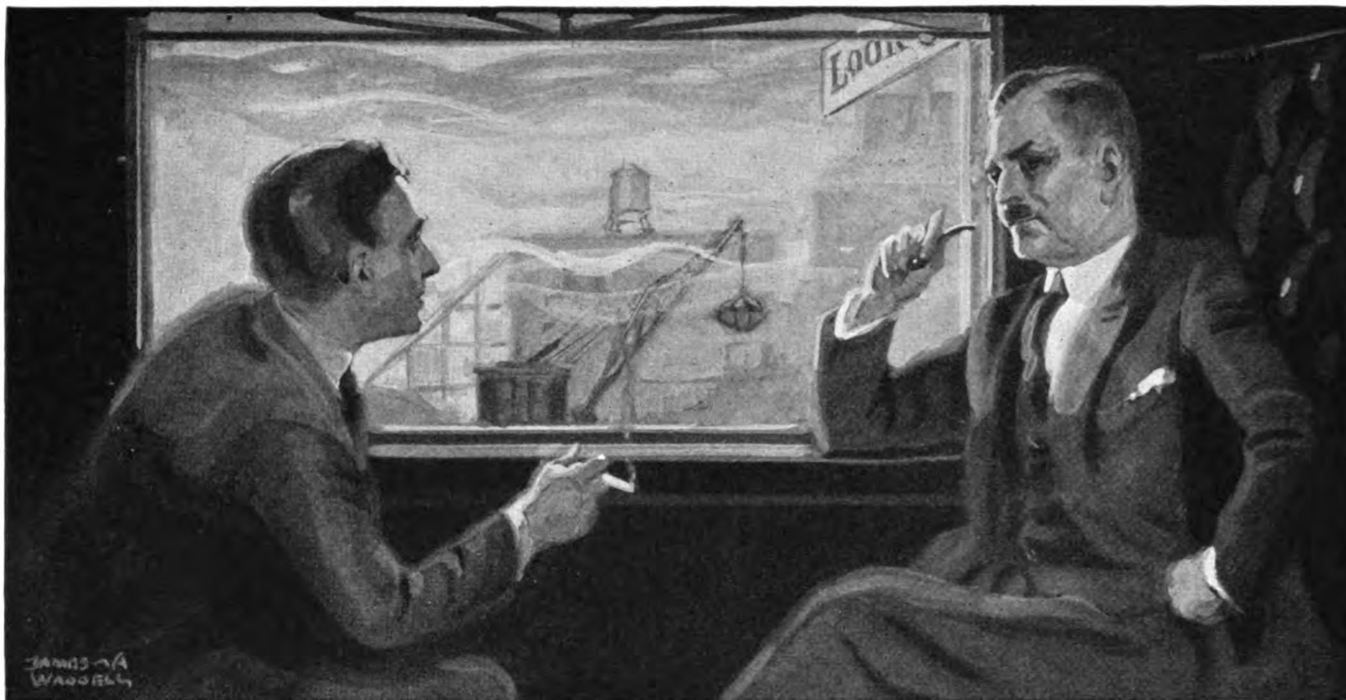


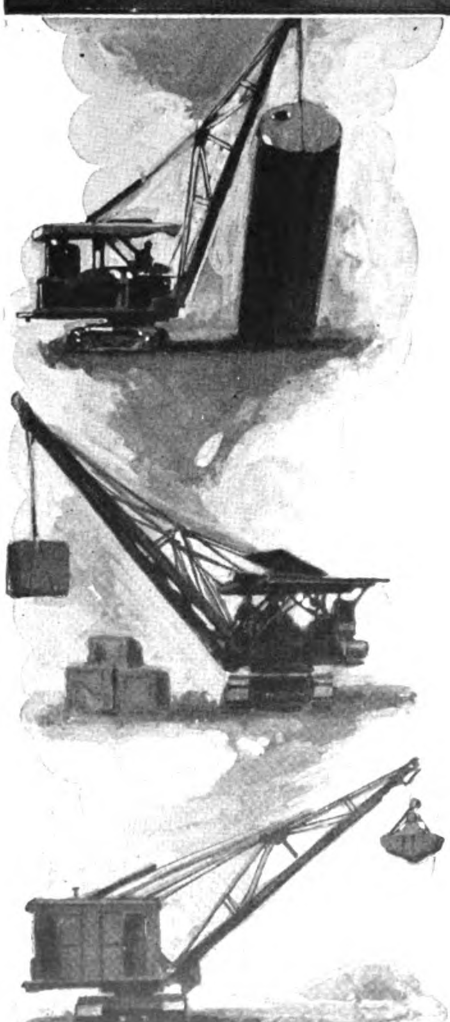
Above—Truscon Boxes designed for Ternsted Manufacturing Company.

Below—Truscon Boxes as employed by Hudson Motor Car Company.

In order to minimize the crushing effect of the upper boxes upon those below, there is a reinforcing member in the corner of each, which forms a supporting column and carries the entire load of boxes when stacked.







A GOOD BELT CONVEYOR

is the Cheap One to Buy

It has just about the same capacity, judged by the first day's work, but *by the month* it leads by a mile. A good machine keeps working—you, yourself, have to keep working at the low price kind. A good machine costs more and is worth it—the difference in work more than squares the account.

The Haiss Company builds the kind of a conveyor that an engineer designs to *start a job and finish it*—without any of the goodness taken out to make it cheap-to-build.

Yet so good a Haiss Portable Belt Conveyor actually costs least to own. For your pocket book's sake your next belt conveyor ought to be of the Haiss kind.

Features of Haiss Belt Conveyors' Superiority

- Lattice Truss Frame
- Ball Bearing Rollers
- Adjustable Tail Pulley
- Head Pulley Take-up
- Closely Spaced Rollers
- High Grade Motors
- Best Quality Belt

Haiss Portable Belt Conveyor

Haiss Truck Loader

A Haiss Truck Loader Saves Still More Labor

- It digs as well as loads
- No hand shoveling
- Handles any loose material
- One operator only
- Gasoline or electric power
- Capacities to 2 tons per minute

Ask for and read over Bulletin 1022 and you'll know why

THE GEORGE HAISS MANUFACTURING COMPANY, Inc., 146th St., and Canal Place, New York

Fast, Husky and Trackless

Down the long shop aisles at 4 to 6 miles per hour, 6,000 pounds on its load platform—up steep ramps with never a pause in its progress—across the shipping platform and into the box-car—dropping its load and away again—a single Baker tractor or truck gets away with more work per day than a sizable gang of hand-truckers.

Write for a fully illustrated explanatory catalog, or ask a Baker engineer to recommend the most efficient type for your requirements.

Baker Industrial Division

THE BAKER R&L COMPANY - - CLEVELAND, OHIO

ELECTRIC TRACTORS AND TRUCKS

TRADE-MARK REG. U.S. PAT. OFF.

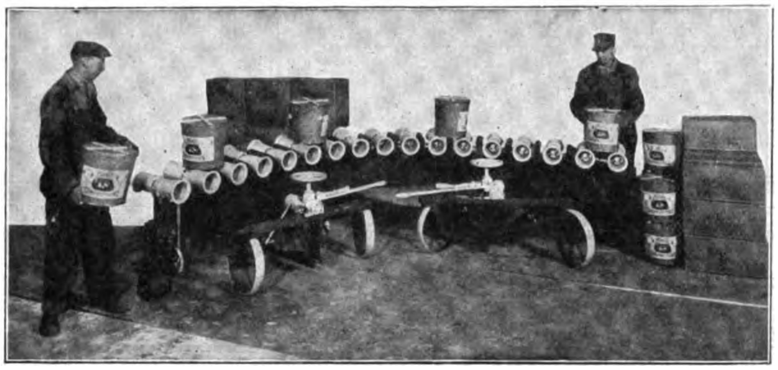
Baker

OTTUMWA

PORTABLE FLEXIBLE CONVEYORS

POWER DRIVEN

SOMETHING
ENTIRELY
NEW
IN
MATERIALS
HANDLING



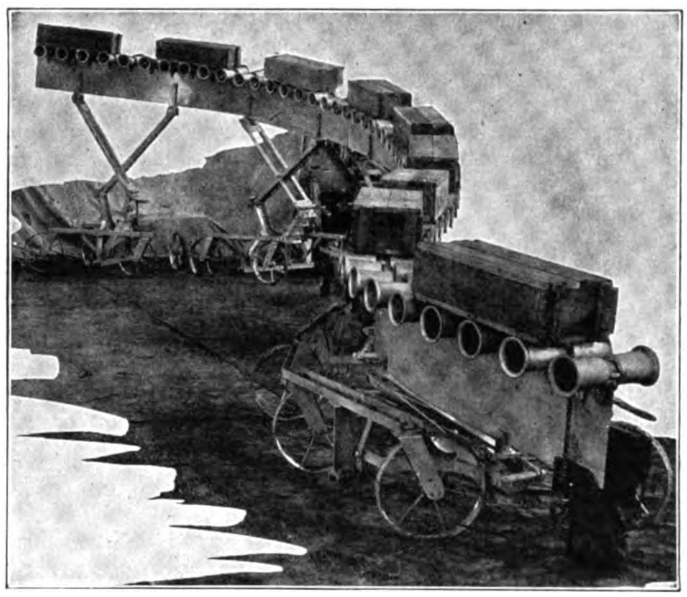
One Section in Operation Conveying Buckets

How many times have you wished for a conveyor that would do many things that could not be done with a straight belt conveyor, gravity rolls or gravity chutes? At last we offer you a solution in the first successful POWER DRIVEN FLEXIBLE PORTABLE CONVEYOR. Its uses and possibilities are almost unlimited. It marks a new era in handling such items as boxes, bags, kegs, pails, lumber, pig iron, and many others including almost any medium sized articles in process of manufacture.

SOME USES:

- Loading Box Cars
- Unloading Box Cars
- Stacking In Warehouse
- Lowering From Stack
- Conveying Up Inclines
- Retarding Down Inclines
- Conveying Around Turns
- Transferring From One Warehouse To Another or From Room To Room
- Conveying From Packing Machine To Cars or Store Rooms
- Conveying In Progressive Manufacture and Many Other Uses

Write us for detailed information without any obligation on your part.

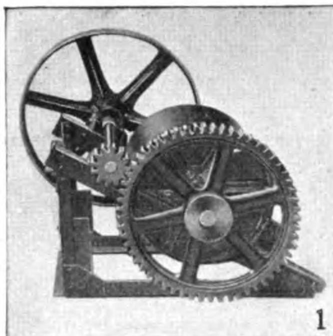


3 Connected Sections Conveying Boxes for Stacking

OTTUMWA BOX CAR LOADER CO.

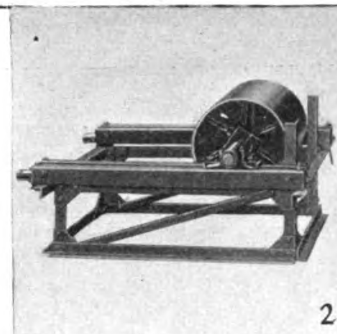
OTTUMWA, IOWA

Patents Pending



1

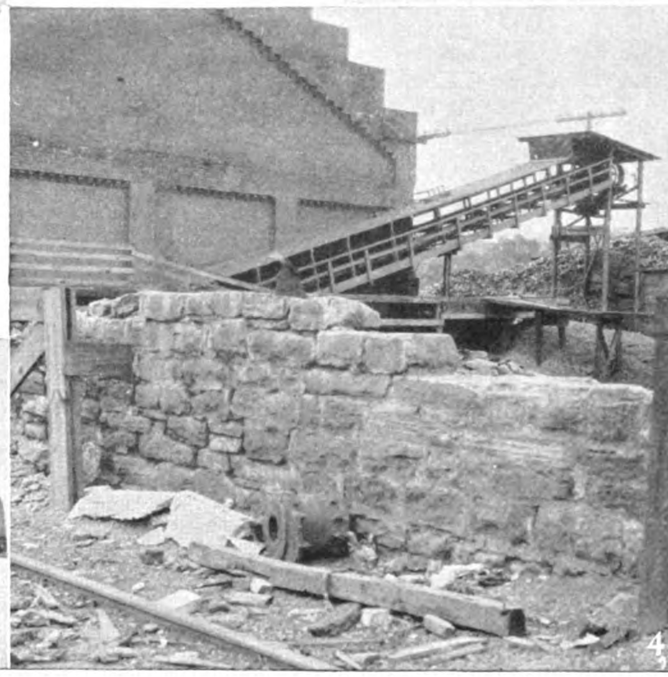
1—Complete drive and discharge end. Rigid mounting. Strong enough to stand the strain as extra intermediate sections are added to increase the length of the conveyor.



2

2—Complete hopper end. Rigid mounting providing ease of belt adjustment. Made strong enough to stand the strain as extra intermediate sections are added to increase the length of the conveyor.

3—Its Alemite lubricating system gives the Barber-Greene troughing carrier, Type 32, a decided advantage over carriers equipped with the customary grease cups or other inferior lubricating systems.



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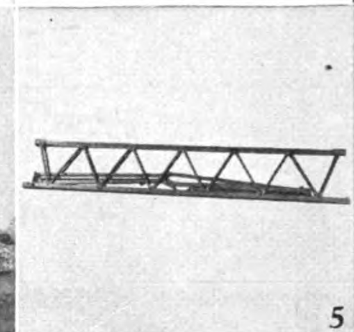

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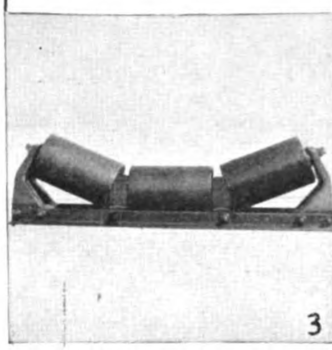


3

4—This Barber-Greene Permanent Conveyor cut the cost of handling coke and limestone from 75 cents to 16 cents a ton for the U. S. Radiator Co.

5—An intermediate frame section of the Barber-Greene Permanent Conveyor. No e the Warren Type side trusses and the lateral cross bracing.

$.59 a ton—Saved
With a Barber-Greene Permanent Conveyor

Because they carry materials from one part of the plant to another at a decided saving in time, men and money, Barber-Greene Permanent Conveyors are proving indispensable to a fast growing list of plants.

For instance, at the U. S. Radiator plant, 8 men used to require a day and a half to unload a car of coke or limestone. Two men and a Barber-Greene Permanent Conveyor now do this in two hours, at the same time saving the company 59 cents on every ton handled.

Unlike the "home-assembled" conveyor, which is usually a heterogeneous collection of parts that may or may not stay in alignment, the Barber-Greene does not get out of line.

Complete rigidity and accuracy of mounting are obtained by making the discharge end and the hopper end two units complete in themselves.

Parts are mounted by template on a steel frame. The intermediate sections are of Warren Truss Construction, ranging in length from three to fifteen feet. When changed production conditions require a conveyor of greater length, one or several of these sections are easily added.

Instead of a nondescript series of shafts, bearings, pulleys, collars and gears—which you must mount yourself and bring into exact alignment—the Barber-Greene is a carefully designed, powerful and permanent conveyor, the work of today's finest engineering and manufacturing skill.

If your operations require the moving of materials for considerable distances—to points beyond the reach of Barber-Greene Portable Conveyors—you will find the Barber-Greene Permanent Conveyor the swiftest and most economical of all existing conveying methods. Send for Catalog E.

BARBER-GREENE COMPANY—*Representatives in 50 cities*—500 W. Park Ave., Aurora, Illinois

BARBER B G GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Automatic Ditch Diggers

$20,000 more net profit

Result of installing Cowan System of reducing handling costs by eliminating unproductive labor.

Photograph shows the Cowan System in use in the plant of the Planters Nut & Chocolate Co.

THE Planters Nut & Chocolate Co., of Suffolk, Va., are manufacturing confectioners, peanut cleaners, graders and shellers. The Cowan System is saving $20,000 per annum for them, according to L. S. Hangwitz, their cost accountant.

The Cowan System is very elastic. It fits many sizes of plants. The Planters Nut & Chocolate Co. use twelve Cowan Lift Trucks or twelve units of the Cowan System. Whereas C. K. Jennings and Sons of New London, Ohio, manufacturers of concrete products, use only one unit and save $1200 per annum.

Saves 40 to 60% of handling costs

WHAT do your handling costs amount to at the present time? Write down the figure and then take 40% of it, to be conservative. The figure obtained will give you a fairly accurate idea of what the Cowan System can save for you. In actual figures, 40% of handling costs often mounts into the thousands of dollars.

What the Cowan System is

THE Cowan System is the most efficient known method of shop trucking. It eliminates the repeated loading and unloading of material as it progresses from raw material to finished product. In place of wasteful handling and non-productive labor you have extra profit.

The heart of the System is the "through-ticket" skid—a movable section of floor space. The Cowan Lift Truck backs under the skid, picks up skid and load, and off it goes to the new location where it sets down skid and load, eliminating both loading and unloading of the material. From one to four men per truck are released for more productive work. And the truck itself is released to serve other skids.

A few typical industries that use the Cowan System are:

Dyers	Ink
Electric Fixtures	Instruments
Floor Coverings	Jewelry
Flour (storage)	Lamps (bulbs)
" (mills)	Laundry
Foundry (iron)	Lead Products
Food Packers	Leather
Fruit Growers	Lumber
Furniture	Machinery (light)
Glassware	" (heavy)
Gum (chewing)	Medicines
Hardware	Motors
Hatchery	Motorcycles
Hotel	Musical Instruments

Survey and plan at no cost to you

JUST what equipment a particular plant or factory needs is a matter to be determined by a survey. And that is the way we work. We make first, as engineers, a survey of your present handling methods and costs. Then we draw up a plan to show you exactly how the Cowan System should be installed to effect the greatest saving for you, and we estimate, pretty accurately, what that saving will be.

We make no charge for our plan and survey. We merely use it as the basis for a mutual agreement between us as to whether you will or will not install the Cowan System.

Our opinion unbiased — we manufacture a complete line

THE opinion we give you in the plan is never in danger of being biased to fit the special equipment we manufacture because we are the only manufacturer of a complete line of hand and electric lift trucks, electric tractors, standard and special skids, trailers, etc. If the plan indicates that you need equipment that we do not manufacture, we will frankly tell you so.

Send today for complete information

FOR complete information, without obligation, simply send us the coupon below. Cowan Truck Company, Dept. A-3, Holyoke, Mass.

COWAN
"TRANSVEYORS"
HAND AND ELECTRIC LIFT AND CARRY TRUCKS

COWAN TRUCK CO., Dept. A-3, Holyoke, Mass.
Gentlemen: Please send complete information about the Cowan System of Reducing Handling Costs to:

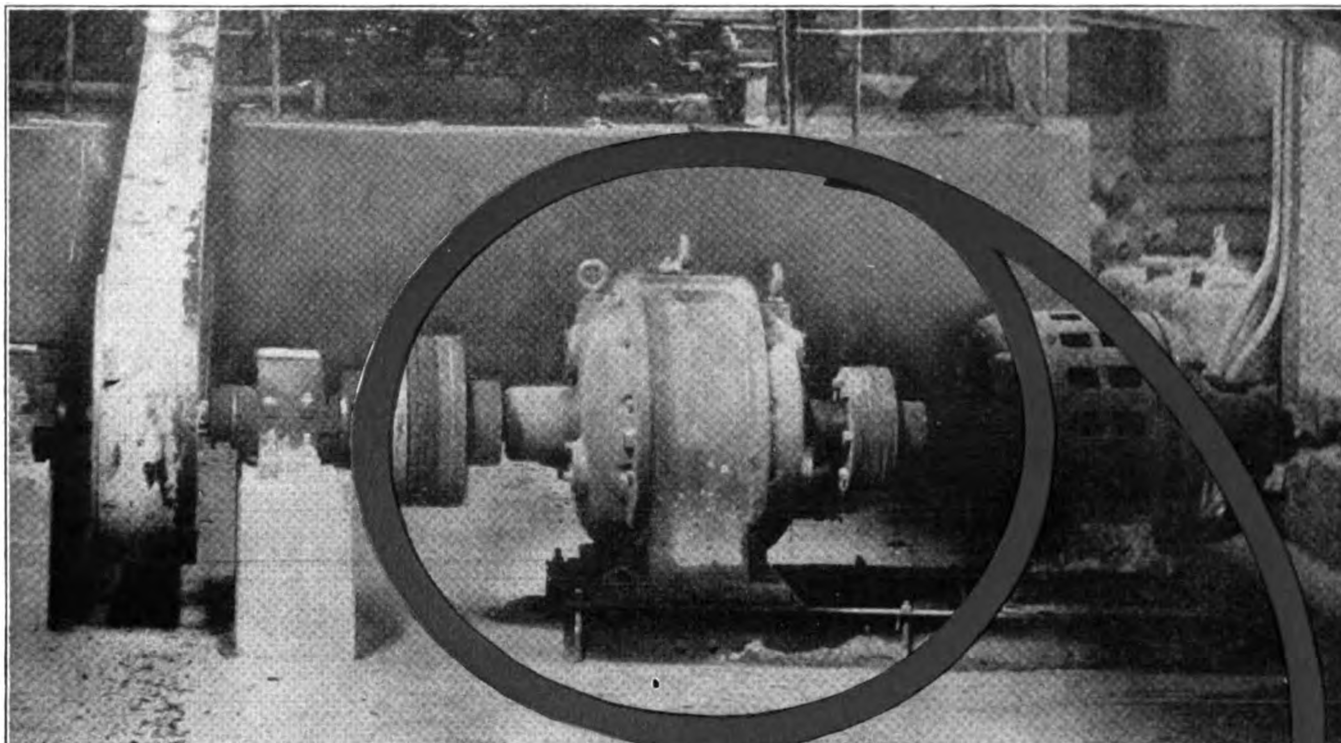
Name of Company ....

Name of Individual ....

Street ....

City .... *State* ....

We do....... we do not .... use lift trucks now. (Please check).



Jones Speed Reducer driving Kilns in a Cement Mill. Motor speed 720 R.P.M. Final Speed, 240 R.P.M.—ratio 3 to 1

Speed Reduction— and Cost Reduction

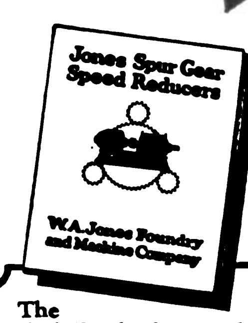
The design of Jones Speed Reducers—fully enclosed—gives assurance of proper lubrication, protection from dirt, dust and moisture, ***uninterrupted service to the job.***

You know what that means in keeping up production volume and in the holding down of production costs.

Add to those features, the elimination of the accident hazard to workmen, always a factor when old-fashioned exposed belts, pulleys, gears and chains are used for the purpose of speed reduction.

Add to that safety to man and machine, economy of floor space; a speed reduction that is accomplished with the minimum loss of power; a neat, compact unit that is built to endure—and you have the Jones Speed Reducer.

Send for Catalogue No. 26, the authoritative guide to modern practice in the application of motor drive speeds to the operation of comparatively low speed machines.



The Only Book of Its Kind

CATALOGUE No. 26—a clear, unbiased exposition of present day speed reduction practices. Endorsed by leading engineers and technical schools. Fifty-six installation views alone of the more than 140 illustrations. Useful tables and formulae on speed reduction. Write for it.

W. A. Jones Foundry & Machine Company

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Branch Sales and Engineering Offices:

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Jones Speed Reducers

and Power Transmitting Machinery

Lifting is Done
The Most Economical Way By The
NORTHERN PROCESS

Being designers and builders of practically every form of lifting apparatus our Engineers are in position to advise and offer you an unbiased opinion and the equipment best suited to your needs.

We can furnish you electric traveling cranes of all types and capacities, Electric and Air Hoists, Gantry Cranes, etc., etc., etc.

We also build a "Standart-ized" 5 ton crane and the finest little "Standart-ized" electric hoist you ever saw—our Type B, ask for Bulletins.

Allow us to assist you in working out your needs

NORTHERN ENGINEERING WORKS

Builders of Lifting Machinery of all kinds

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District Offices

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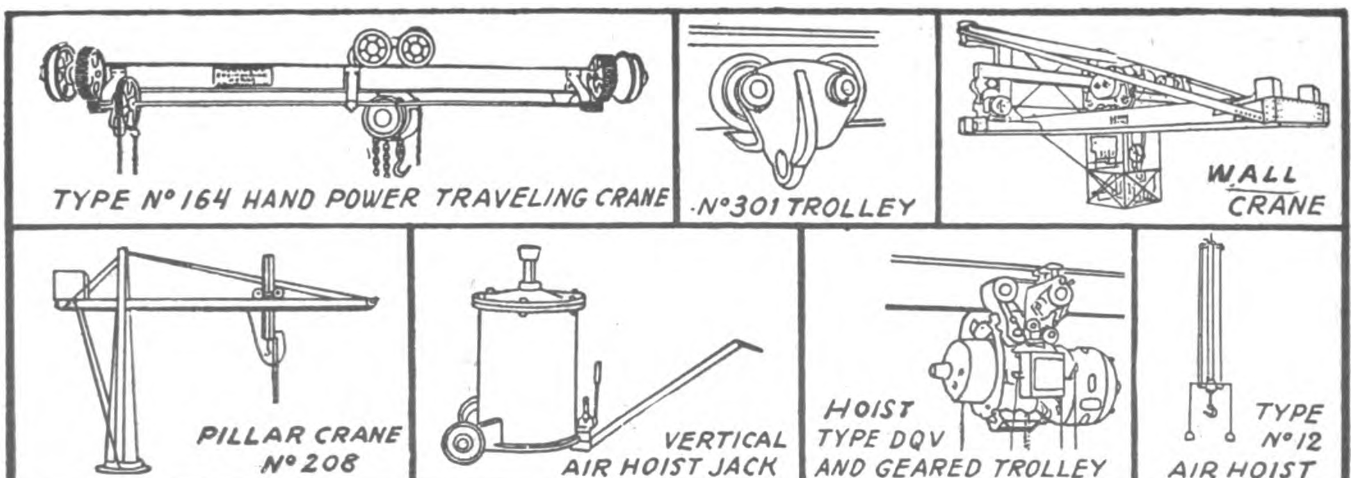
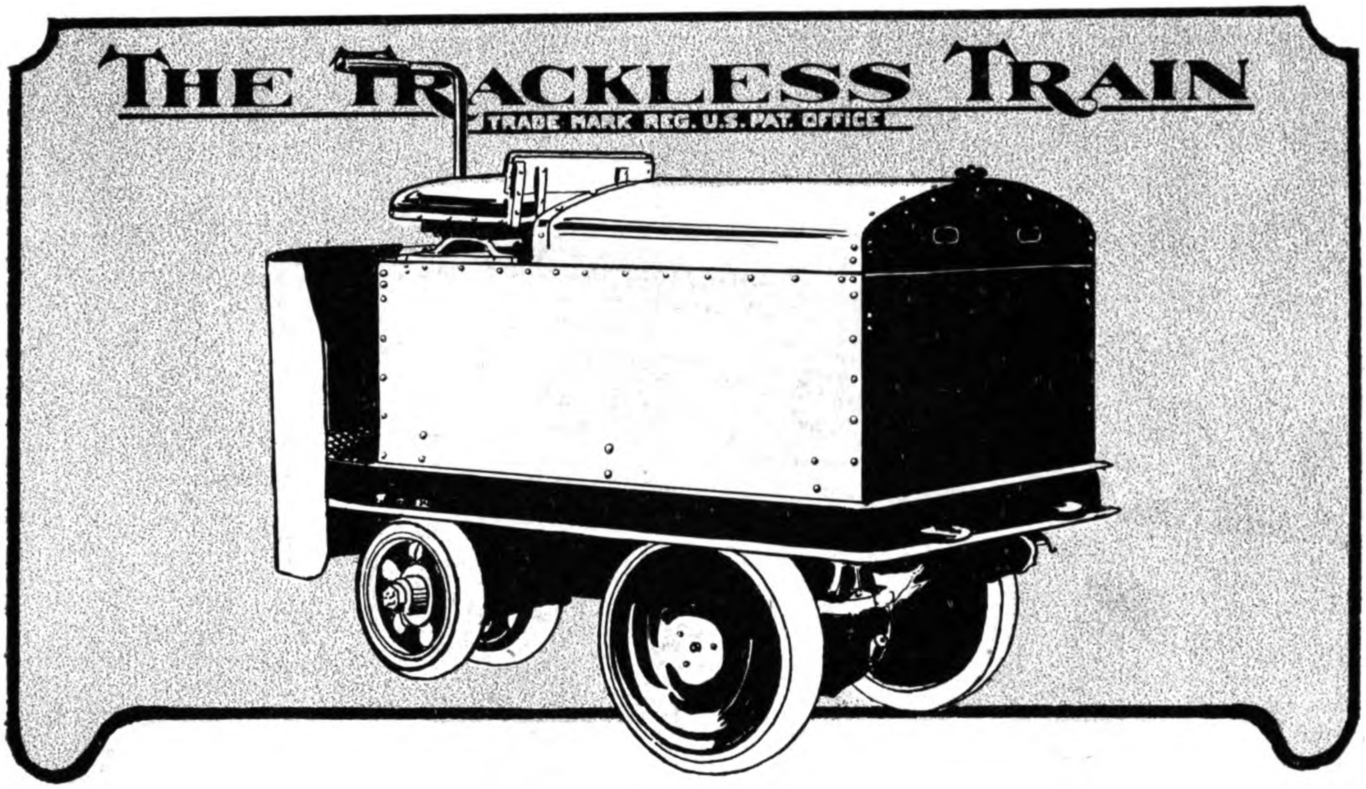
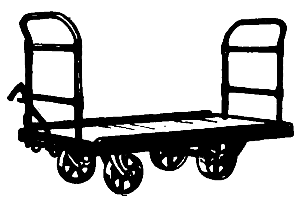
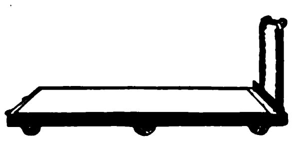
594 Union Trust Bldg........................Pittsburgh, Pa.
633 Carondelet St..........................New Orleans, La.
201 Devonshire St..............................Boston, Mass.
147 Orlin Ave., S. E.......................Minneapolis, Minn.
Room No 630, Monadnock Block
53 W. Jackson Blvd.............................Chicago, Ill.
438 E. Third St............................Los Angeles, Calif.
606 Pontiac Bldg...............................St. Louis, Mo.
923 Traders Bank Bldg.......................Toronto, Ontario





For more than ten years


The Universal Trailer Type "A-310"


Type "A-200" Dolly

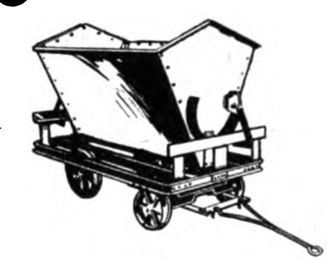

Production Trailer Type "A-139"

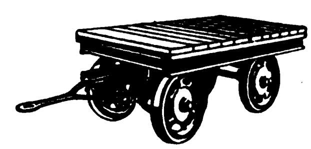
we have been devoting our sole attention to the manufacture and installation of industrial tractors and trailers.

The natural result is that we offer a full and complete line of such equipment—refined to the last detail in design and construction — and are able to give time-tested and valuable advice on the tractor-trailer subject in general.

You are invited to bring your problems to *"Tractor-Trailer Headquarters."*

A brief investigation will disclose that a preponderance of tractor-trailer installations are "Mercury." Complete bulletins sent upon request.


Type "A-206"—A Self-Discharging Body for Bulk Material


Type "A-240"—A Miniature Highway Trailer for Rough Going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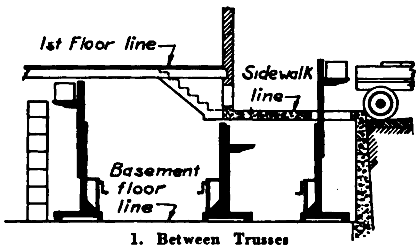
THE TRACKLESS TRAIN

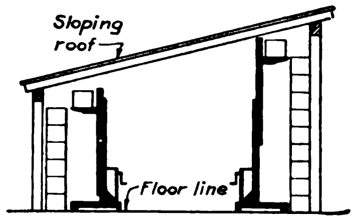
Mercury Manufacturing Company
Chicago, Illinois

The Economy Telescoping Portable Elevator

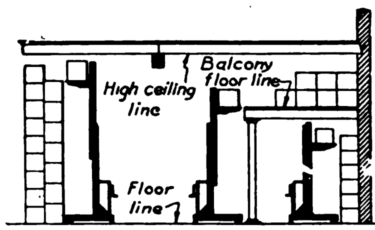
Permits the Utmost Versatility



1. Between Trusses



2. Under Sloping Roofs

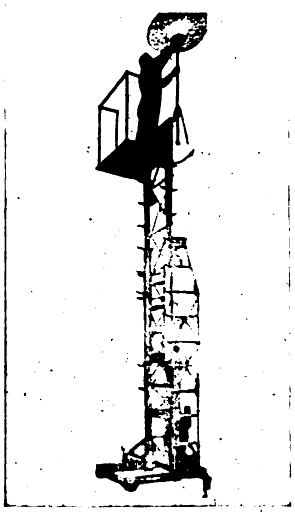


3. For Balcony Work

Economy Telescoping Portable Elevators will fit in all the "hard" corners of your plant. Down in basement corners, under and between pipes, where headroom is lacking or up through trap doors, Economy Telescoping Machines are ready for work.

Modern ideals of economical material handling and space conservation demand the utmost attention to the lifting operations going on in and about your plant. Investigate for yourself and see if it isn't possible for you to correct improper methods by installing the Economy System.

They enable you to utilize every inch of storage space you have; in addition, can find a hundred different lifting jobs to do about the plant. Invariably they reduce costs by releasing men for other work.



Drop us a line if you want us to go over your plant with you—without obligation of course. It may be possible for us to suggest ways and means of saving many of your material handling dollars.

The Economy Engineering Co.
2663 W. Van Buren St., Chicago

New York Office:
342 Madison Avenue

ECONOMY LIFTERS

The MERRICK WEIGHTOMETER

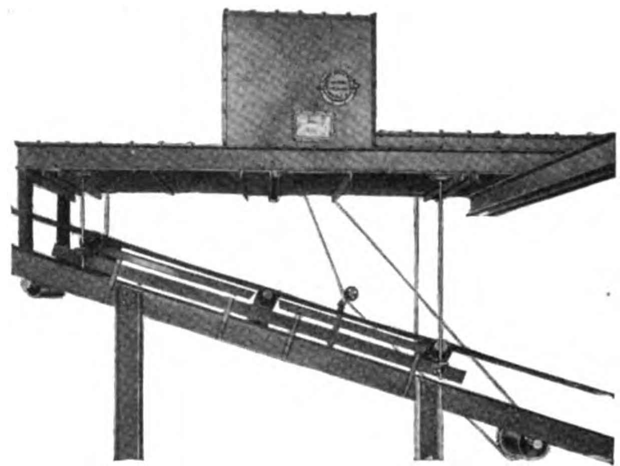
Weighs Materials on the Move

Any conveyor handled material can be accurately weighed in transit by the Merrick Weightometer.

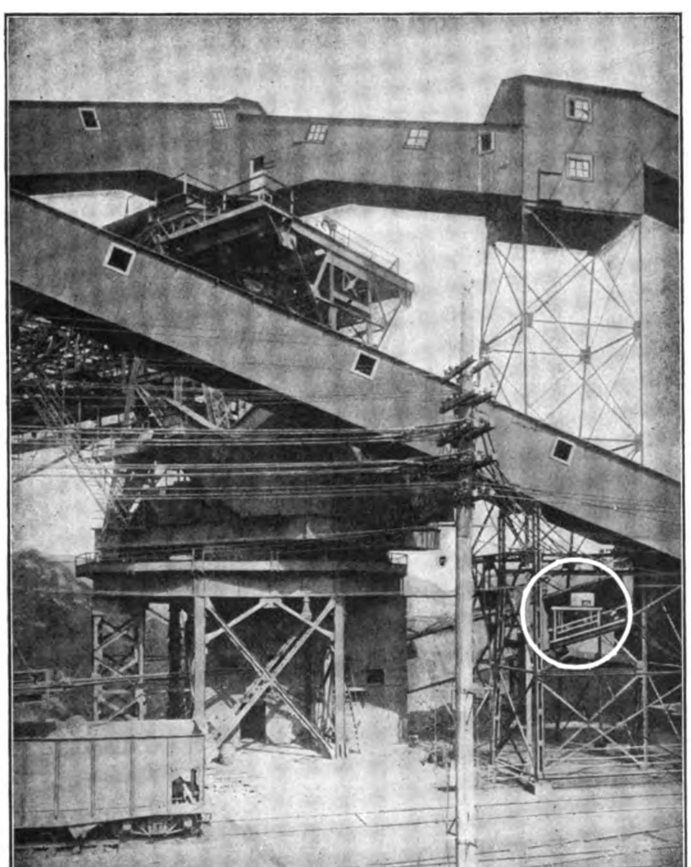
Materials such as

- Coal, run o' mine and crushed
- Coke
- Stone, coarse and fine
- Gravel
- Sand
- Cement Rock
- Cement Clinker
- Finished Cement
- Zinc Ore
- Iron Ore
- Copper Ore
- Lead Ore
- Gold Ore
- Silver Ore
- Metallic Ore Concentrates
- Phosphate Rock
- Phosphate Pebbles
- Wood Chips
- Sulphite Pulp Slabs
- Fish and Fish Products
- Copra

The Weightometer weighs and records the weights as materials pass over the conveyor. No extra labor required—no time lost.



Weights Guaranteed 99% Accurate



Installation of Merrick Weightometer at a prominent gas and coke company's plant

You eliminate once and for all the necessity of relying on bill of lading weights. Hundreds of firms now know the amounts of materials they receive and ship by means of the **Merrick Weightometer.**

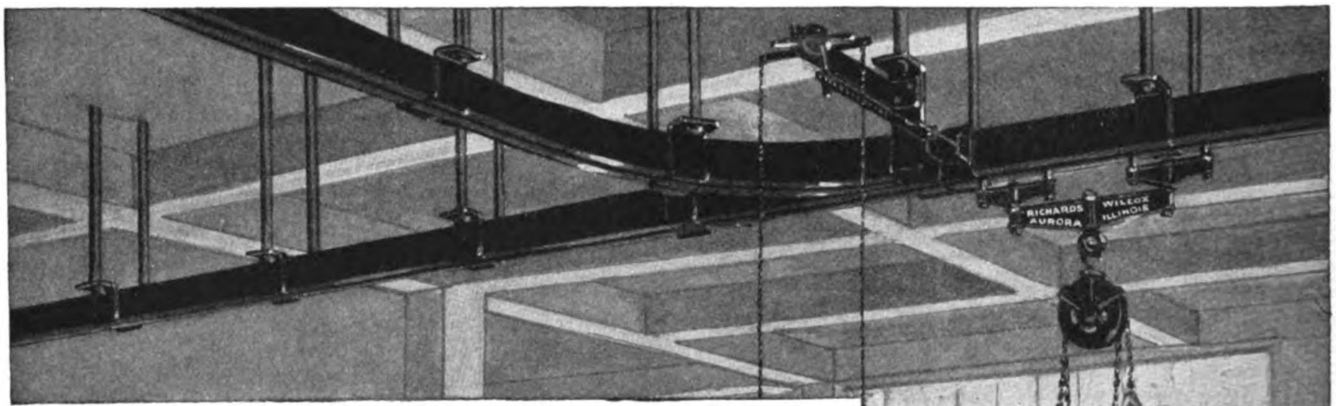
It is designed for use on any style, type, or size belt or pan conveyor. Easily installed and requires very little attention—hardly any upkeep or maintenance costs.

Write for the Merrick circulars.

MERRICK SCALE MFG. CO.

180 Autumn Street, Passaic, N. J.

QVALITY LEAVES ITS IMPRINT



Let this Ceiling Railroad slash your handling costs

By providing a speedier and less costly means of moving heavy loads, OveR-Way Conveying Equipment makes heretofore wasted ceiling space as valuable as floor space. OveR-Way hurries up production, economizes on storage space by permitting higher piling, and multiplies man power by enabling one man to do the work of six.

OVER-WAY

Conveying Equipment

can undoubtedly be put to many helpful uses in *your* plant. The cost is of course incidental, for no OveR-Way installation has ever yet failed to repeatedly pay for itself. In fact, it is not at all uncommon for an OveR-Way installation to repay its cost the first year.

Free Engineering Service to Manufacturers

Our Engineering Department will gladly tell you how OveR-Way can be adapted to your particular requirements, and submit complete plans, specifications and estimated savings. This service is given without cost or obligation to any manufacturer who earnestly desires to modernize his plant. Write for details of this free service and a copy of Catalog BB-23

OVER-WAY

Economically Moves—

Ashes	Lead
Bags	Leather
Bales	Lumber
Barrels	Machinery
Boxes	Metal in Pigs
Bushings	Molten Metal
Castings	Motors
Cement Blocks	Moulding Sand
Chains	Moulds
Coal	Nails
Crucibles	Nuts
Drums	Oils
Forgings	Paper Rolls.
Hardware	Patterns
Heavy Timbers	Pipe
Hose	Screws
Ingots	Shafting
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Jacks	Structural Steel
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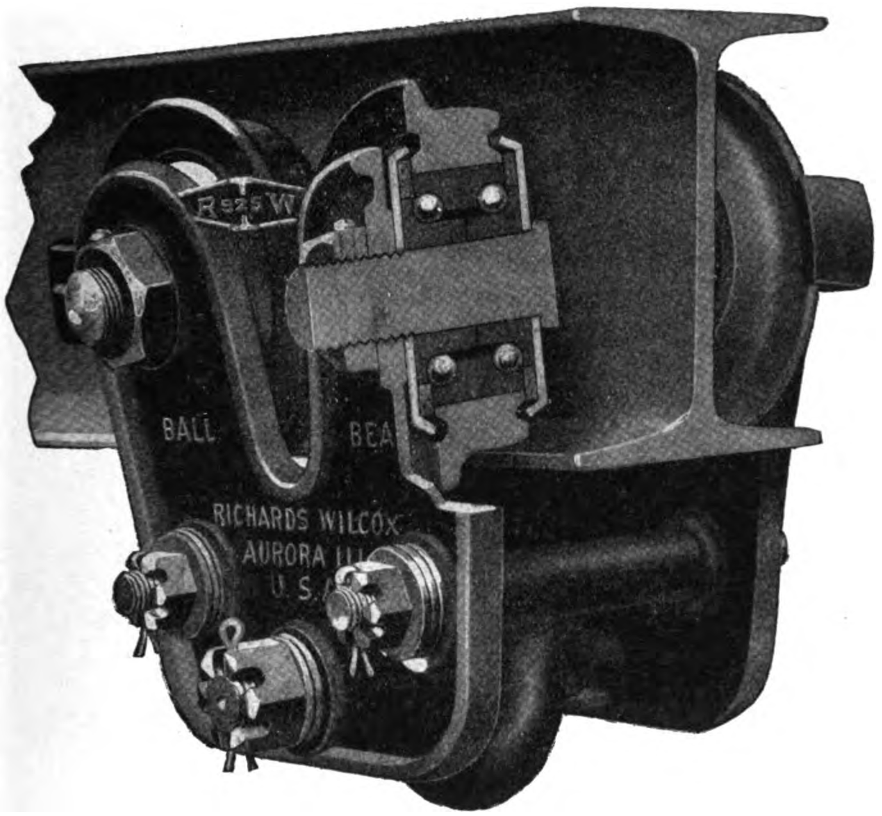

Sent for FREE TRIAL

So confident are we of the ability of the ***R-W No. 925 Trolley*** to render superlative service that we will gladly send it to any reputable manufacturer for free trial. Such a trial involves no cost or obligation, for if the trolley fails to demonstrate its superiorities under actual working conditions you have only to send it back at our expense. This offer, we believe, is far stronger than any claims we can make.

R 925 W

Ball-Bearing I-Beam Trolley

is the outcome of years of endeavor to overcome ***every*** fault common to I-beam trolleys. Rigid tests over a long period of time have convincingly demonstrated that the ***R-W No. 925 Trolley*** is the most durable, most useful and most easily operated trolley obtainable. Among its many exclusive features are bumpers which protect wheels from chipping; an exceptionally short wheel base, permitting easy operation on curves; bearings protected from gritty dust by felt washers; crowned wheel treads, which reduce friction, and combination radial and thrust ball bearings. The ***R-W No. 925 Trolley*** is made in seven capacities—¼ ton to 4 tons. Write today for Catalog BB-23 and further details of free trial offer.

A Few Representative Users

American Magnesium Corp.
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American Radiator Co., 12th and Eastern Ave., Kansas City, Mo.
American Radiator Co.
Buffalo, N. Y.
Arizona Iron Works
Phoenix, Ariz.

Bacon Co.
Brooklyn, N. Y.
Baker Machinery Co.
Des Moines, Iowa
Bellamy Co., Inc.
Boston, Mass.
Berry Iron & Steel Co.
St. Joseph, Mich.
Brooklyn Union Gas Co. Meter Repair Dept., Brooklyn, N. Y.
Burnham Boiler Corp.
Lancaster, Penna.

Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Central Foundry Co.
Marshalltown, Iowa
Challenge Co.
Batavia, Ill.
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Portsmouth, Ohio
Corduroy Tire Co.
Grand Rapids, Mich.
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A Hanger for any Door that Slides

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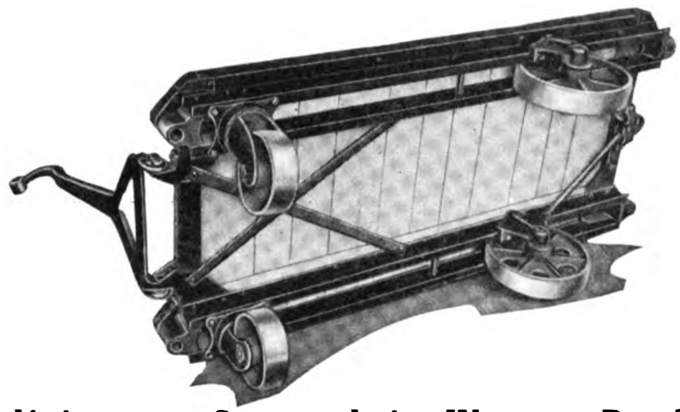
Lowest Prices on Dependable Products

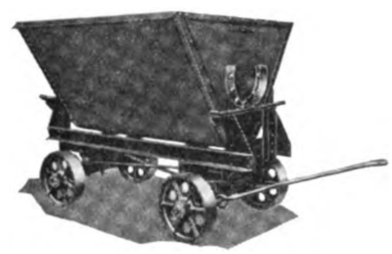
The WARREN MANUFACTURING COMPANY

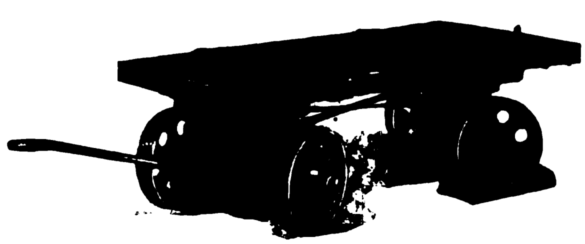
Springfield, Massachusetts

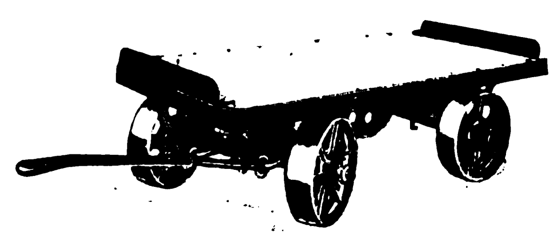
EXPERT DESIGNERS and BUILDERS
of
INDUSTRIAL TRUCKS and TRAILERS
for all purposes

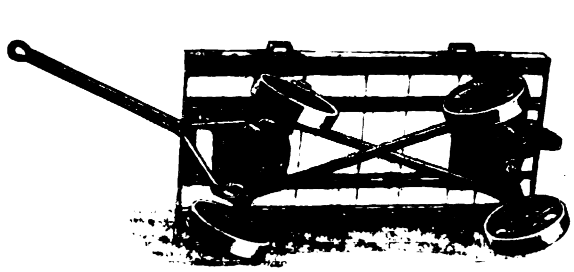


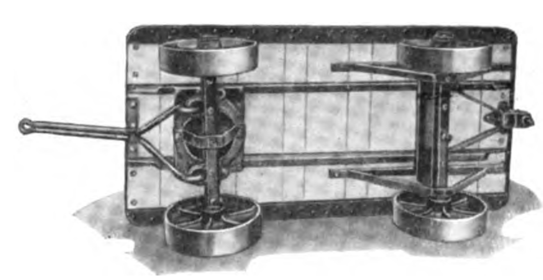
Simplicity and Strength in Warren Products
Produce Perfect Performance—Steady Service—Endurance
and
The LOWEST COST PER YEAR OF OPERATION



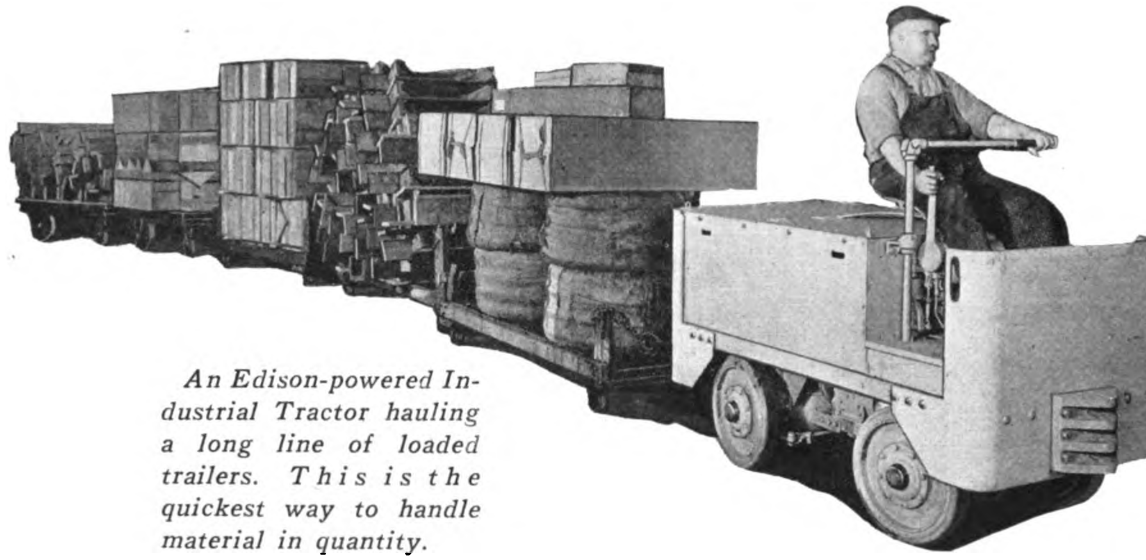








Warren Trucks and Trailers are used by leading Manufacturers, Railroads and Steamship Lines

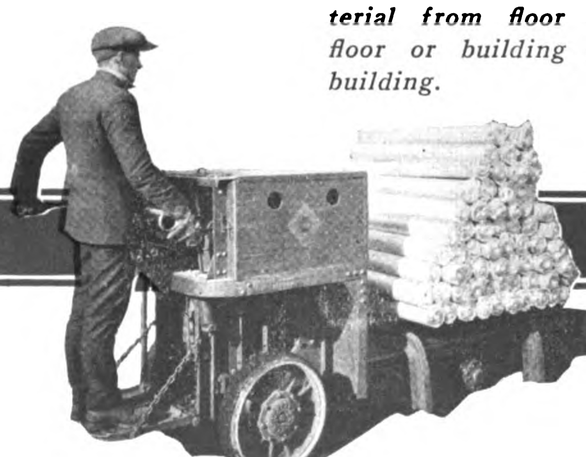


An Edison-powered Industrial Tractor hauling a long line of loaded trailers. This is the quickest way to handle material in quantity.

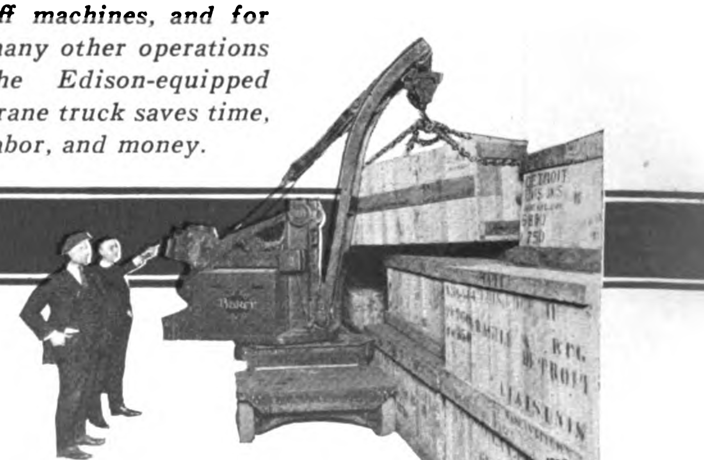
We have prepared Bulletin 1994 describing the tests referred to on the opposite page and will gladly send it to any one who wants to lower his battery expense.

Or Bulletin 804, describing in detail the principle, construction, and manufacture of Edison Batteries is yours on request. Send for either or both of them.

In and outside the plant Edison equipped industrial trucks easily and quickly carry material from floor to floor or building to building.



For handling heavy or bulky material, for stacking, for quickly swinging work on or off machines, and for many other operations the Edison-equipped crane truck saves time, labor, and money.



More Miles—
More Material Moved

Wherever comparative tests, under working conditions, are made between Edison Batteries and the well known lead-acid types, Edisons show their ability to stay on the job longer and do more work. Whether the tests are made by the user of the batteries over a period of years, or whether they are formally conducted with every detail carefully recorded, Edison Batteries prove their money and time saving qualities.

Two particularly interesting tests were made not long ago. In one, the Edison Battery hauled 70 tons more and ran almost five miles further on a charge. It made the grades faster and saved time on each trip. In the other a 2½-year-old Edison Battery made ten more trips, gave a half hour more continuous running service, hauled 60 tons more, gave 63 ampere hours greater capacity (exceeding its own rating by 85 ampere hours), and made faster time per trip than a new lead-acid type battery of a very well known make especially selected by the maker for a demonstration.

That Edison Batteries can make such records under tests, or, working for you, can save money by doing more work, requiring little care, giving no trouble, and lasting many years, is due to their entirely different principle and construction, invented and perfected by Thomas A. Edison. Edison Batteries use nickel hydrate and iron oxide for the active elements, immersed in an alkaline (non-acid) solution. The container, pole-pieces, grids, and tubes containing the active elements are all of nickel-plated steel.

This nickel-iron-alkaline principle and the strong, compact steel construction has made impossible the "diseases" common to all lead batteries and saved much money for users of electric truck and tractor equipment. Many Edison Batteries have given seven, eight, and even ten years of service and are still working.

Leading Electric Truck and Tractor Manufacturers gladly furnish Edison Batteries.

Built like a watch
—Rugged as a battleship

Thomas A. Edison
A PRODUCT OF THE EDISON LABORATORIES

Edison Batteries Haul More for Less Money

EDISON STORAGE BATTERY COMPANY
Valley Road, Orange, N. J.
or

ATLANTA, 138 South Forsyth Street
BOSTON, 702 Beacon Street
BUFFALO, 145 Minnesota Ave.
CHICAGO, 3130 South Michigan Avenue
CLEVELAND, 2090 East 19th Street
DETROIT, 417 Garfield Building
HUNTINGTON, W. Va., Fifth Avenue Hotel
LOS ANGLES, 400 San Fernando Building
NEW ORLEANS 440 Maison Blanche Annex
NEW YORK, 247 West 35th Street
NEW YORK, Export 26 W. Broadway
PHILADELPHIA 2415 Chestnut Street
PITTSBURGH, 630 Fulton Building
SAN FRANCISCO, 206 First Street
SEATTLE, Polson Building
ST. LOUIS, 2088 Railway Exchange Building
WASHINGTON, D. C., 1419 G Street, N. W.

Why Leading Truck and Tractor Manufacturers Furnish

Edison Power Batteries

You are the judge of the trucks and tractors in your service, the one who profits by the use of storage battery driven haulage equipment. Increased truck business can only come from your knowledge of the profits earned by your own trucks.

The lower the cost of upkeep and the less trouble the truck or tractor units give, the lower your material handling costs will be. The truck manufacturers' business depends upon your satisfaction with their products.

There is no profit for you in having your trucks laid up on account of battery trouble. The expense for the truck goes up and the work performed goes down.

Cheap, short-lived batteries are about the only source of trouble in an otherwise strong, rugged machine. Knowing that, the leading truck and tractor manufacturers are always glad to furnish Edison Batteries, because only Edison can stand up regularly under rough shop and terminal conditions and give the many years of life for which they are well known. Neglect, which ruins more batteries than any other cause, has little or no effect on Edison Batteries. Care and operation is extremely simple and inexpensive. There is never any necessity, with Edison Batteries, for the complete internal rebuilding operations required by lead-acid batteries. Throughout their long life Edison Batteries operate with none of the troubles or "diseases" common to lead-acid type batteries. They are the most reliable in service and the lowest cost per year of life.

Leading Electric Truck and Tractor Manufacturers gladly furnish Edison Batteries.

Built like a watch
—Rugged as a battleship

Thomas A. Edison
A PRODUCT OF THE EDISON LABORATORIES

Edison Batteries Haul More for Less Money

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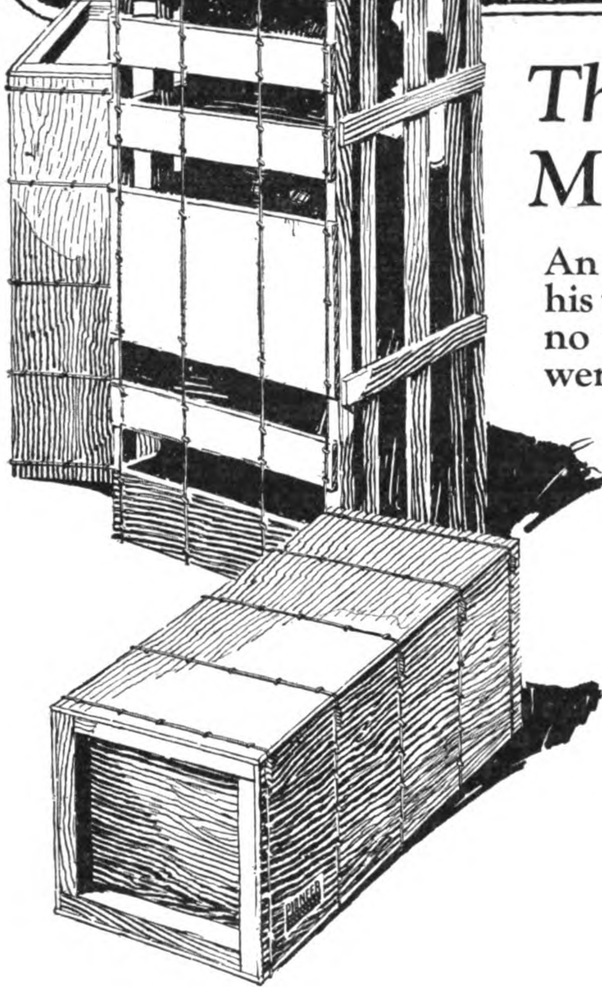
BOSTON, 702 Beacon Street
BUFFALO, 145 Minnesota Ave.
CHICAGO, 3130 South Michigan Avenue
CLEVELAND, 2090 East 19th Street
DETROIT, 417 Garfield Building
HUNTINGTON, W. Va., Fifth Avenue Hotel
LOS ANGLES, 400 San Fernando Building
NEW ORLEANS 440 Maison Blanche Annex
NEW YORK, 247 West 35th Street
NEW YORK, Export 26 W. Broadway
PHILADELPHIA 2415 Chestnut Street
PITTSBURGH, 630 Fulton Building
SAN FRANCISCO, 206 First Street
SEATTLE, Polson Building
ST. LOUIS, 2088 Railway Exchange Building
WASHINGTON, D. C., 1419 G Street, N. W.



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Each crate weighs fifty-four pounds less. His average freight and express rate is $3.27 per hundred pounds. Most of his fenders are express shipments. The saving in transportation charges alone is $1.77 per crate—more than the cost of the crate.

The expense of damaged fenders is done away with. He saves also on labor cost because the Pioneers come to him three-fourths assembled.

Perhaps we can do as much—or more—for you. Let our Engineering Service Department submit a report or recommendation **on your shipping problem. There is no cost or obligation involved. But investigate Pioneer economy today. It pays to do so.**

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SEVENTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

Bogalusa, La.	**Cincinnati, Ohio**	**East St. Louis, Ill.**	**Illmo, Mo.**	**Nashville, Tenn.**	**Sheboygan, Wis.**
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Brooklyn, N. Y.	**Detroit, Mich.**	**Houston, Tex.**	**Louisville, Ky.**	**Pearl River, La.**	

Receiving and Distributing Raw Material

(*Continued from page 19*)

are divided into three sections, as shown in Fig. 6. The section to the right is the receiving bins, to which the boat unloaders immediately discharge the raw materials. The other sections, one of which is visible, are for storage. The wall shown to the left is the dividing wall between these sections and is located approximately half way, which makes each section about 125 feet wide. As previously stated, the length of these bins is in the neighborhood of one half mile, and at regular intervals separating walls are installed which make individual storage pockets. Over these storage bins two ore bridge gantry cranes operate and these cranes handle all the raw materials on the various operations, from receiving bins to high line and to the various equipment which is fed from this point. To the left of Fig. 6, high line is visible and one end of the gantry cranes is supported at this point. In addition, a locomotive handling a train of coal cars is visible and it might be stated at this point that raw materials received by rail are all brought to high line if they are to be placed in outside storage, and the gantry ore bridge cranes unload the cars and distribute the materials. Cars can also be dumped direct to conveyors under high line, which will transport the materials to various operations. This system will be taken up in detail.

As the locomotive is not always on the high line any more than it is always on the bulkhead, another cable haul, to facilitate the shifting of loaded and empty cars was installed at this point; but, as high line from one end to another is more than half a mile, these cable hauls are separated into three units, and this separation conserves power as well as making for better operating conditions. The first cable haul, at this point, moves the cars at ground level into position so that a cable haul barney car can come behind them so as to push the cars up the long incline to high line level. On high line is the main cable haul, approximately half a mile long, and this operates in a trough, as shown in Fig. 7. The method of attaching to the cars is also clearly shown; and this consists of an auxiliary cable on one end of which is a large hook and on the other end a special clamping device, which permits the operator to quickly fasten to the cable or release the same without stopping the main cable. As in the case of the bulkhead cable haul, the two mentioned, the one on the ground level and the one on the high line, are also fully equipped with remote control stations at approximately every fifty feet. The drive unit for the cable haul in Fig. 7 is shown in Fig. 8 and some of the circuit breakers are visible in the cabinet. The motor, which is 100 hp., is in the right foreground of the picture and the method of wrapping the cable around the driving drum is clearly shown. All these cable hauls necessarily have to be counter-weighted so as to keep the cables taut. Digressing a bit from the subject of materials handling, we would like to call the reader's attention to the cleanliness, housing conditions, and safety guards, both on this drive and the one shown in Fig. 11.

After the cars have been emptied, it is necessary to lower them from high line to ground level. Instead of hauling the cars back and lowering them by means of locomotives, which would necessitate more than a mile haul, they are all brought to the southerly end of high line and lowered by the means of a conveyor and gravity switch-back, as shown in Fig. 9. The start of this conveyor and control house are shown in Fig. 10, with a car half-way down the incline. The man in the booth controls the conveyor, as well as the bumping-post between the tracks which prevents other cars from being fed to the conveyor before the first one is fully clear. The view in Fig. 9 is taken from the control booth and shows a car part way up the gravity switch-back. The run from the end of the conveyor gives the car momentum enough to pass the spring switch at the ground level; the run up the incline stops the car and, in addition, reverses its direction of travel; and with a slight grade, the empty car will travel under its own momentum a distance of more than half a mile, finally coming to rest on one of the tracks located on the bulkhead, previously mentioned in connection with Fig. 3. Fig. 11 shows the drive of this conveyor, which is located directly beneath the control booth. It might be surprising to know that only a 20 hp. motor is required to drive this conveyor.

We have now been over the ground and described some of the materials handling equipment used in the handling and storing of raw materials both as received by boat and received by rail, but this same material has to be again handled and distributed to various parts of the plant: for instance, coal must be taken from outside storage and fed to a conveyor system, which distributes it through various buildings where it is prepared for use either in the coke ovens or in Power House No. 1. The iron ore has to be reclaimed and distributed to feeder bins from which it can be transported to the blast furnace skips. Limestone must likewise be handled. In order not to confuse the reader, we will take each one of these steps as units although in a number of cases it will mean repetition for the reason that there is an overlapping, or in other words, the same equipment is made to serve more than one operation.

The overlapping of units is clearly shown in Fig. 12, where a diagrammatic layout is presented, showing the coal and coke handling systems in plain view. Only the buildings which are a part of this system are shown, and these are plainly marked by name. The conveyors that are represented by shaded lines make up the coal handling system while those represented by unshaded lines make up the coke handling system. Each conveyor is numbered and the direction of travel is indicated by arrows. In order to make the picture more complete, designating letters are marked on the plan and on Figs. 13 and 14 these conveyor letters are marked.

Much has been written regarding the use of coal at the River Rouge Plant and the method of utilizing every part, but little has been said regarding the important item of handling this large tonnage with a minimum labor cost. At this plant, approximately 2,000 tons, or forty cars of coal, are handled daily. Mechanical methods necessarily have to be employed, for it would require an army of men to move such a volume by any other method. As previously stated, coal can be received by boat or from cars on high line, and at the same time coal can be unloaded at a point in the plant yard, as shown in plan on Fig. 12 and illustrated in Fig. 14. In the case where the coal is held in the outside storage bin, or received in railroad cars on high line, it is started through the conveyor system by being dumped into the coal hopper. Under these hoppers are four beaded flight feeder conveyors which discharge to one 48" belt conveyor ("B") which carries the lump coal up an incline and discharges into the breaker and crusher building.

When coal is received by railroad cars it is not necessary to transport it to high line in order to dump it and it has been found expedient to have more than one coal dumping station. For this reason a coal car dumper is located at the point shown on the plan and as illustrated in Fig. 14. This car dumper is operated by two men and is capable of taking a gondola car and dumping the entire contents in a very few moments. The coal siding at this point of discharge is protected by a high wire fence, as shown, and an electric locomotive operated by power received from the third rail and running on separate tracks parallel to the coal siding moves individual cars into place at the foot of the incline so that the barney car cable haul (Fig. 14) can push the loaded cars to the dumper. The loaded car ejects the empty car from the dumper and the empty car proceeds to a gravity switch, as shown in Fig. 12, from whence it returns to the empty car siding. The coal, after being dumped from the car, is fed to a 48" belt conveyor ("A") which carries the coal on an incline and discharges into the breaker and crusher building at the same point as conveyor ("B") discharges its load.

At the top of this breaker and crusher building are two 200 ton steel plate storage bins from which the material is discharged by gravity through regulating gates to breakers. After the coal is broken into 1½" sizes, and the over-sized lumps, together with iron, slate and stone, are diverted to a 42" picking belt, the larger lumps of coal are discharged to another beaded flight conveyor

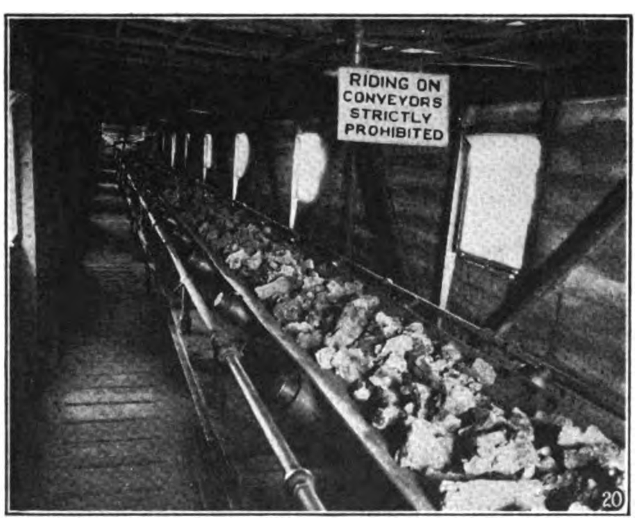


Fig. 20. Conveyors are so familiar to the Ford employees that it is necessary to post signs forbidding their use as passenger conveyances.

which feeds to a final crusher. Crushed coal, having a maximum of 1½" size is discharged at the base of the breaker and crusher building to a 48" belt conveyor ("C") which again elevates the coal on an incline and discharges same on the top of the pulverizer and mixer building, as shown in Fig. 13. Here a self-contained shuttle conveyor distributes the coal into storage bins under the classification according to high or low volatile content. From these bins, the coal before being delivered to the coke ovens, is properly proportioned on the mixing tables which are 48" belt conveyors. In addition to the conveying equipment, this building contains the hammer mills, or pulverizers, where the coal, after being mixed, is further reduced in size so that it will pass through a ¼" mesh screen. From these pulverizers the coal drops into a 30" spiral screw conveyor, which carries the material to a large bucket elevator which again raises the coal to the top of the building and discharges to a 48" belt conveyor ("D") placed on an incline, as shown in Fig. 13, which conveys and raises the coal in proper condition for coking to the 2,500 ton coal bins between the blocks of coke oven.

As shown, the coke ovens are divided into two separate units, but they receive their raw materials from the central storage bins. This material, pulverized coal, is transported to the ovens in unit charges of 32,000 lbs., by means of the electrically propelled coke oven charging car, shown in Fig. 15. It will be noted that this car is divided into four 8,000 lb. hoppers and these hoppers are mechanically dumped into the man-holes which are directly beneath each hopper. As the capacity of the charging car is equal only to the capacity of one oven, it is necessary to make a trip back to the central storage station after each charge.

To give an indication of the activity at this point it might be well to tell the reader that it requires twenty-two hours at the present time to transform an oven full of coal into finished coke, and under present operating conditions each coke oven runs twenty-four hours a day, seven days a week; which means that an oven of coke is discharged every eleven minutes, and likewise

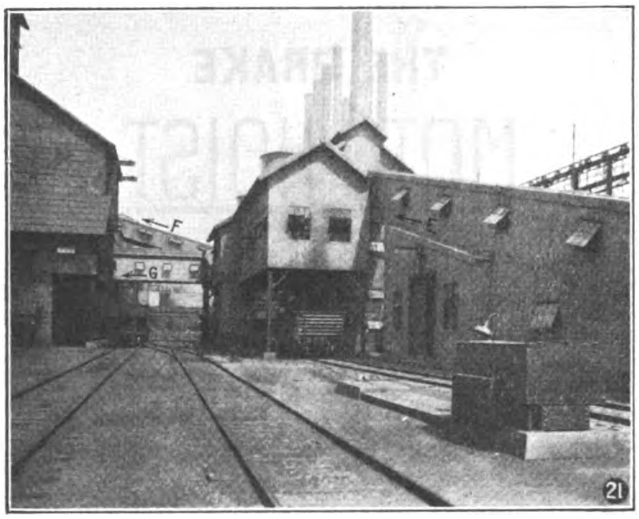


Fig. 21. Coke handling is an important operation and every mechanical convenience has been installed for the transporting of this product.

at the same time intervals ovens must be re-charged. The pushing of the oven is mechanical and requires three pieces of apparatus, a mechanical pusher, as shown in Fig. 16, a coke guide on the opposite side of the ovens, and a quenching car (Fig. 17) propelled by an electric locomotive. When an oven is to be discharged the "pusher car" takes its place on one side of the oven, the coke guide and quenching car are likewise aligned at the other side of the oven. The oven doors, which are hydraulically operated, are then raised and the pusher ram, which exactly fills the cross-section of the oven, is propelled forward through the oven, discharging the mass of hot coke to the coke guide into the quenching car. This car with its load of incandescent coke is then run into a quenching tower, where streams of water are played upon the car and its contents. After being cooled the car is run back to the coke wharf, shown in Fig. 13. The coke is discharged upon its slanting, smooth, cast-iron surface, from which it is mechanically fed as required through gates at the base of the inclined wharf, as shown in Fig. 18, which is the beginning of the coke handling system.

While large quantities of coal and coke are being handled about the coke ovens there are also other materials handling activities, as shown in Fig. 19. Here an inclined bucket elevator is handling coke breeze and clay, from ground level to a balcony, where the material is put into a mud mill to be prepared into a properly mixed mass used for sealing up the various cracks about the oven door and elsewhere where gas might escape. Returning to the coke wharf (Fig. 18) we see how the operator raises the counter-balance stop racks so that the revolving mechanical feeders can discharge the coke to a belt conveyor beneath. This conveyor ("E") after running on the horizontal is inclined shortly after it leaves the coke wharf and discharges into the coke grading building Fig 21. The inclined run of this conveyor is shown in Fig. 20, and the reader's attention is directed to the sign suspended above the conveyor: "Riding on conveyors strictly prohibited." These signs are a necessity about the Ford Motor Company's plant for the reason that the men have become so familiar with the conveyors that they feel they should not only handle materials but passengers as well. To countenance such practice would be dangerous, particularly as, if the man does not know the point of conveyor discharge he might be thrown into the jaws of a crusher. For this reason the signs are conspicuously posted and the ruling enforced.

All conveyors are constructed of the very best materials and ample room is provided on both sides of the conveyor so as to permit a walk-way. The conveyor galleries are well constructed, well lighted and every convenience for equipment maintenance has been given consideration.

At the coke grading building various conveyors and chutes are installed, and here the coke is divided by a system of screens. Coke which passes these screens is considered as "foundry coke" and approximately eighty-four per cent. of the coke made at this plant comes under this classification. Foundry coke continues on its journey by passing over belt conveyors ("G") which consists of two conveyors, one at right angles to the other, and from these conveyors is discharged to a belt conveyor ("J") which transports it through the pulverizer building and deposits it on conveyor ("L"). The latter carries it to an additional conveyor running the full length of the foundry cupola buildings. The further handling of this coke will be described in connection with the foundry.

At the coke grading building car loading devices, both for gondola and box cars, have been provided, so that if desired various grades of coke can be shipped by rail to other plants of the Ford industry. Fig. 21 shows a gondola car spotted beneath a boom belt conveyor which lowers the coke for car loading. The cars are moved forward by means of a car haul winch as the loading progresses, and this winch is clearly shown to the right. The control for this winch is located near the window, on the second floor of the building, so that the conveyor operator can move the car at any time desired. When box cars are to be loaded, the loader shown in Fig. 22 is brought into service, and this loader can lay foundry coke in any size box car with minimum breakage. It is entirely flexible and with this equipment no shovel handling is required.

Coke which is not fit for foundry use is transported over conveyors ("F"), which are belt conveyors, and discharged to various storage bins by means of shuttle conveyors in the storage and screening building, adjacent

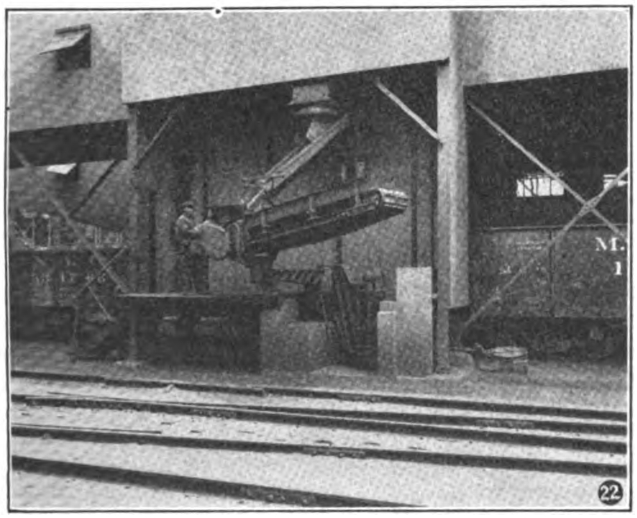


Fig. 22. Shipping coke by box cars requires a special loading device if degradation is to be avoided. Such a device is shown here.

to high line. In this building, egg, nut and pea screens are located and the coke is further graded; some being shipped to other Ford industries, some sold to employees for domestic consumption and some being delivered back to high line transfer cars which transport it to blast furnace charging hoppers. It will be noted that coal starts at high line, and a certain portion of the finished coke returns to high line, thus making a complete circuit.

In case of emergency, and for other reasons, a coke hopper and conveyor ("H") which is a belt conveyor, was placed in high line, as shown in Fig. 12, to permit other than coke-oven coke being fed to the storage and screening building. Under this hopper are two reciprocating plate feeders, discharging to a 36" belt conveyor, which discharges on the 36" belt conveyor ("H"). The latter elevates it on an incline to the storage and screening building.

Immigration Restriction and Mechanical Handling

Immigration restriction is here to stay. Cheap labor is a thing of the past. The pick and shovel and wheelbarrow are symbols of a by-gone industrial age.

It is for this reason that this issue of INDUSTRY ILLUSTRATED is of such permanent value to American industry. In it you will find hundreds of photographs which depict what is probably the most advanced practice anywhere in the world with regard to handling operations in a great variety of industries.

Do not attempt to get the good of this issue in one reading. It required months of time for our editors and the Ford photographers to put the material in shape. Keep this issue and refer to it whenever the subject of mechanical handling comes to your mind.

The World's Most Modern Iron Foundry

(*Continued from page* 25)

37, handles gates and sprues which have been removed from castings in the small parts foundry. This metal is all re-melted in the cupolas. It is interesting to note that a belt conveyor is used for handling the gates and sprues and by looking closely at the belt (Fig. 37) we can see how this hot metal has attacked the surface of the belting. Exceptional service has been given by this belt and, at the time the picture was taken, it had been in operation, handling the same material day in and day out, for approximately a year.

The charging of the cupola proper is all done by hand, but as new developments occur even this charging operation will be done by mechanical materials handling equipment.

The hot metal from the cupola is drawn off into ladles which are transported on monorail trolleys. The method of supporting the ladle, by chain hoist and trolley, is shown in Fig. 39, and the complete layout of the monorail track system and its relation to the cupolas is shown in Fig. 33. Slag from the cupolas at the present time is being drawn off into special types of trailers, which are eventually hauled to the dump; but, as in the case of the blast furnace, this slag will shortly be granulated for use in the cement plant. Conveyors and elevators for handling this slag are now being installed.

It is interesting to note here that in developing the method of granulating slag from the cupolas, a number of special spouts had to be designed and built before the proper one was obtained. One of these units is now operating successfully. The conveyor for handling this granulated slag is special and so far as the writer knows is the only one in the country, having been designed by the Ford engineers, and consists of a drag chain operating in a special cast iron trough filled with water. This conveyor discharges into a settling pit. From the settling pit the slag is elevated by means of perforated bucket elevators, as shown in Fig. 40. Perforations permit the water to drain off and the moist slag is discharged to a small storage hopper from which it will be drawn to trailers and hauled in trains by gasoline tractors to the cement plant.

In connection with the handling of materials at the blast furnace, it was mentioned that the hot metal which is drawn off in ladle cars can be taken to the pigging house or to the foundry. Until just recently about fifty per cent. of the blast furnace metal was immediately delivered to the foundry at the three points shown as hot metal spurs on Fig. 33. As in the case of the pigging house, it is necessary to pour direct from the 80 ton ladle, and for this purpose a 125 ton gantry crane, shown in Fig. 41, is used. This crane pours the blast furnace metal into a pair of smaller containers (one at a time) which transport the material from the hot metal spur to a point near the cupolas, as shown in Fig. 42. Each of these containers can be pivoted upon heavy trunnions and discharges into the monorail cupola ladles by being tipped mechanically. This action is regulated by the operator, shown in the elevated cake, where he has a clear view of the container outlet and also of a scale dial connected to a loose section of monorail from which the ladle is suspended while being filled. By watching this scale, the operator is able to regulate the amount of blast furnace material going into each partially filled ladle of cupola metal, varying the proportion to suit the chemical qualities and requirements of the metal being run.

At the point where blast furnace metals and cupola metals are mixed we come to a converging point of two distinct lines of travel, both of which have employed various types of materials handling equipment. Although the equipment described in the preceding paragraph is not in use at present writing, its use may be resumed at a later date.

The Handling of Both New and Reclaimed Foundry Sand.

In a foundry of such size, and where so many castings are made each day, it is necessary to provide an efficient handling method for both new and reclaimed foundry sand. Sand, from the time it is unloaded from cars until it is finally discarded, literally travels hundreds of miles and in all this traveling the means of transportation consists of various types of conveyors, such as belt conveyors, screw conveyors, flight conveyors, drag scraper conveyors, bucket elevators, etc. To give the readers a clear picture of the line of travel would be difficult without elaborate drawings and diagrams but the accompanying illustrations and description will show some of the equipment used on these operations.

New sand is received in gondola cars at the north end of the foundry building, as illustrated in Fig. 43. Here the cars are dumped to an unloading pit from whence a locomotive crane, equipped with a grab bucket, raises the sand and discharges it to a beaded flight conveyor. If the cars are not self-dumping the crane unloads from them direct and in such cases it is necessary to do a little shoveling when the cars are nearly empty.

The sand after being dumped on a beaded flight conveyor is discharged direct to a hopper which feeds the vertical bucket elevator. This elevator in turn feeds to a belt conveyor discharging to the intermediate hopper which provides storage space to allow for shut-down of the long belt conveyor, which carries the sand into the foundry buildings. This conveyor is shown (Fig. 43) running on the horizontal, the further end being inclined in order to carry the sand to the second floor. From center to center of this conveyor is approximately 500 feet and from here the sand is discharged to another belt conveyor which carries it approximately 800 feet, where it is again elevated and conveyed to various spouts and bins, which act as a distributing center from which the sand is taken by means of tractors and trailers to various points of use. Fig. 44 is a diagrammatic sketch of a single line of sand conveying equipment, as employed on the heavy molding machines in the large casting foundry. There are twelve such batteries, one being located on each side of the molding machines, (See Fig. 33), and over the small parts foundry, other equipment of similar type is employed for handling the sand. To give an itemized description of this equipment would require a far longer article than space permits, but the illustrations will provide the reader with details of construction and general arrangement.

New sand is fed into the system in the proper proportion at a point where the reclaimed sand is cut, screened and returned to the elevating flight conveyor, the vertical run of which is shown in Fig. 45. Here a man is stationed who tests the sand through the opening in the casing. Some of the cutting and screening equipment is visible directly behind the elevator. From here, the sand is raised (Figs. 46 and 47) and upon reaching the horizontal run the elevator becomes a drag flight conveyor, details of which are visible in Fig. 46. Beneath this conveyor, at regular intervals, are located storage bins (Fig. 47) from which the molders draw their supply of sand. The opening to these bins is provided with a rack and pinion gate so as to regulate the amount of sand which the conveyor will discharge. The bottoms of the bins are equipped with radial gates so the molder can make a quick discharge to the molding machine.

At certain points, in the foundry, the equipment shown in Fig. 48 is used in place of discharging by gravity from the sand storage bins. This is a compact molding unit, operating on the materials handling principle, where an operation is carried on at the same time material is being handled. The unit consists of a sand throwing machine, mounted on a flexible arm, to one side of a floor turntable, approximately twelve feet in diameter. Spaced at the four quarters of this turntable are stripping plate machines. For handling material at this point, the sand is fed to the sand slinger from an overhead hopper, which receives the sand from the drag flight conveyor previously mentioned. The sand is thrown into the flask as the turntable is revolving and by the time it has made a full circuit, the flask containing either cope or drag is ready to be placed on the conveyor where the mold is assembled. It will be noted to the left of the turntable (Fig. 48) that a grated opening is provided in the floor, through which the sand spilled is fed back into the elevating flight conveyor, which again carries it back to the overhead storage bins; thus making it practically impossible for any sand to escape from doing its respective duties. In a day's work thousands of tons of molding sand are handled.

Handling Sand in the Form of Cores.

In addition to the molding sand a large quantity of core sand is also handled, but here more care as to the reclaiming of sand and the feeding of sand to the molders is taken. Sand in this department is all prepared on a mezzanine floor and then sifted by small vibrating sifting devices into bins which discharge direct to the core ramming tables (Fig. 49). Here the sand is molded and immediately transferred to a pendulum type conveyor with overhead suspension running on wheels on tracks. These conveyors are classed as "merry-go-round" conveyors for the reason that they make a continuous travel. The pendulum arms are provided with spaced holes so that the platforms, or hands, can be raised or lowered, if desired, or in the case of small molds two platforms can be carried on the same arm. These conveyors transport the molds from the ramming tables to the core ovens and are approximately 65 feet long, center to center. The relations of the pendulum conveyor, core oven conveyor and core conveyors are shown in Fig. 50, while the location of each battery of this equipment, in the main large casting foundry, is shown in Fig. 33.

The core oven conveyors are similar in design to the pendulum core conveyors, but instead of having arms suspended from the overhead carrying medium, we find racks with shelves, as shown in Fig. 51. These oven conveyors travel very slowly so as to allow plenty of baking time, approximately two hours being required to make the round trip in the oven, which is slightly over 62 feet long. From the ovens the cores are placed on a wood platform conveyor, which travels parallel to the molding conveyor, and upon being taken from this conveyor the cores are placed in portable rack shelves, where they are held until required by the molders.

The Handling of Large Castings.

As previously stated, the majority of operations in the foundry buildings are performed on some type of traveling conveyor, and, at the same time, all materials are handled mechanically. We have traced out the flow of raw material from the time it is received at the plant until it is poured as hot metals from the cupola and, at the same time, we have shown how sand is handled in the foundry and how cores are made and molds prepared prior to the actual casting operation. We will now follow the path of hot metal and molds in order to show a few of the handling operations performed by mechanical methods in the manufacture of large castings.

A general plan of the large casting section of the foundry is shown to the left of Fig. 33, but a more detailed idea of each one of the casting conveyor units is given in Fig. 52. It will be noted that each unit consists of two molding conveyors, a system of overhead

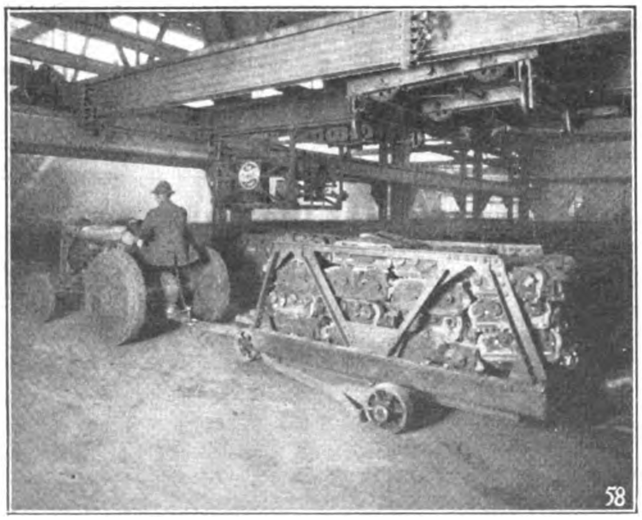


Fig. 58. Tractors and trailers are used to transport the cool castings from the cooling floor to the cleaning conveyor, Fig. 59.

monorail track for the hot metal ladles, a cooling line conveyor, a shake-out station, and two conveyors for handling hot castings to the mezzanine floor for cleaning. The accompanying illustrations (Figs. 53, 55, 56, 57) show each of these conveyors in actual operation.

The hot metal is drawn from the cupolas into ladles which are suspended from chain hoists fastened to overhead monorail trolleys and, by means of switches, ladles from either one of the cupolas can quickly be transported to either one of the pouring stations, which parallel the molding line conveyor. Fig 53 shows the pouring station and the method of suspending the ladle from the monorail trolley. Here the metal is being poured direct to the molds, which are being transported slowly on a chain conveyor, which is also visible. This conveyor can be quickly started or stopped, but for the greater portion of the time it travels at a steady pace, thus assisting in maintaining the operating schedule.

The molds after being assembled and poured continue to travel in the same direction until they reach the end of the runs and at this point the materials from two molding conveyors are transferred to the single cooling line conveyor, which travels parallel to the molding conveyors in the opposite direction. This conveyor is covered with a sheet metal hood, as shown in Fig. 53, which acts as a stack or ventilator for collecting the gas fumes and carrying them out of the foundry.

The molding conveyors and the cooling conveyor are almost the same length; the cooling conveyor being approximately 288 feet long, while the molding conveyors are approximately 230 feet long. These conveyors consist of two runs of chain; one acting as a carrying or drag run, while the other is the return run. The molds are placed on tracks and the chain grips a dog or lug under the mold and slides it on the rail frame. It is amazing that even with the rough usage which these conveyors receive, there is seldom a shutdown due to breakage. The reason for this is that the Ford engineers under-

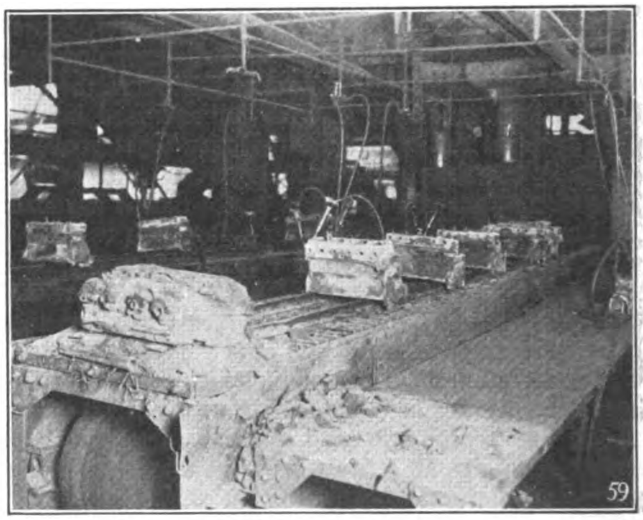


Fig. 59. The cleaning conveyor consists of a grating support upon which the castings are placed so that the sand and materials cleaned off fall direct to the belt conveyor underneath.

stand conveyors and materials handling methods, and if trouble is experienced when new equipment is installed, they do not become discouraged but set about to rectify the mistakes in the original designs and consistently stay at the problem until it is solved. Because of this tenacity of purpose toward the idea of conveying all materials mechanically and performing all operations on the move, we find in this plant conveyors which the manufacturers and the engineers outside of the organization would never consider. Here theory is blasted and it is found that under operating conditions more can be done with conveying equipment than theory would permit.

In order to obtain good castings it is necessary to watch carefully and see that the ladles are emptied of all cool materials before being returned to the cupola and, in order to conserve this material, the overhead monorail track systems, at the pouring stations, converge at regular intervals to pigging conveyors (Fig. 54), where the ladles are emptied of all residue, which is pigged, finally returning to the cupola stock gallery for re-melting.

When the molds have passed the full length of the cooling conveyor they are knocked down and, while the castings are red hot, they are solidified sufficiently to permit the flasks being dumped. This operation takes place over gratings (Fig. 55) so that the sand immediately drops into a conveyor and is returned into the sand handling system. The hot castings are picked up with an ice tong arrangement and a hand rope hoist, which is connected to overhead trolleys, and by a quick swing and push are delivered to a special bar platform and drag flight conveyor, known as the hot casting conveyor, which elevates these castings to the mezzanine floor. The point of feed on the foundry floor is shown in Fig. 56, while the carrying run and drive end of the same conveyor, located on the mezzanine floor, is shown in Fig. 57.

It will be noted that this conveyor is called a special conveyor; the reason being that it performs two operations. It carries the hot castings and, at the same time, reclaims sand which falls from these castings during cooling. This is possible by the peculiar construction. The hot castings are transported (Fig. 57) while resting on the bars between the chains and on the return run the flights act as scrapers and drag the sand in a trough, discharging it back into the sand handling system.

On the mezzanine floor, hand operated overhead cranes equipped with I-beam trolleys and rope hoists again pick the warm castings from the cooling conveyor and they are loaded into racks (Fig. 57) and placed in storage for further cooling. From this cooling bay, it is necessary to transport the castings to a cleaning station, also located on the mezzanine floor.

The reader's attention is called to the overhead electric traveling crane (Fig. 57), placing the castings in the cooling bay. Here a peculiar crane attachment is used and this attachment is similar to the type used for the handling of lumber. This same crane picks up racks of cool castings and loads them on low three-wheel trailers (Fig. 58) which are hauled by gasoline tractors to the cleaning station (Fig. 59). Here the castings are raised to a grating built over a belt conveyor and are cleaned of the greater portion of sand. This sand, dropping through the grating and being picked up by the belt conveyor, is fed back into the sand handling system.

After being cleaned of the major portion of sand, the castings are placed on special platform conveyors which carry them from the mezzanine floor through many complicated turns to the tumbling barrels. Diagrams of these conveyors and the various turns they make are shown in Fig. 33, while a close-up view of the descending run from the mezzanine floor and an angle turn on the tumbling barrel floor is shown in Fig. 60. This special casting conveyor consists of a number of four-wheel dolley trucks running in angle iron tracks and being propelled by means of a chain fastened to the bottom of the trucks and running on edge. In one of these conveyors the overall length of the chain is approximately 500 feet and in this distance more than fifteen turns are made and the conveyor passes from one floor to another, thus acting in the capacity of an elevator. The interesting part is that the entire conveyor is driven from one drive sprocket.

When this type of conveyor was first installed, breakage of chain was frequent and the difficulty encountered was hard to find. By the process of elimination it was eventually decided that the chain stretched to such an extent that it would not engage properly on all the corner or turn sprockets and was causing the breakage. To remedy this condition all sprockets, except the drive sprocket, were replaced by traction wheels and now no difficulty or break-down occurs.

We have now followed the hot metal from the cupola to the tumbling barrels in the form of large castings, but a considerable quantity of small castings is also required in turning out Ford cars and Fordson tractors. We will, therefore, look over some of the equipment used in the small parts foundry.

The Handling of Small Castings

In the section of the main foundry devoted to small castings manufacture, the handling of sand is similar to that used in the section where large castings are made, but the molding conveyors are entirely different. In

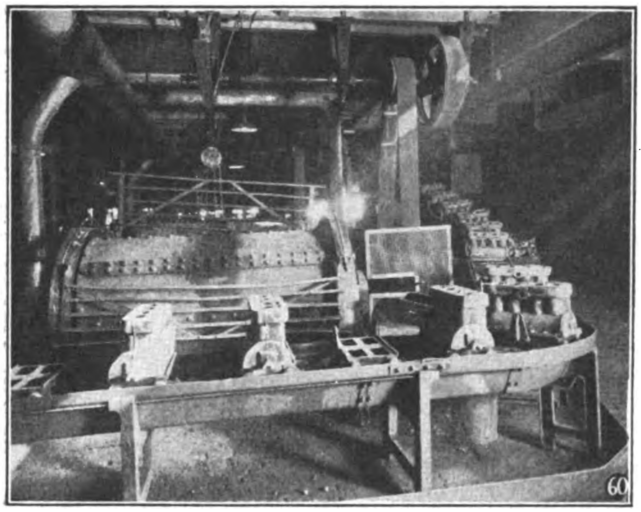


Fig. 60. This conveyor lowers castings from the cleaning floor to the tumbling barrel floor and also transports them for a distance of about 500 feet. According to theory, this cannot be done.

this foundry the molding conveyors are of the "merry-go-round" type and are located as shown in Fig. 33. One of the short "merry-go-round" conveyors is visible in Fig. 61. Here the pouring of the hot metal is entirely different from that previously described. Fig. 33 shows very plainly the layout of monorail track for taking hot metal from the cupola, but instead of pouring direct from the cupola ladles it is necessary to transfer this metal to hand ladles. These hand ladles are carried by men to the point of pouring and during the pouring operation they are suspended in hooks from an I-beam trolley rail which conforms to the run of the conveyor. This little assistance given to the pourers makes for better and speedier operation. The speed of these conveyors is so governed that the casting has time to set from the point of pouring before it reaches the further end of the run. Here the mold is picked off of the arm and dumped over a grating, as shown in Fig. 62, and the sand drops into a series of conveyors which carry it back into the sand handling system. The hot castings are deposited upon suspended tray elevator conveyors which raise these hot castings to about 30 feet above the foundry floor where they again travel on the horizontal a distance of some 200 feet for cooling. The construction of these conveyors is shown in Figs. 61 and 62, which also illustrate the point of feed. Castings are picked off the conveyor and fed direct to the tumbling barrels and after being thoroughly cleaned are removed and fed through an elaborate system of belt conveyors and platform conveyors which serve as inspection tables, and from these tables they are transferred by hand to overhead chain conveyors which carry the castings into the machine shop for finishing.

It will be seen from this description that the method of operation in the small parts foundry is similar to that employed in the foundry where large castings are made, but we particularly wish to point out that in each foundry the equipment is designed to handle the products manufactured; in other words, it would be difficult and probably impossible to design a "merry-go-round" conveyor for large castings, and it would be expensive as well as a space waster to use drag chain conveyors in the manufacture of small castings. Thus, each conveyor is placed in its proper sphere of operation, bringing about an efficient and economical layout both as to initial investment, space requirement and operation efficiency.

During the investigation of the Ford River Rouge Plant when data was being collected for the preparation of this article many improvements were being made on various handling operations, especially in the foundry, and possibly by the time of publication the majority of these improvements will be in actual operation and additional ones will be contemplated. It does not matter, in this plant, what the equipment cost to install or how long it has been in operation, for if a more efficient method presents itself it is immediately tried out and, if found successful, the old method is disposed of and the new one installed.

To point out one of the new improvements: When the cores are removed and placed in racks the core plates present a handling problem, as it is necessary to return

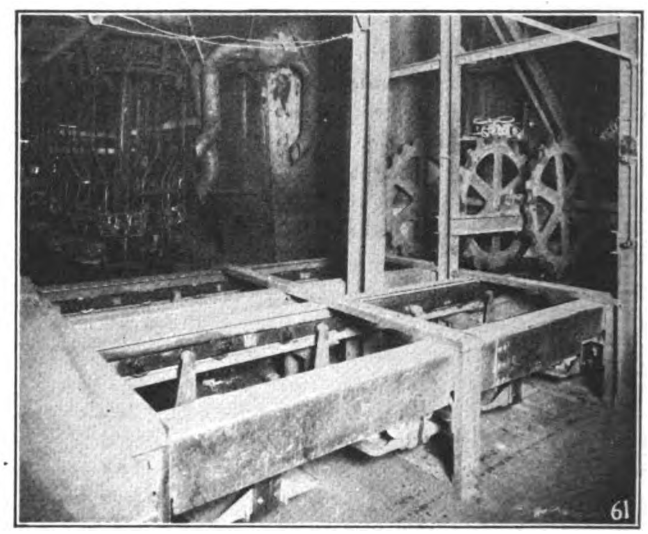


Fig. 61. To the left can be seen one of the "merry-go-round" conveyors upon which small castings are poured, while in the foreground is a suspended elevator conveyor which handles hot castings on the cooling operation.

them to the core makers. With the old method these plates were piled in stacks and trucked by hand to the core making department where they were re-distributed for further use. This required a large number of hand trucks and a considerable amount of manual labor and led to confusion in the molding and core making departments. To eliminate these objectionable features belt conveyors are now being installed and these plates will be returned by means of these conveyors direct to the core makers. This one improvement conserves the labor of over 400 hand truckers, eliminates the maintenance and repair on a number of hand trucks and simplifies the entire operation.

It was formerly the practice to centralize the reclamation of all core sand and in this central department the risers, stiffeners, etc., used in core making were also

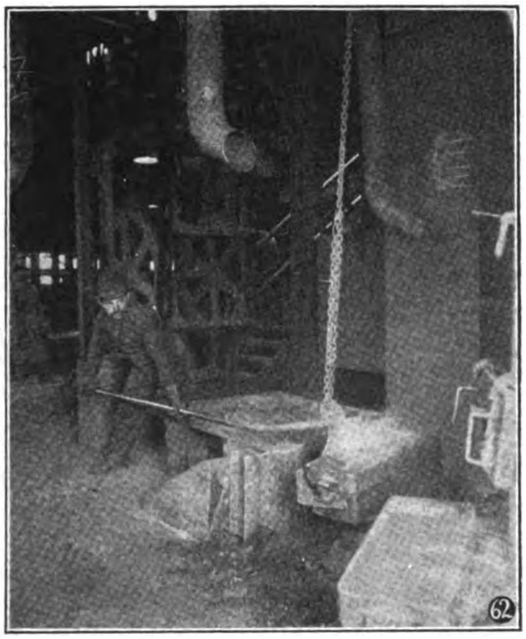


Fig. 62. A shake-out station, near one of the cooling conveyors, which receives hot castings from the light mold systems, shown in Fig. 33.

reclaimed and re-distributed to the core makers. Now, individual units are being installed for reclaiming this material and bucket elevators, belt conveyors, and magnetic separator pulleys play an important part in this work.

You Can Use Ford Methods in Your Own Business

Some of those who read this issue may say "mechanical handling is all right for Ford with his large scale production, but it does not fit into my business."

Henry Ford is no magician, although his industrial achievements have been so marvelous. If he were running a small plant he would use the same success-building principles that he would use in running a big one. And that plant would not stay small very long because these principles would make it grow.

Ford has no monopoly on mechanical handling. Lifting and carrying and moving of product parts and materials are done in every plant. The manager of a small plant would not think it advisable to employ hand labor on producing operations if he could buy a machine tool or a press or some other producing machine that would economize labor cost. The same principle should apply to lifting and moving the product. Wherever machinery would do this cheaper and faster than men, common sense dictates that such a machine should be used.

One may not be able to install miles and miles of conveyors nor hundreds of tractors and overhead cranes, but nearly everyone can profitably do on a small scale some of the things that Ford is doing on a large one.

Keep this in mind when you read this issue and keep the issue because of its permanent value as a textbook in modern mechanical handling.

Handling Large Castings Through the Machine Shop

(*Continued from page 26*)

veyors are generally continuous runs equipped with special platforms to hold the castings in different positions. The platforms are fastened to the chain and are equipped with rollers which run in angle-iron tracks. The position of the chain in relation to the platforms, and four different types of platforms are shown in Figs. 63, 65, 67 and 68.

The conveyors being continuous, it is possible to use them for several operations. As an example, the reader is referred to Fig. 65, where a special platform conveyor is operating on the handling of Fordson motor blocks. This conveyor brings the semi-finished blocks to the babbiters, who prepare the bearings and then redeposit the same blocks on the same conveyor, which, in its line of travel, carries them to the next machine operation, where they are trimmed and finished. They are then replaced on the conveyor and carried to the next point, where they are grooved and inspected. If a casting passes any one of the above mentioned operations it remains on the conveyor until it eventually returns to the operation where it should have been taken off. It is well to state that the timing of these conveyors is so accurate and the feeding of new castings so well regulated that it is seldom possible to find any one piece passing an operation without being taken off and properly finished.

Some conveyors, as shown in Fig. 68, are used as traveling work benches, the castings being placed on the platforms and the operations performed while the conveyor is in motion. In such cases, the conveyors carry the materials to the next operation, which, in a number

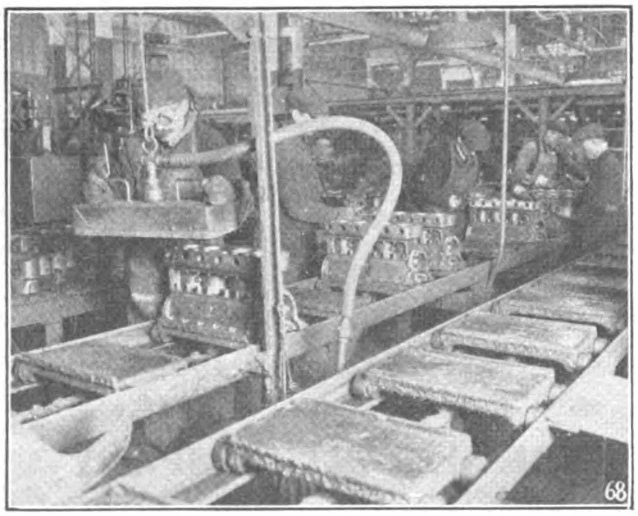


Fig. 68. Some conveyors are used as traveling work benches, in which case they act as pacemakers.

of cases, is performed on the same conveyor. Thus we see materials handling equipment being used for transportation and also as a part of the operating equipment. This is efficiency of the highest type but there is no reason why castings should be removed from the conveyor for minor operations. It would be difficult to describe each and every type of conveyor installed in the machine shop but here the principle of continuous runs and platform conveyors at first appears to predominate. In looking about, one is surprised to find how many other different types of equipment are here employed. For instance: Fig. 69—here we see an elaborate system of overhead monorail track equipped with I-Beam trolleys. From these trolleys are suspended chain hoists, electric hoists, rope hoists and other equipment to assist in the lifting and transporting of the various castings to and from machines and replacing them on other types of conveyors. The only thing missing in this shop is the

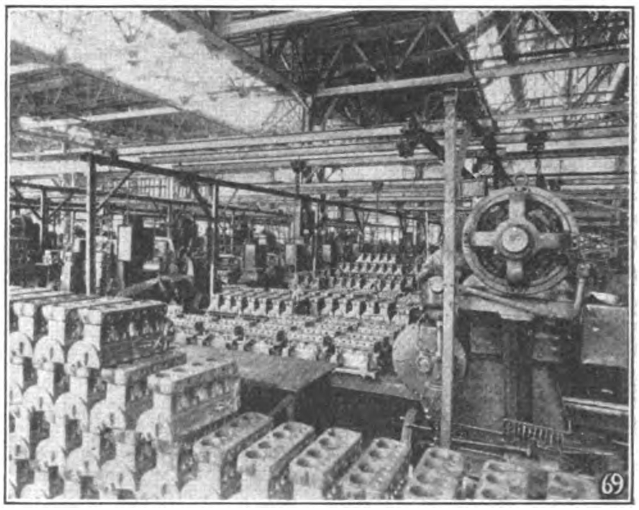


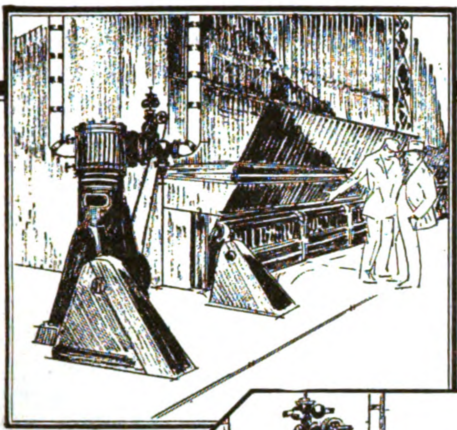
Fig. 69. I-beam trolleys, equipped with chain hoists, electric hoists and other lifting devices, are of such importance that special superstructures are erected in the shop to carry this equipment.

presence of various types of hand trucks, but by looking at any of the illustrations and considering the quantity of materials being handled, and the layout of machine equipment, the reader will realize that hand trucks could not conveniently operate under such conditions, and for this reason the various types of conveyors and overhead equipment are best adapted for this particular shop.

The machine shop, roughly speaking, is 1,200 feet long and 150 feet wide and with the machinery spaced so close together the reader will realize that to make repairs, to remove or install new equipment, on heavy production machinery, would be difficult. Using the same principle on maintenance operations as on production operations, namely that of doing all handling mechanically, the Ford Motor Company has installed three large-capacity overhead traveling cranes that operate horizontally the full length of the building. In addition to handling all machine equipment, these cranes are used for handling miscellaneous materials, when required.

In Fig. 70 a general view, showing some of the gravity conveyor equipment used in the machine shop, is presented and it will be seen that each machine is tied together by this method and that curves as well as straight sections are employed. It is well to point out for the readers that these conveyors have no pitch, the castings being pushed by hand instead of gravitating to the low end of the conveyor. The live rollers are utilized to reduce the friction which would be required if only plain plate conveyors were installed. On some operations, where the movement is only for a short distance, plain plates, well greased and lubricated, are used as conveyors. To give the readers an idea of the number of machines in this one shop and to show how the various types of conveyors are operating side by side, we refer to Fig.

(*Continued on page 164*)



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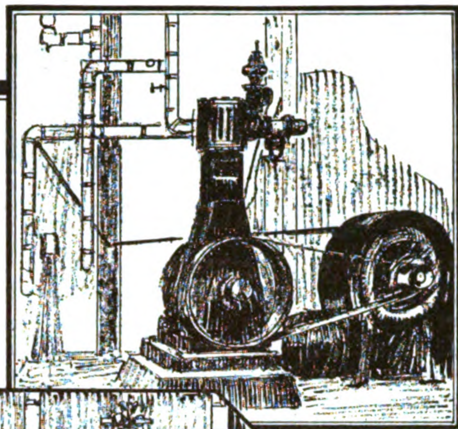

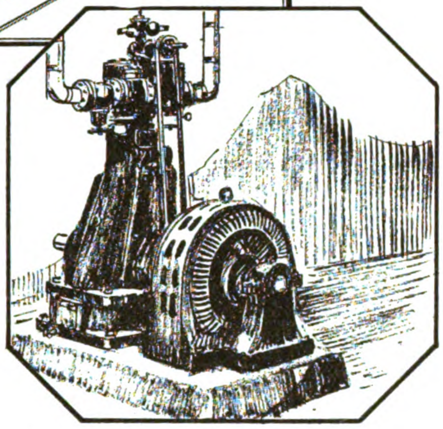

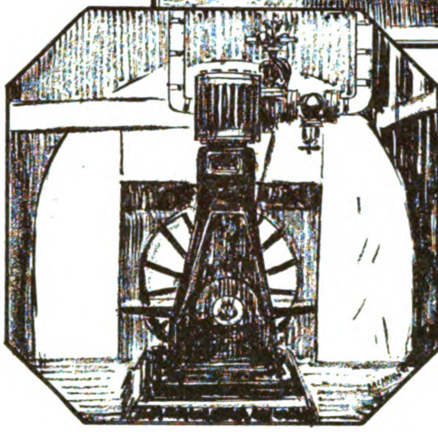

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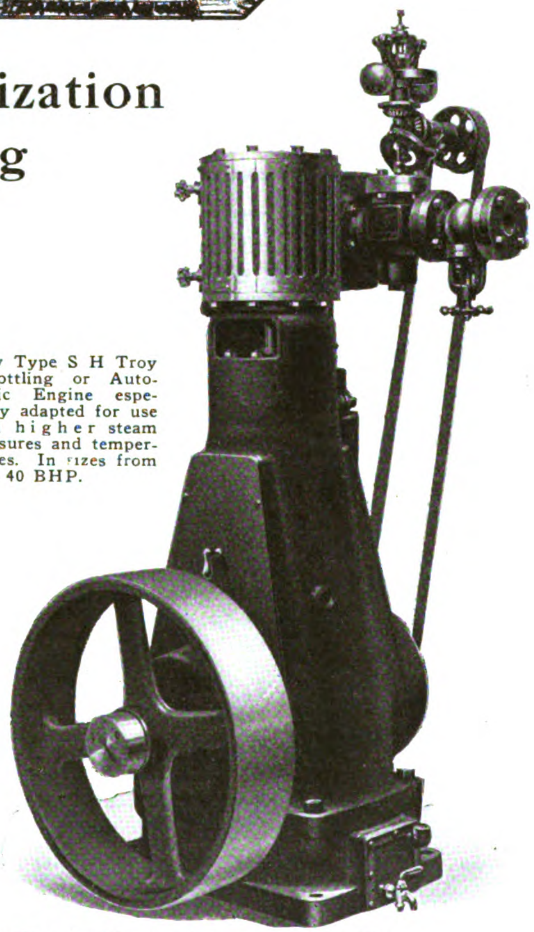

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(Continued from page 162)

71. It will be noted that this is the end of the machine shop where finished castings are given the final test and are then placed on the two wood platform conveyors shown in the foreground. These conveyors act as final inspection tables and all finished parts are transported by them to the end of the machine shop. Here we find a right-angle turn to another pair of wood platform conveyors which travel for a short distance on the horizontal, are then inclined to a height of about 30 feet, and then again travel on the horizontal the full width of the foundry building, where they deliver the finished castings to another set of conveyors on the loading dock. From center of tail sprocket to center of head sprocket on each one of these two conveyors is roughly 500 feet. These are exceedingly long centers especially when considering the loads carried.

In addition to finished castings being carried to the loading dock by the conveyor, we find some being put through openings in the side of the machine shop and loaded direct to large wagon trailers. These trailers are in turn hauled by gasoline tractors to the tractor assembly building, where the finished parts for the tractors are made, especially the small parts, transmission gears, etc. Those castings and small parts carried to the loading dock are placed in cars and shipped to the Highland Park plant, where they are assembled with other parts into Ford motors. At the present time, a large building is being erected so that this motor assembly can be done at River Rouge, and when the building is complete and in operation, a new layout of conveyors for handling these parts will be made.

At the same time the castings are being handled, it is necessary to provide a system of transportation for chips and borings. The conveyors used for this purpose are very ingenious. Fig. 67 shows how a belt conveyor is supported directly under a special platform conveyor, and this belt transfers chips to a main conveyor, which will be mentioned later. On other operations, and at different machines, troughs are provided under the floor.

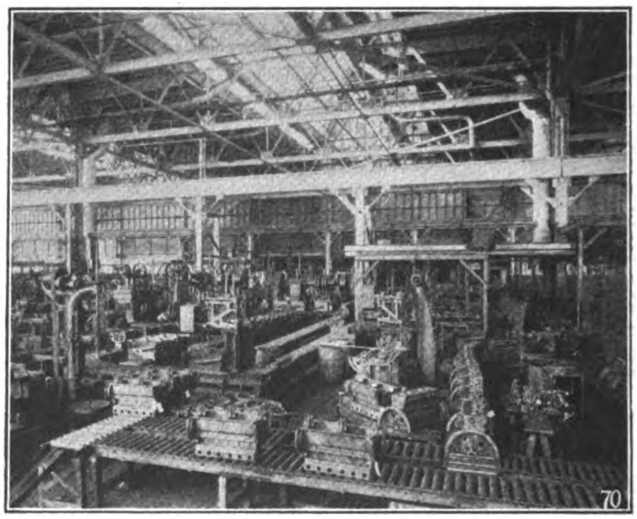

Fig. 70. A small portion of the machine shop, showing a few runs of gravity conveyors, handling Fordson cylinder blocks between machine operations.

The machines discharge chips and borings directly into this trough, where a drag chain conveyor hauls them to the central conveyors. The central conveyors, of which there are several, are of both the drag chain and belt conveyor type, and these conveyors converge to a central station where the material is elevated into a storage bin. From this bin it is deposited into sheet-metal canisters and transferred to an overlapping pan conveyor, which transports the material back to the cupola buildings for re-melting.

In such a large shop it is natural to have scrap and imperfect parts in proportion to the perfect parts and as this represents a handling problem, it is also natural to find conveyors being used, and the first conveyor in this system is the one which was encountered at the

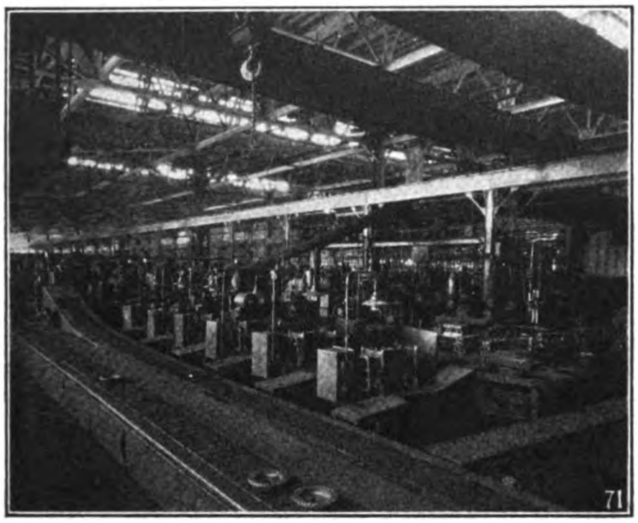

Fig. 71. In the machine shop many conveyors are used, and in this illustration can be seen wood platform conveyors, gravity conveyors, special gravity conveyors, and overhead traveling cranes.

point where castings were brought into the machine shop from the tumbling barrel. The imperfect castings which are discovered at the time when they first enter the machine shop remain on this conveyor and all imperfect ones which appear at any time during the finishing operations are replaced on this conveyor, which is approximately 1,000 feet, center to center. From here they are fed to a large jaw crusher which breaks them into small scrap-metal and deposits this material on the overlapping pan conveyor which was previously mentioned on the handling of sheet-metal canisters, filled with borings and chips. This conveyor, approximately 250 feet, center to center, elevates the material approximately 30 feet and discharges to a similar conveyor running at right angles. The second conveyor is approximately 500 feet long and again, discharges at right angles to an overlapping pan conveyor 500 feet long which carries the materials through the cupola buildings; and this material is distributed to the cupolas for re-melting. Thus a casting which was poured in the morning if found imperfect, might possibly be returned to the cupola for re-melting in the same day. In the installation of this series of pan conveyors, Ford engineers were told that the centers were too long, the installation was impractical and the equipment would not operate. With their knowledge of conveyor application they went ahead over the objections placed by the manufacturers and today an impossible installation is working successfully and economically.

Power House Fuel Handling and the Electric Furnace Building

(*Continued from page 27*)

by gravity to pulverizer mills, which are located on the ground floor of the building. Pulverizing is accomplished by feeding raw coal to the mills through spouts from the bunkers overhead, and the entire operation takes place in an air current induced by exhaust fans. After the coal is reduced to a powder, it is immediately carried away and re-elevated to the top of the building (by air) leaving only the coarse material in the mill for re-grinding, which is taken care of automatically.

The handling of the pulverized coal is a problem which calls for dust type equipment, as 94% of the material will pass through a 100 mesh screen, and 78% of it

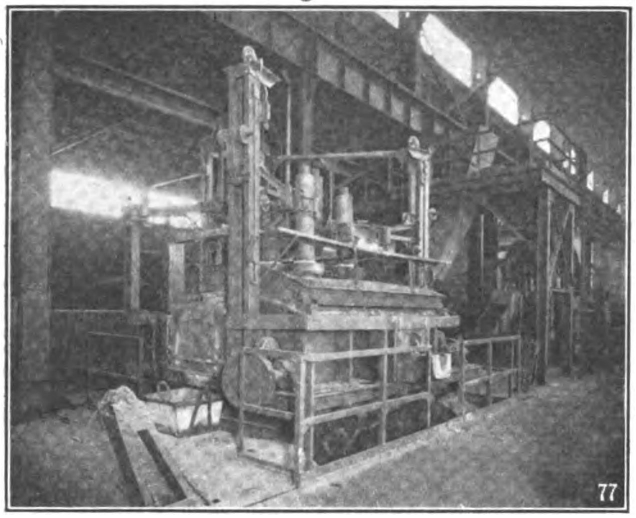

Fig. 77. A general view of one of the electric furnaces in the electric furnace building.

through a 200 mesh screen. Upon reaching the top of the building, the air and coal pass into cyclone separators, where the air is partially extracted by centrifugal separation and the heavier portion of the coal drops by gravity to spouts which feed into 16 inch screw conveyors on the floor above the bunkers. The remaining air passes over into additional dust collectors which extract the fine particles of coal and deposit them by gravity into the pivoted bucket conveyor over the bunkers. This is the same conveyor previously mentioned in connection with the distribution of coal.

The pulverized coal, which has been fed to the screw conveyors, of which there are four in number—two of which are always in use while the other two are for emergency shut downs—is carried on the horizontal to bucket elevators. These bucket elevators raise the coal at the rate of sixty-five tons per hour and discharge it into the two 16-inch screw conveyors, which run through a conveyor gallery, as shown in Fig. 73, and carry the material to the distributing conveyors over the bunkers in the power house proper. One of these distributing conveyors is shown in Fig. 74. From these conveyors, coal falls by gravity into the bunkers. During a test run on the boiler efficiency, the weighing machines, shown in the foreground (Fig. 74) were installed so as to weigh the coal fed to one set of boilers.

The construction of the screw conveyors for handling pulverized coal is of the very best and must necessarily be heavy because of the tonnage carried. The box of these conveyors is of cast iron, while the flight or screw is of extra heavy metal wound on extra heavy pipe. The drive units of all this equipment are rigidly attached and each conveyor is driven by a separate silent chain drive.

From the bunkers pulverized fuel is fed by gravity to automatic feeders, there being four of these feeders for each boiler. Each feeder consists of a cast iron hopper, at the bottom of which are mounted three parallel cast iron screws of coarse pitch. These screws are driven by variable speed motors, controlled by rheostats mounted on the boiler control panel on the boiler room floor. These screws admit coal to the feed pipe at varying rates, depending upon the load. As the coal is admitted to the feed pipe, which conducts it to the burners, it is met by a current of air at a pressure equivalent to 8 inches of water. This mixture of air and coal is then carried by pipes to the combustion chamber. The efficiency of the boilers in this power plant is such that there is really no problem of ash or cinder disposal. There is a slight accumulation of this material, however, and at ground level, gates are provided in the ash pit under the boilers as shown in Fig. 76. Material is allowed to accumulate and is finally dumped direct into railway cars or hopper body trailers and is hauled to the dump or used about the plant for road work and fill.

In all the handlings which have taken place from the time coal was dumped by the car dumper at the point shown in Fig. 12, until it is finally discharged from the ash pit of the boilers, it was never necessary to do any hand handling. It will also be noted that in the pulverizer house the first system of pneumatic conveying was described. Different systems of pneumatic conveying will be taken up in connection with the glass plant and woodworking shop.

Electric Furnace Building Handling Operations

The electric furnace building is located as shown on the panoramic view and is one of the new departments just completed by the Ford Motor Company. The furnaces in this building will be operated on electric power generated in Power House No. 1, and, at the present time, two of these furnaces are installed and operating. The handling operations in this building are reduced to a minimum.

The building itself consists of two bays, one with a roof higher than the other, and in the bay having the lower roof there is also a balcony floor. The building construction is clearly shown in Fig. 78. Raw materials entering the building by railroad cars are received on the first floor of the low bay and, by spotting under large hatchways, the cars are unloaded by means of the electric overhead traveling crane. When handling bulk materials, this crane is equipped with a grab bucket. When unloading bar stock and scrap sheet metal an electric magnet is substituted for the bucket. The raw materials are stored directly on the balcony floor, except in the case of bulk materials, and these are stored in bins.

When charging the furnace, the raw material is again picked up by the crane, using the electric magnet, and discharged into a weighing hopper, from where the charge is deposited to an overlapping pan conveyor which elevates the material on an incline and discharges it by chute into the furnace. Under the present arrangement, difficulty of feeding the furnace through the chute by gravity is being experienced and the Ford engineers are contemplating a high speed conveyor which will receive the material from the chute and project it into the furnaces. One of the furnaces and the gravity feeding chute are clearly shown on Fig. 77. These furnaces are located in the high-roof building, and a balcony floor is built around them.

When discharging hot metal from the electric furnaces to the pouring ladles, it is necessary to tilt the furnace at a considerable angle, and for this purpose,

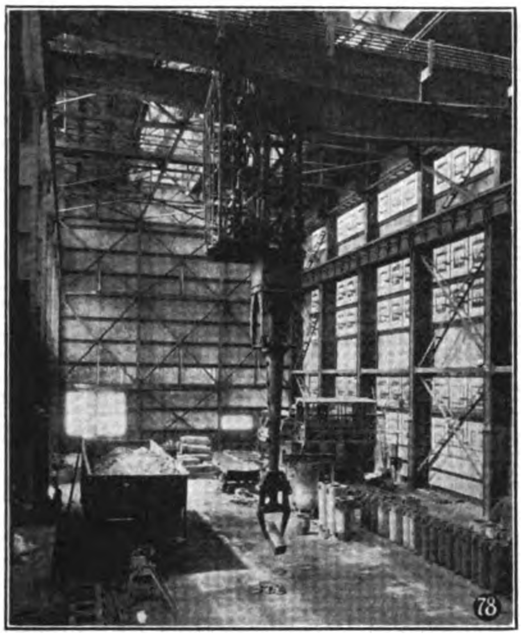

Fig. 78. Special crane for handling steel ingots in the electric furnace building. Note the operator's control cage and special pick-up mechanism.

the entire apparatus is mounted on rocker frames. As the furnace tilts, it is necessary to elevate the section of balcony floor directly in front of the discharge spout, and so this floor is constructed on a drawbridge arrangement which raises and lowers mechanically.

In this furnace room the ladles of hot metal are of a considerable size, not quite as large as the ladle cars at the blast furnace, and not as small as the monorail ladles in the foundry building. Because of the size and weight of material, these ladles are handled by means of overhead traveling cranes, one of which is equipped with a ladle hook with a capacity of 100 tons and with an auxiliary hook of ten tons. Another overhead traveling crane for handling miscellaneous materials, as well as small ladles of hot metal for the pouring of castings, has a capacity of twenty-five tons, with an auxiliary five ton hook. For the handling of steel ingot molds and steel ingots, the overhead traveling crane, of ten tons capacity, equipped with a special trolley and hook, as shown in Fig. 78 is used. The operation of this crane reminds one of a human hand picking up pieces between its fingers.

At the present time, ingot molds are placed on the floor for pouring and allowed to remain in the same position for cooling. In order to bring about more efficiency and better operation, a special pouring machine equipped with moving chain conveyors for handling the molds is being erected. This machine is visible in the background of Fig. 78, behind the crane hook, and when

(*Continued on page* 169)

An Interesting Bit of History

The beginnings of Time Study date back to 1881, when Frederick W. Taylor, the outstanding figure in Modern Industry, was foreman of the machine shop of the Midvale Steel Company. As part of his great contribution to human progress in pointing the way to raising labor to a higher degree of productivity, he recognized that it would be more accurate to time each element of the various kinds of work to be done with a stop-watch, and then find the quickest time in which each job could be done by summing up the total times of its component operations, and adding a reasonable percentage of allowance, than to search through records of former jobs. It did not take him long to be convinced that his method was a success. "This department far more than paid for itself from the very start," is the way in which he summed up its results.

A Prediction Made Long Ago

In 1895, while addressing the A. S. M. E. at Detroit, on the subject of Time Studies, Dr. Taylor made use of these words:

"The great need is the lack of data. Although there are hundreds of operations common to many factories, most shops study the speed problems for themselves. Days of labor are wasted in finding out what other shops have already discovered. The trade needs a handbook of the speeds with which work can be done. The prediction is ventured that such a book will be forthcoming before long. The work when produced should describe the best methods of making, recording, tabulating and indexing time observations. Much time and effort are wasted by the use of inferior methods."

The History Finds Its Fruition And the Prediction its Fulfillment

In

"Time Studies as a Basis for Rate Setting"

By

DWIGHT V. MERRICK

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Detailed times are given for many different kinds of work; numerous mechanisms are shown that have been found helpful in taking observations; many practical suggestions are presented for taking the preliminary surveys, for analyzing tasks in their simplest elements, for collecting data, for organizing a time study department, for training the men to take up the work enthusiastically, intelligently and efficiently.

Thousands of industrial organizations that have used the book testify that it has helped them to lower their unit costs, enabled them to pay a man for exactly what he does—and not merely for how long he works, stimulated their workers to put forth their best efforts, increased their production without increasing their working force or their equipment.

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(*Continued from page 167*)

completed will be equipped with three conveyors. These conveyors will be made of the largest forged steel chain ever used for materials handling equipment.

Every handling operation in this building, of any magnitude, is done mechanically, and the main labor cost consists of control operators and supervision. It is interesting to note that when difficulty is encountered with any of the present materials handling equipment, it is not the policy of the Ford engineers to condemn the entire system. They have been taught by experience that the principle is sound and it only requires the proper application of this principle to bring out a solution which will handle the problem completely. It is for this reason that they have gone over the entire system of charging the electric furnaces, and have decided to eliminate the hopper and scale, and install a different type of scale upon which the magnet will deposit the material. By subtracting the tare weight of the magnet from the

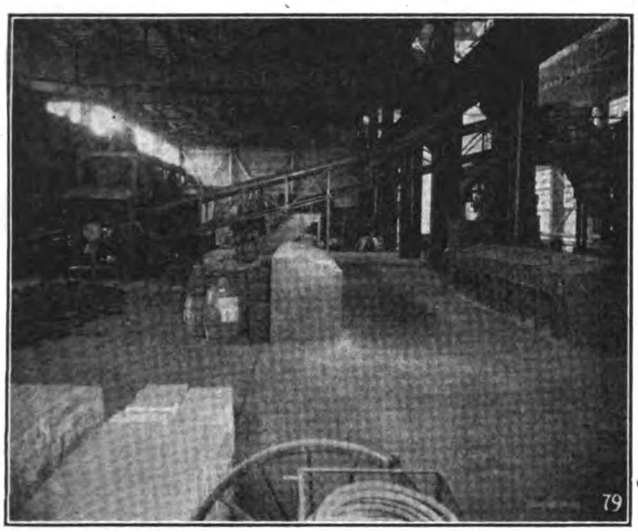


Fig. 79. Overhead traveling crane equipped with a magnet handles raw material to the conveyor, which feeds same to the electric furnaces.

gross weight on the scale, the net weight of the metal charge can be obtained. It will then deposit the charge, as formerly, direct to the conveyor without the necessity of passing through a small feed gate. The conveyor portion of the system is operated without any difficulty and is therefore left as originally installed; but as previously mentioned, a high speed feeder conveyor is now being designed to project the material from the spout into the furnace. The hopper and scale has already been removed and that portion of the system has been corrected. It is more than likely that by the time of publication the feeder conveyor will be built and in operation.

It is under such conditions that the average industrial executive gives up and says that the whole system is impractical, not workable and, therefore, should be dismantled. They can all profit by having a little more of the tenacity of Ford engineers, who are taught that the thing which seems impossible, is the thing which they must necessarily bring their ingenuity to bear upon, in order to improve conditions. It is not a difficult task to do something easy but it requires considerable persistence to work out of difficult situations.

The Saw Mill and the Tractor Assembly

(*Continued from page* 33)

same conditions of picking off of "B" belt distribute wood parts to another wood working unit on the opposite side of the building.

Various wood parts and sheet metal parts finally converge at one end of the assembly conveyor (Fig. 94) and a detail of this conveyor is shown in Figs. 92 and 93. It consists of two chains running in channel-iron tracks, with lugs at regular intervals to grip the parts. The view in Fig. 92 is taken near the beginning of the conveyor and shows how various brackets, bolts, nuts and other parts are stored in bins between the chains so as to be handy for the workmen.

This conveyor represents one of the big profit-makers for the Ford Company, and demonstrates the proper application of materials handling equipment; that is, it makes the equipment serve more than one purpose. (a)—The materials are transported, (b)—the frame work for the conveyor is also used as a work bench, (c)—small parts are stored in the line of travel, (d) the speed of the conveyor acts as a pace maker and controls the production rate, (e) it makes for ideal working conditions.

Small parts are delivered to work benches and stock adjacent to this conveyor by means of various type hand trucks, lift trucks, Ford motor trucks and overhead traveling cranes. Thus we see several types of equipment assisting in the handling of materials in this department. Even the tools with which the men work are suspended from counter-weighted pulleys, light electric hoists and chain blocks.

As the assembly conveyor approaches the finishing end, the space between the chains is covered with sheet metal, as shown in Fig. 93, and this same view shows how the work benches are placed in reference to the conveyor. Certain operations are performed on one side and the body part placed back on the conveyor, while further operations are performed by men working on the other side of the conveyor. After the body sides are completed they work through various operations across the building, through the door hanging lines, where the doors are fitted and hung. They are then deposited on a flat belt conveyor, which carries them to the finishing tables.

After being finished, the body parts are separated to two different lines of travel; those going to domestic plants for final assembly, and those being shipped to foreign assembly plants. This is another point of interest at the Ford River Rouge Plant, because export shipping is here given every consideration and the cases are well constructed.

In the export packing department for body parts, cases are handled bv various mechanical means. The knocked-down ends and sides are received on the ground floor of the building and are placed in piles and elevated to the second floor by means of overhead traveling cranes. When they are lowered from the cranes they rest on wood legs or strips, approximately 8" high, so that it is convenient to run a hand lift truck under the load to transport it to the point of storage. When placed in storage they are again lowered to wooden legs or strips and the truck returns for another load. The operation of unloading a truck is shown in Fig. 95. By using hand lift trucks on this operation, many handlings are eliminated and one man can handle a number of cases in a day.

When taken from stock for use the same handling method is used and the box parts are placed adjacent to a gravity conveyor run set in the floor. The boxes are assembled on this conveyor, packed, nailed shut and stenciled and are then lifted by overhead traveling cranes and placed direct in cars for shipment. The method of using gravity conveyors for progressive export packing is illustrated in connection with the shipping of Fordson tractors.

Those body parts to be used in assembling cars for domestic sale take a different line of travel than those used for export. After passing the finishing tables they are suspended from an overhead monorail trolley chain conveyor, a diagrammatic plan of which is shown in Fig. 94. This conveyor transports the parts through a spray booth (Fig. 96), where the interior woodwork is painted. The same conveyor then continues down an inclined run to the first floor and proceeds a considerable length parallel to the railroad tracks, then curves around and returns so that the parts can be unloaded direct from the conveyors and packed in the freight cars for shipment. This same conveyor is also used on the return run for transporting materials from cars on the first floor to work benches on the second floor. A side elevation of the conveyor, showing a portion of the runs on the first floors and the inclined sections, is shown in Fig. 97.

In this conveyor we have another example of solving the impossible and doing something which engineering theory says cannot be done. It will be noted that this conveyor runs on the horizontal, on an incline and also makes approximately eight right angle turns. While it is not possible to see the details of construction, they consist of the following: A continuous I-Beam monorail trolley track, a long-link forged steel chain suspended from I-Beam trolleys approximately every three feet, these trolleys running on the track. Under each trolley is a hook to which can be fastened the material being handled. All sprockets on the curves are placed on the horizontal plane instead of the vertical plane. The overall length of the conveyor is approximately 1,200 feet from the start of the chain at the drive sprocket until it returns, and the elevation or incline is about 20 feet. The surprising thing is that this conveyor when fully loaded is driven from one point by a 20 horsepower motor, but actual test shows that the 20 horsepower is only required for a few moments when starting; after being in operation and the first inertia overcome, the motor only draws about 5 horsepower.

This is an interesting conveyor installation and another conveyor of the same type, but using a different chain and suspension hook, will be shown in connection with the tractor assembly building. In addition, longer conveyors of this type, but handling lighter parts, are installed in the main machine shop for handling small castings. Thus we find the same principles of mechanical handling applied in various departments of the plant and under entirely different conditions. This is something that the average executive does not seem to realize, but the Ford engineers know from experience that by slightly altering some part of the equipment they can use the same principle for handling entirely different materials.

Handling Materials in the Manufacture and Assembly of Fordson Tractors.

In the machining of cylinder blocks and large castings, also smaller castings, in the general machine shop which is adjacent to the main foundry building, it was found that heavy gravity conveyors, special platform conveyors, overhead I-Beam trolley conveyors and wood platform conveyors were employed. If the reader could go through the various shops he would find that while the same principles of materials handling, and even the same types of conveyors are used in different buildings, the operation and installation under various conditions are different. Each class of material usually requires different treatment and in installing conveyors, the size, weight and shape of the parts handled should be given as much consideration as the layout. Frequently, the shape of an article can be utilized in order to make the equipment installation less expensive than would be the case if regular or standard equipment was employed. This is all brought out very clearly on the second floor of the tractor assembly building, where transmission parts are machined for Fordson tractors. Here gravity conveyors of different designs are installed and this type of conveyor predominates in this particular department on the handling of miscellaneous parts. Figs. 98 to 102, inclusive, show different types of gravity conveyors, some of which are standard equipment and others of special design by the Ford Motor Company's engineers.

In the handling of transmission gear blanks and through to the finished products, a type of close-spaced small diameter roller gravity conveyor, as shown in Fig. 98, is used on all the handling operations. It will be noted that these conveyors are installed with a fairly good pitch so that the parts are quickly carried away from the machines after each operation, and the parts are not only carried in straight runs but they negotiate right-angle curves.

A partially finished large transmission gear blank, which is of greater diameter, is handled in the same department by gravity conveyors of a different design. In this case the shape of the part is utilized in its transportation. Fig. 99 shows the type of conveyors used for the handling of these parts. It consists of a channel iron track with two angle guard rails and the part is transported by its own rotation, the conveyor acting as a guide. This type of conveyor also handles material around corners and, at the same time, can run around posts diagonally, as shown. The reader's attention is called to the floor stands which are bolted to the floor, and also to the fact that one conveyor run is mounted above the other. The reason for mounting the conveyors in this fashion is to permit parts, which have to be machined, to come in on the lower run, and the finished parts are then placed on the upper run, thus separating parts according to their state in process. Another point of interest in these conveyors is the drip pan placed beneath the conveyor run to catch the cutting liquid, thus keeping the floor clean.

Two different types of special gravity conveyors are shown in Figs. 100 and 101. These conveyors were also designed by Ford engineers but there is no reason why other machine shops cannot have this type of equipment built for handling similar products, it being understood, of course, that there is no patent which would debar the application of the same principles to handling operations in other plants outside the Ford industries. It will be noted that consideration has been given when designing these conveyors to the shape of the products handled, but the same principle applies in each installation; namely, gravity to propel the material.

A very unwieldy, highly finished part is being handled on a close spaced small diameter gravity roller conveyor as shown in Fig. 102, and is presented to illustrate what can be done with this type of conveyor when properly installed. There is never any tipping off of these top-heavy parts from this run of conveyor.

As machine parts are finished they are deposited to various types of rack trucks, some of which are large, low box shapes, equipped with rings on all four corners to take a crane sling. These are moved forward to the various balconies in the crane bay and an overhead traveling crane lifts, lowers, and transports them to the proper point on the main floor, where they are assembled into tractor units. In the case of finished parts, these trucks are fitted with wood spacers, or racks, so

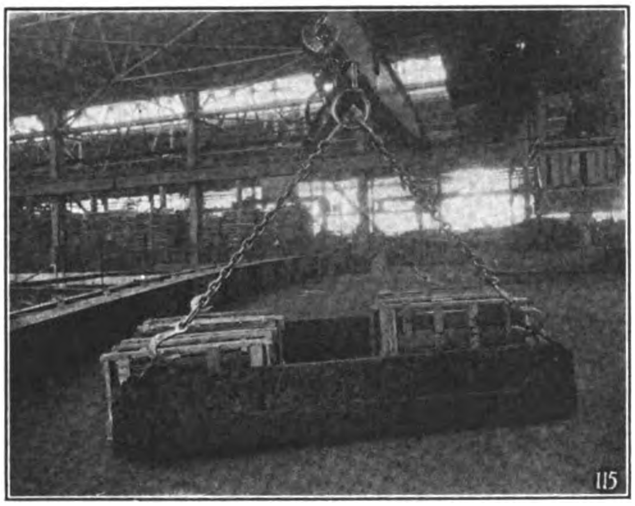


Fig. 115. Boxes of this type, some of which are equipped with casters, are used for inter-departmental handlings in the tractor assembly building.

as to keep the parts from being damaged by coming in contact with each other. The crane sling, and a similar box to the truck just described, are shown later on in this article.

The majority of small parts for Fordson tractors are machined and finished on the second floor of the tractor assembly building, while large castings, such as the rear end, receive their final finishing operations on the first floor. Tractor wheels are purchased and are received on railroad sidings to the east of the tractor assembly building, while the Fordson motor blocks are finished in the general machine shop, adjacent to the foundry, and are shipped on trailers propelled by gasoline tractors to unloading docks on the east side of the tractor assembly building. These unloading docks include gravity conveyors, the trailers that transport the castings, the railroad sidings, and the special conveyor which carries the tractor wheels from the cars to the assembly line; all of which is shown in Fig. 103.

The conveyor which handles tractor wheels, is a monorail chain conveyor, and the reader, by looking at Fig. 103, can visualize the line of travel. First the wheels are hung on the conveyor at the unloading dock; they pass up the incline, under the sheet metal hood shown; make a right angle turn; are lowered into the building by passing down an incline, and then travel for a short distance on the horizontal to a balcony unloading station; the empty run of the conveyor returning to another load.

From the unloading docks, the heavy castings brought to the building by trailers are unloaded direct to a system of gravity conveyors, which system transports these castings to the proper assembly line. At the same time, other types of conveyors and assembly tables, as shown in Figs. 104 and 105, are being used in the make-up of other unit parts, which were previously machined on the second floor, or elsewhere about the tractor assembly building. Thus we find down one side of the building several runs of assembly conveyors, each of a different design, depending upon the operation being performed. To illustrate this point we call attention to Fig. 106, which shows four runs of assembly conveyors. The one to the left is handling finished motor blocks, which were fed to this conveyor from the gravity unloading system. While in transit, certain parts are assembled to this casting and upon reaching the end of the conveyor it is mechanically transferred to the second conveyor, which is running in an opposite direction. On this conveyor, crank, shaft and other parts are added and it will be noted that a work bench is a part of the conveyor. These two conveyors are known as chain conveyors, and the castings, upon being engaged by a dog on the chain, are propelled forward by sliding in angle iron tracks. When the assembly of certain units is completed on this conveyor, they are again transferred to the conveyor on the right, but it will be noted that this conveyor is a special platform conveyor, and the motor block is held in a different position. This is to provide for efficient working by the assemblers and places the work in its proper position. Near the wall is visible another conveyor. This is also a platform conveyor, which is used for assembling pistons to piston rods. Loose parts being fed to the conveyor in units of four, when these parts are assembled they are immediately passed through another operation which takes place between the piston conveyor and the motor assembly conveyor, and the completed piston and piston rod unit is assembled into the motor.

As the motor assembly conveyor continues to travel, various parts are added until finally it reaches the point shown in Fig. 107. Here the burning-in process takes place and it is necessary to transfer each assembled motor to a machine located at either side of the conveyor and these machines spin the motors until the bearings run smooth. To lift these heavy motors by hand would be expensive and difficult and here again the principle of mechanical handling is applied and a complete layout of I-Beam trolleys, hand rope hoists and chain hoists are used. Each trolley running at right angles to the conveyor is equipped with a hand rope hoist. This simple apparatus permits a man easily to lift the motor, and by giving it a slight push, place it directly on the burning-in machine. Occasionally, the motor needs adjustment and it is necessary to return the motor to an inspection department for adjustment. For this purpose, an I-Beam trolley, equipped with a chain hoist, is located running parallel with the conveyor and over the burning-in machines. In the illustration (Fig. 107) one of these chain hoists can be seen handling a motor on the left-hand side of the picture.

This description of the conveyors used in the motor assembly is more or less complete, although a number of conveyors cannot be described in the space which is allowed for this article, for the simple reason that in addition to the motor assembly, there is an assembly of what is known as the tractor rear-end. This is a unit in itself and consists of several assembling operations, but mechanical handling equipment is used wherever possible.

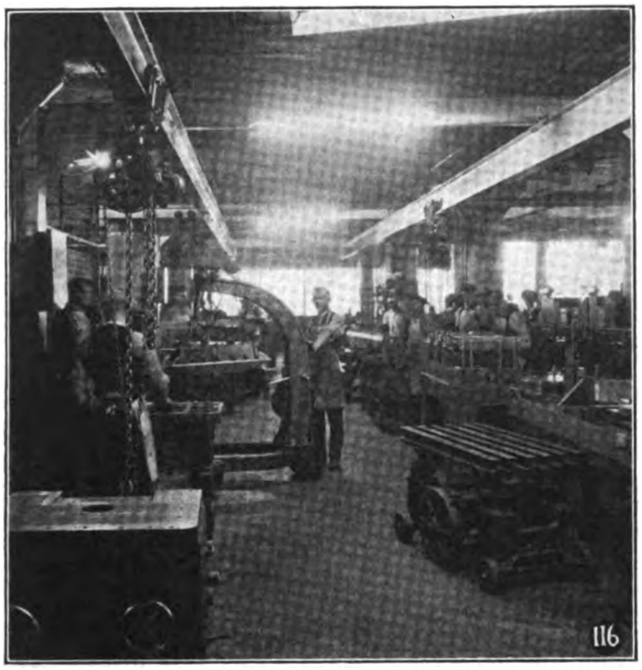


Fig. 116. The tool rooms, as well as the production departments, are fully equipped with various types of materials handling equipment.

The heavy castings, or frames, are brought in on wood platform conveyors, and after passing through various operations, are carried by special chain conveyors, and finally all assembled units converge into a rear-end assembly conveyor. Fig. 108 shows the point at which these lines of transportation come together and shows the start of the final assembling of the rear-end unit. The reader should note that this assembly conveyor is a standard chain conveyor equipped with special carrying platforms, and attention is called to the construction details. It will be noted that the return runs on this conveyor and on the conveyor in Fig. 106 are completely enclosed, thus protecting the workmen and at the same time permitting tote boxes of nuts, and other parts, to be located convenient to the conveyor.

One of the busiest points in the tractor assembly building is located approximately in the center and at this location there is a transverse line of travel for Fordson engines, Fordson rear-ends, radiators, etc., which are being fed to the tractor assembly conveyor. A portion of this busy point, showing some of the conveyors, small electric hoists, rope hoists, chain hoists and I-Beam trolleys is shown in Fig. 109. The conveyor in the foreground is handling the assembled motor unit which by this time has been fitted with the front axle and it will be noted that a special lifting attachment is used, while a chain hoist mounted on an I-Beam trolley is the medium for transferring this motor to the tractor assembly conveyor. In the background, radiators are being inspected and these are lifted by a light-duty electric hoist and after being attached to an air hose are submerged in a tank of water. Those passing inspection are immediately fed by gravity conveyors to the tractor assembly conveyor, shown in Fig. 110.

On the tractor assembly conveyor, the Fordson tractor starts to take form and Fig. 110 shows the beginning of the final assembly operation. It will be noted that an entirely different type of conveyor is used for conveying the tractors on this operation. It consists of a steel framework and a drag chain, the chain being fitted with dogs to engage the tractor and propel it forward by sliding on the tracks, which are a part of the conveyor frame work. The speed of this conveyor sets the pace for final assembly and all the finishing parts are added while the conveyor is in motion. Such parts as gasoline tanks, wheels, etc., are brought to this conveyor run by other conveyors.

Taking the item of gasoline tanks, which are made on the second floor of the tractor assembly building, we refer to Fig. 111, which shows the conveyor especially designed to handle this commodity. Here, again, the principle of I-Beam trolleys and chains being made into a conveyor unit, as mentioned in the description of the body parts manufacture, is shown, but instead of using a heavy forged chain, a lighter malleable iron and steel chain is used. The overall length of this conveyor, starting with the drive sprocket, and returning to the drive sprocket, is approximately 300 feet, and in this line of travel, nine turns are made and about five inclines are negotiated, and the parts are lowered to the first floor. The drive unit for this conveyor is shown in Fig. 111, and it is interesting to note that the motor is a 5 hp. motor, but after the conveyor is in motion only about two electrical hp. is consumed in operating it.

As each part is added to the tractor, the load on the assembly conveyor continues to get heavier, and as tractors on this conveyor are spaced as close together as possible, as shown in Fig. 112, the total tonnage being transported by this unit at any one time is rather hard to estimate. It is interesting to state, however, that this conveyor is approximately 160 feet from center of tail sprocket to center of drive sprocket and still only a standard malleable iron and steel chain is used for the carrying medium. According to engineering theory, this chain is not capable of hauling such heavy loads, and yet in the Ford plant under actual working conditions this chains operates day in and day out with little or no breakage. It would be of immense benefit to the engineering profession if a complete survey could be made of this plant and each conveyor gone over in detail and the problem worked out on a theoretical basis and then checked by actual practice. The writer feels that the result would be a revelation to engineers, salesmen and manufacturers. As previously stated, accomplishing the impossible is the problem which the Ford organization usually tackles and sticks with until a successful conclusion is reached.

Shipping Ford Tractors.

When Fordson tractors leave the end of the final assembly conveyor, their individual motors are immediately set in motion and under their own power they are driven to the testing stand and finally run to the tractor shipping platform, where they are prepared for domestic or foreign shipment. Those going to domestic consumers are properly braced in freight cars, while those going to foreign lands are crated and finally loaded to flat cars.

Domestic shipments are easily handled, but foreign shipments require many operations, as it is necessary to partially disassemble the tractors and pack them in individual cases. In order to reduce the handling costs in this department and also to speed up the operation, an electric monorail trolley and hoist and gravity conveyors are used. Fig. 114 shows the electric monorail hoist and the special sling raising a tractor from which the wheels have been removed. The bottom frame of the export box is already in place on the gravity roller conveyors which are located in the floor. As the packing proceeds, the box is built up, the wheels, etc., are placed in the case and it is slowly moved forward until it it finally emerges on the loading dock, as shown in Fig. 113. Here the sides and top are nailed in place, stenciling is done, and the case is ready for car loading.

To transfer the loaded case from loading dock to car by hand would not be thought of in the Ford organization and so we find a small steam locomotive crane, with a wooden boom, and equipped with a special sling, handling these cases. This is also clearly illustrated in Fig. 113. Some idea of the amount of equipment handled on this shipping platform can be obtained by stating that at the present time the production is about 500 tractors per day.

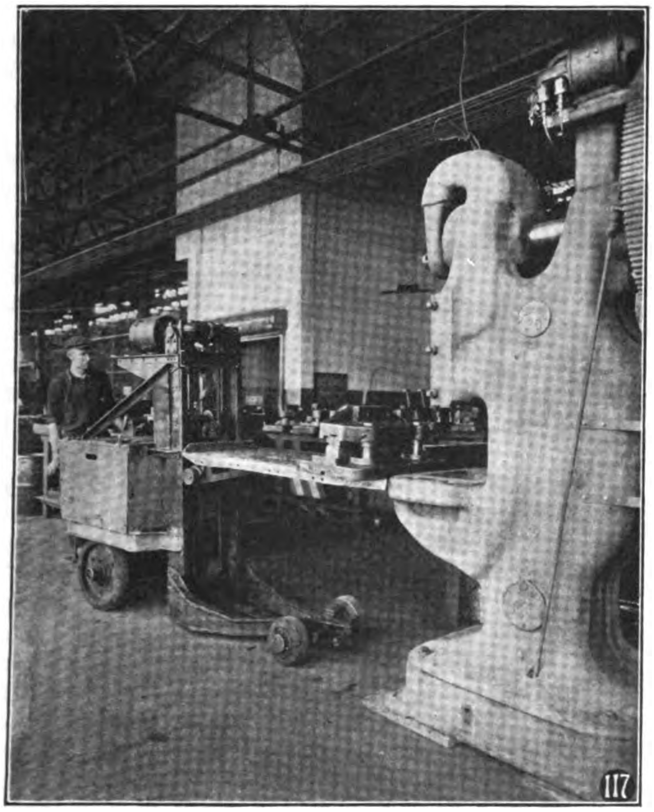


Fig. 117. Lifting heavy dies into and out of punch presses is the major occupation for this tiering truck.

We have tried to give the reader a consecutive story of tractor assembly so as to make the operations and units stand out in sequence, and for this reason, we have not diverted from the straight line method of presentation in order to show inter-departmental equipment in the tractor assembly building. In such a large building and where so many activities are being carried on, it is natural that there would be other handling operations than those which apply strictly to production of individual parts, but, again, space will not permit illustrating and describing each piece of equipment, and so only a few have been selected.

Inter-Departmental Handling Equipment in the Tractor Assembly Building.

The first inter-departmental equipment and most important for this building are the overhead traveling cranes, which operate in a central crane bay the full length of the building. These cranes handle machinery, sheet metal, finished castings, finished machine parts and, in fact, it would be difficult to tell all the things which these cranes are called upon to do. In handling various products, different types of slings are employed and various containers are used. Earlier in this article we told of trucks equipped with rings at the four corners which were used for the handling of finished parts on the second floor to the first floor. Fig. 115 shows a box on the same order as this truck, except that the truck is not equipped with casters, for the reason that it is not used except for lifting and lowering loads. This same illustration shows the type of sling employed when handling boxes and trucks and, in addition, shows one of the bridges which span the crane bay at various points at the second floor elevation. These bridges permit the transfer of materials from one side of the building to the other when desired.

Many hand trucks are used in this building and these range all the way from old style stevedore trucks to large platform hand trucks, low platform hand trucks, lift trucks and special trucks. The floors being of concrete and well laid it is easy to move materials with this type of equipment if desired. In addition to the various types of hand trucks, etc., an unusual feature, and one which could possibly be applied only to the Ford Motor Company, is the use of Ford delivery trucks for inter-departmental transportation. These trucks can come in on the first floor, run direct to freight elevators, and upon being elevated to the second floor can proceed up and down designated aisles which are wide enough to permit their passage. Thus we find almost every type of equipment operating in this one building.

One of the large freight elevators, mentioned above, and equipped with a high door, is shown in the background of Fig. 117, but in the foreground is an important piece of equipment and these electric storage battery lift trucks are found performing many operations, such as the lifting of dies in and out of punch presses and transporting them to the various tool rooms. At the same time they are used for raising motors when these are mounted high up on the production machinery and various other operations where heavy lifting is required.

A different type of electric storage battery truck, known to engineers as a load carrying truck, is also used by the electrical department for handling and transporting motors about the building to and from the repair shop. This truck is equipped with a superstructure of structural steel so that an I-beam is suspended directly over the center line of the truck and projects beyond the end of the truck frame at a height of about five feet from the truck platform or six foot six from the ground level. From this I-beam is suspended a monorail trolley equipped with a chain hoist and this equipment permits the truck to be used as a utility truck for picking up motors and other heavy parts and bringing them to the repair shop or delivering them to the point of use after they have been repaired. With this special superstructure it is possible for the truck driver to load and unload heavy motors and other parts without calling for assistance and this permits low handling cost and conservation of labor.

In the various tool rooms other types of trucks, monorail trolleys, chain hoists and hand rope hoists are employed, and Fig. 116 shows some of this equipment operating in one of the tool rooms on the second floor of the tractor assembly building. The truck shown to the right is known as a die lifting truck and while it is capable of transporting the loads for a short distance it is not recommended for long hauls. The bed of this truck can be elevated or lowered by the simple turning of a hand crank and the use of this truck is of great assistance in the handling of heavy dies, jigs and fittings, from one

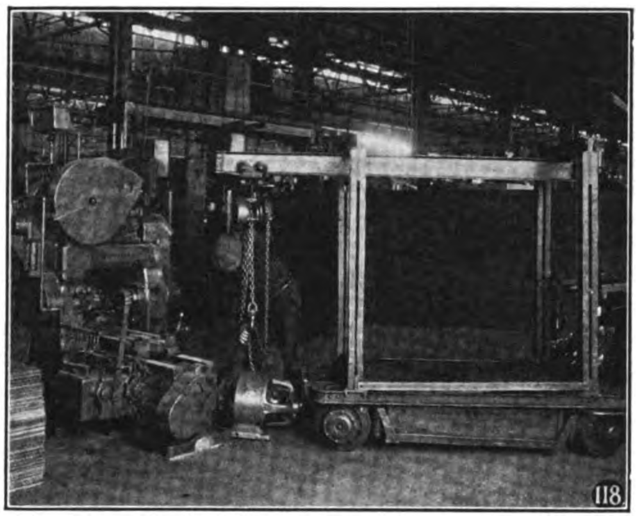


Fig. 118. Load carrying trucks, equipped with special superstructure, as shown, materially assist the electrical department in handling heavy motors about the various buildings.

elevation to another, such as from the wood bench to lower trucks for transportation, to the production machinery.

To the left of the picture is shown a piece of equipment known as a skeleton jib crane, and the same or similar operations can be performed by this crane as are performed by the die lifting truck. This crane is also hand operated by means of a crank and being equipped with wheels can easily be propelled where the floors are level. It is not recommended for long hauls but is shown in this illustration operating under the proper conditions.

As stated many times in the articles in this issue, but possibly not in the same words, the main idea or principle of the Ford organization is to eliminate all unnecessary exertion of man effort and for this reason materials handling equipment is extensively employed and stands out in every department as a universal panacea to overcome the fear of an unskilled labor shortage and in addition the management has found that the men are more contented, production is more uniform and better conditions exist if all drudgery can be removed from the workmen's daily occupation.

Successful Innovations in Plate Glass Manufacture

(*Continued from page* 35)

ation for handling abrasive and large lumpy material is to dump direct from the box car into the chute at the left of the picture and this chute in turn discharges to a belt conveyor under the floor, which transports the material to a bucket elevator. When handling fine material or dusty material, such as soda ash, etc., the vacuum pneumatic conveying system, shown to the left, is brought into operation. The long, flexible hose, shown in the center of the picture, is placed directly into the materials in the car and a high-vacuum pump is started. The material is then sucked into the large receiver, and the air going to the pump is filtered in the three bag filter compartments shown on the top of this receiver. At regular intervals, the bags in these filters are automatically cleaned and the heavy dust dropped into the main receiver. From this receiver the materials flow by grav-

Fig. 128. General view of the glass cutting department, showing men cutting polished glass to the required sizes.

ity through a power driven air lock and are discharged into the same elevator which is used for elevating the large, lumpy material. It is, of course, understood that one product at a time is being unloaded.

When the materials reach the top of the storage hoppers, they are discharged to a shuttle belt conveyor, which distributes them to their proper bins. It would be well to mention here that not all cullet is received from outside sources and a certain quantity has to be transported from the far end of the building, where finished glass is cut into the right sized pieces or where defective plates are rejected. We therefore find an additional handling system, placed at the extreme end of the building from that shown in Fig. 119, and here cullet is produced from defective plates and scrap pieces. These are broken up by means of a crusher (fed by a pan conveyor), are elevated by means of bucket elevators and discharged to the long belt conveyor shown in Fig. 120. This conveyor is placed in a little gallery, high above the operating floor and adjacent to the bay in which the railroad siding is located. The cullet on this conveyor is fed to another elevator which carries it to the top of the storage bins previously mentioned and discharges it to the proper compartment.

Under the storage bins are screw conveyors to draw off the various materials. These conveyors discharge to wooden chutes which feed to small compartments on the first floor, as shown in Fig. 121. Here the materials are mixed into batches and fed by belt conveyor to a bucket elevator which elevates the material and discharges into a small storage hopper on the furnace charging floor. This elevator and hopper is visible in Fig. 122. To charge the furnaces, an electrically propelled weigh larry, running on industrial tracks, is employed and the method of charging this weigh larry from the small storage hopper is also illustrated. After the weigh larry is filled with the proper weight it is propelled to the furnace opening and the material is dumped by raising a slide gate. The car then returns and is filled with another batch and the operation is repeated. Attention is called to the warning bell on this weigh larry, which is a safety precaution to warn the furnace operator while the car is in motion.

After the material is dumped into the furnace it becomes a molten charge which finally is drawn off by a steady flow in the form of liquid glass. Immediately after leaving the furnace discharge spout it passes through rollers which makes the glass into plates the proper width and thickness and this plate is immediately fed to a continuous lehr in one solid strip. The furnace, discharge, rolling operation and feeding point of the lehr are shown in Fig. 124.

This type of lehr is a new development in the plate glass industry and is the application, in a sense, of an old material handling principle: namely, a conveyor consisting of power driven rollers. Such conveyors have been used for handling lumber, rolls of carpets and other long materials, but this is the first time the writer has seen plate glass handled in this manner. By looking closely, the reader can see the worm wheel drives which propel each individual roller and also the motor and gearing which drives the main or worm shafts.

As the glass travels through the lehr it is gradually cooled until eventually it emerges at the discharge end, as shown in Fig. 125. Here it is transported on a gravity conveyor or live roller conveyor and, at the same time, is cut into the desired lengths and the first inspection, as well as other minor production operations, take place at this point.

As the lehr is built up on a balcony it is necessary to provide a means of lowering the glass plates, and for this purpose a slow-moving belt conveyor (Fig. 126) using a stitched canvas duck belt, is used. After the glass is lowered it is immediately transferred to the polishing machines or placed in temporary storage on industrial cars, as illustrated in the same picture. This method of storage acts as a production balance between the lehr and the polishing machine. The relation of the lehr, lowering belt and polishing machines is shown in Fig. 127.

The polishing machine is also built in the form of a conveyor, to permit continuous operation without rehandling, and this operation is as follows: The glass is taken from the lowering belt, or temporary storage, and cemented to cars which, when coupled together, form a continuous platform conveyor, or train; and these cars equipped with a driving dog are propelled by electric power at regular intervals in the run by engaging with a chain. After the glass travels the full length of the building, having one side polished, it is removed from the car and the car is automatically transferred by means of a turntable arrangement, as shown in Fig. 127, from one run of conveyor to the other. The glass is then turned with the polished side down, re-cemented to the same car, and the operation repeated. It will, therefore, be seen that the finished glass is finally removed from the polishing machines, at the same point where the rough glass started.

Polished or finished glass is handled by various types of caster trucks to the various cutters who work on tables, as shown in Fig. 128, and improvements in the handling methods of this glass are now being given consideration. The overhead traveling crane shown in Fig. 128 is used mainly for the installing and taking down for repair of various units of the polishing machinery, but at times these cranes also handle boxes of plate glass and other heavy loads.

This plate glass plant, as previously stated, is one of the most modern in the country and the machinery installed is of the very best quality and the highest class

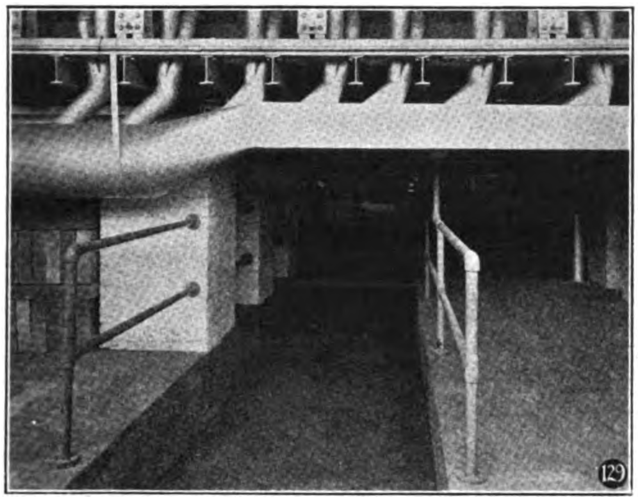


Fig. 129. Where head-room is not sufficient under the glass furnaces, depressed runways were built in to permit a trucking passageway.

of workmanship. The elevators and conveyors are all equipped for grease gun lubrication and the bearings on the lehr and polishing machine conveyor cars also employ the same system. Roller bearings take the place of a lot of ordinary babbitt bearings and every unit, as well as the details, have been designed and built to give maximum efficiency. Even the building itself is provided with runways, aisle-ways and proper doorways to permit the passage of trucks when necessary. Fig. 129 shows how the floor is depressed to make a truck passage way under the glass furnaces. Attention is also called to the guard rails around these depressions.

While, as previously stated, every consideration has been given to the proper laying out and equipping of this new plant, the Ford engineers have already discovered a number of improvements that can be made in the materials handling operations and one or two of these improvements are already being made. Thus, even the best equipment is subject to change after installation, and it would pay the average industrial executive to keep this one point in mind, and remember that though the manufacturer and engineer designing and installing the equipment has tried to think out every possible condition, it is frequently necessary, under actual working conditions, to make revisions in the original layout.

Handling Diverse Materials in the By-Products Plant

(*Continued from page 36*)

incoming slip but this slag pile is now being reclaimed by steam shovels and locomotive cranes, which load the slag to gondola cars to be hauled to the cement plant, a general view of which is shown in Fig. 130. To the left will be seen some of the cars of slag and the one at the corner of the building is dumping to a track hopper. Under this track hopper is an overlapping pan conveyor feeder which carries the material and discharges it to another conveyor, as shown in Fig. 131. The second conveyor dumps the slag to a crusher, where it is immediately reduced in size and transported by means of pivoted bucket elevator conveyors to large storage bins.

From the storage bins the slag is again carried by means of various conveyors and elevators to a long kiln, where it is further reduced by burning and finally discharged to a pivoted bucket elevator conveyor in the

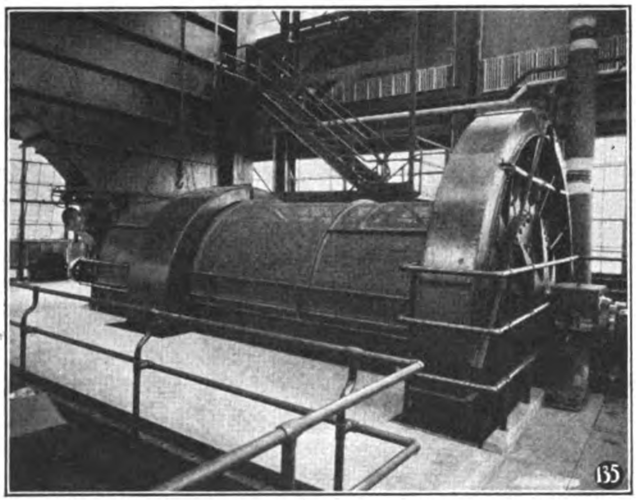


Fig. 135. View in the cement mill room showing hopper for raw material, feeder and mill.

form of clinker. This clinker is finally discharged to a belt conveyor running in a gallery over the outside storage bins. A view of this conveyor is shown in Fig. 134. In the immediate foreground the feeding chute is visible, and the next apparatus in the conveyor run is an automatic weighing machine, which tallies up the total weight of the clinker passing over the conveyor each day. Further along, but not visible, is a belt tripper which travels the full length of the conveyor gallery so as to discharge clinker to any part of the outside storage bins.

It was mentioned in connection with the cupola, or foundry building, that a new method of handling slag was being installed and that in the near future granulated slag would be transported in trailers from the cupola buildings and pumped through pipes from the blast furnaces to the cement plant. To care for this new form of slag, which, when received from the blast furnace, is wet, the perforated bucket elevator, shown in Fig. 132, has already been installed. The large pipe, marked with an arrow, is the one which conveys the slag into the cement plant, and the slag mixed with water will deposit into a large settling pit and is elevated by the perforated bucket elevator to the storage bins. This slag is also transported to the kiln by the same conveyor system, as previously mentioned, and discharged by this system in outside storage bins for seasoning.

In the manufacture of cement, limestone is also required, and the building directly under the words "limestone storage," in the panoramic picture, is the one which prepares the limestone required for cement manufacture. In this building are various types of elevators, conveyors, etc., and also storage bins, and after passing through this system the limestone is deposited on a belt conveyor in the run of which is an automatic weighing machine, which registers the amount of limestone passing over the conveyor each day.

Under the outside storage bins, where clinkers have been placed for seasoning, we find several runs of belt conveyors which are fed by power-driven feeders. These conveyors reclaim the clinker and carry it to elevators and other conveyors to a point where it converges into a hopper above the mill floor. Here the clinker and limestone, mentioned in the above paragraph, are mixed together and fed by power driven feeders to the mill shown in Fig. 135. In this mill the mass is ground together into portland cement, which is discharged from the mill to a system of screw conveyors and bucket elevators, and is finally placed in storage in the cement silos.

From the cement silos we find a system of screw conveyors and bucket elevators handling the finished cement

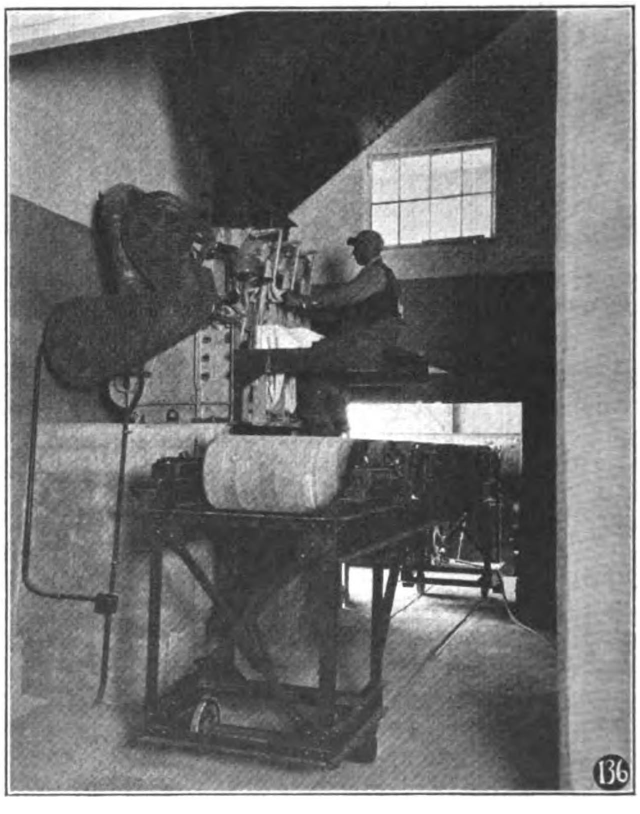


Fig. 136. The bagging of cement is also done mechanically and the belt conveyor immediately transports the bags to the cars for loading.

to large storage hoppers in the bagging and shipping building. In this conveying system are automatic hopper weighing scales, which tally up the weight of the materials handled each day.

The hoppers in the bagging and shipping department feed by gravity to the bagging machines which are shown in Fig. 136. These machines are capable of filling three bags at a time. The bags are patented sealers, so that upon being drawn from the bagging machines they can be immediately dropped to the shuttle belt conveyor, which transfers them to the cars on the railroad siding for shipment.

It is safe to say that over 80% of the operations in the cement plant consist of material handling, but all of these operations are done by mechanical equipment and thus it will be possible for the Ford Motor Company to produce a high grade of cement that can be sold at a reasonable price. Labor costs in this cement plant are reduced to a minimum and every modern improvement has been incorporated in its construction. As in the plate glass plant, all the equipment is of the best and has been scientifically laid out so as to perform all op-

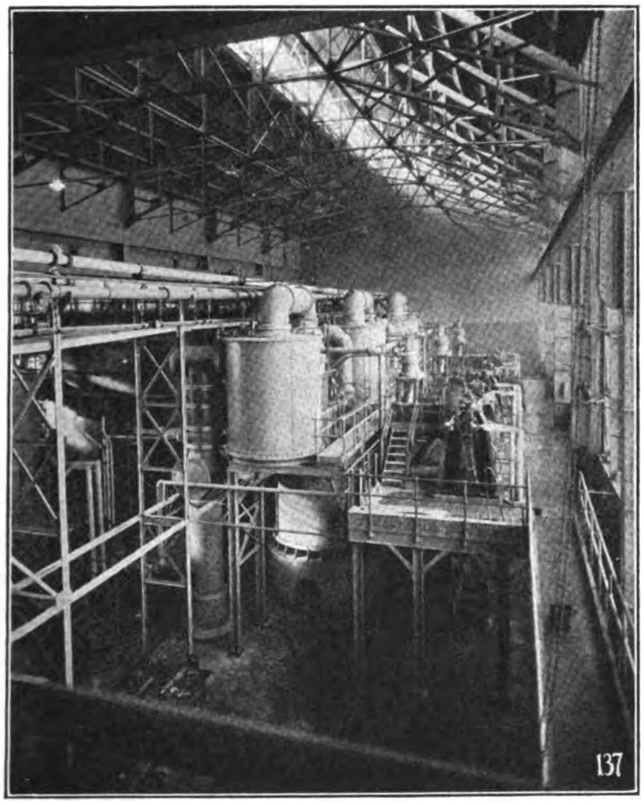


Fig. 137. General view in the coke oven by-products building. To the right can be seen the centrifugals which discharge ammonium sulphate to the buggies under the balcony floor.

erations quickly and efficiently. To illustrate the consideration that was paid to detail we are presenting Fig. 133, which shows one of the control boards for starting and stopping a small portion of the materials handling equipment. This control board is located in the receiving building where slag first enters the plant. Reading from left to right, controllers are as follows: Magnetic separator, screw conveyor, dust exhauster, rotary screen, magnetic separator, pivoted bucket carrier, crusher, apron conveyor, apron feeder. In addition to this main, or centralized, control board, each piece of equipment is equipped with a remote control which permits starting and stopping at various points in the line of travel. Other boards, similar to the one shown, are found at several points in the cement plant.

Where so much depends upon efficient handling it pays to think of details, especially in connection with the starting and stopping of machinery. Industrial engineers and executives could learn much by visiting the Ford plant in this one connection. There is no doubt that the engineers of this company have installed the most complete installations of conveying equipment from all standpoints.

Handling of Ammonium Sulphate or Fertilizer.

In the handling of coke-oven by-products, the greater portion is piped in the form of gas or liquid and while pumps and pipes could be considered as handling equipment, it would not be well to make the scope of this subject too large. We do find, however, that at a certain point, part of the by-products are solidified and after being passed through centrifugals for the drawing off of the moisture the residue is ammonium sulphate. Fig. 137 shows a portion of the coke oven by-products building and the equipment shown on the balcony floor is the centrifugals. Directly beneath each centrifugal there is

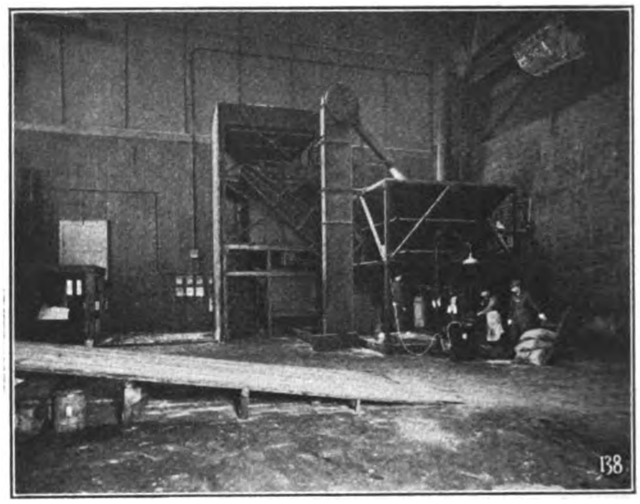


Fig. 138. General view in the fertilizer storage building, showing the materials handling equipment used in the drying and bagging of ammonium sulphate.

an opening in the floor through which the solid products are discharged into buggy carts. These buggies are propelled by hand to the fertilizer storage building.

Upon reaching the storage, these buggies are placed upon scales as shown to the right of Fig. 138, where the material is weighed and then dumped into a pit, which is located between the scale and the drying equipment. From this pit, the damp ammonium sulphate is picked up by the grab bucket suspended from an overhead traveling crane, and by this means it is either dumped into the hopper above the drying equipment or is transported to the bulk storage. The same method (namely, an overhead crane equipped with a grab bucket) is also used for reclaiming the material from bulk storage and feeding to the drying equipment hopper.

The drying equipment consists of power-driven feeders, two rotating kilns, screw conveyors, bucket elevators and hoppers. It will be noted that directly under the hopper for dry materials is located a bagging machine where the fertilizer (ammonium sulphate) is weighed, bagged, the bags sewn and tagged, placed on trucks and transported up the ramp shown in the foreground for loading to freight cars or trucks for shipment. Thus we find materials handling not only playing an important part in the manufacture of Ford cars and Fordson tractors but we also find this equipment reducing the handling costs in the manufacture of by-products.

Miscellaneous Industries Within the Ford Plant

(*Continued from page 38*)

veyor frames and special conveyors, is built. The fact that the Ford Motor Company is now building some of its own conveyors proves how thoroughly the management has been sold on the idea of mechanical handling as one of the biggest factors in industrial economics.

Materials Handling in a Modern Jobbing Foundry.

There is a tendency for a number of executives to say that materials handling equipment is well adapted to quantity production but the same principle cannot be applied to shops where each piece manufactured is different, or where only small quantities of duplicate parts are produced.

It is true that quantity production on a large scale offers, not only the most obvious field for mechanical handling, but also the most impressive savings through its proper application. In the course of a year, a single new conveyor system in the Ford plant may result in savings running into the hundreds of thousands; but a similar saving of only a few thousands of dollars, in the average small plant, looms much larger on the final balance sheet. And it must be remembered that a new conveyor system at River Rouge woud have to show these impressive economies over an existing installation which, admittedly, was already performing with more than average efficiency.

We have already shown that certain types of materials handling equipment are best adapted to quantity production and the many articles which have appeared in our various issues have stressed the point that materials handling is a broad subject. This article will again show our readers that every handling operation in any industry has already designed for its performance some type of materials handling equipment, and the thing for the executive to do is to be well versed in what equipment has already been built, what types are available and then apply this knowledge to his particular plant activities.

To show another industry using this equipment we present the illustrations in a modern jobbing foundry. Here we encounter conditions as they exist in other foundries, but with added difficulties—for in this work, castings are produced from the size of a man's hand to large generator frames which measure over twenty feet across the widest points, and at the same time intermediate-size castings are produced. Frequently, only one or two castings of any one pattern are made, and occasionally as high as fifty from the same pattern are produced. Figs. 141 and 142 illustrate some of the various molds as they are found on the molding and pouring floor.

To describe some of the handling operations and to show some of the illustrations, we have presented Figs. 140, 141, and 142. The view in Fig. 140 is through the jobbing foundry bay, where large castings are poured. Visible in this illustration are three overhead traveling cranes and the hook of a fourth overhead traveling crane can be seen in the foreground. The locomotive crane is erecting the fifth overhead traveling crane for operation in this one bay. This will give the reader some idea of the many handling operations that take place in this foundry at one time. There are very few foundries in the country that are so well equipped with material handling equipment. These cranes are all large capacity, even going as high as 125 ton; the reason being that occasionally it is necessary to handle large ladles of hot metal for pouring, and then it is also necessary to lift large castings of the size previously mentioned. While overhead traveling cranes seem to predominate in this section of the foundry, we also find many pillar jib cranes, equipped with I-Beam trolleys, electric hoists and chain hoists to assist the men in handling patterns, cores and other foundry equipment.

In the section of the foundry devoted to production of smaller castings we find an entirely different variety of materials handling equipment, although here, again, overhead traveling cranes are installed for handling heavy parts longitudinally in the building.

The reader's attention is directed to the illustration, Fig. 141, which shows the following types of materials handling equipment: Ladle cars, industrial railway track system, perforated bucket elevator, pigging conveyor, pillar jib cranes, I-Beam trolleys, chain hoists, sand slinger, overhead traveling cranes, bucket elevator and freight elevator. This is quite an array of handling apparatus to be contained in one illustration.

The ladle cars handle hot metals from the cupolas and transfer same over the industrial track system, shown in Fig. 142, and from these cars the metal is transferred to smaller ladles for pouring. This industrial track system is also used for other industrial cars for the transferring of molds, cores and patterns. One of the turntables in the system, and a car for this purpose, is shown in the same view, and the men can be seen attaching the overhead traveling crane sling to a heavy load which they wish transferred to a point which cannot be reached by the industrial track.

In the preparation of material for charging the cupolas we find similar devices being used as in the case of the cupolas in the main foundry. Here, such equipment as gantry cranes, carrying turntable boom cranes equipped with electric magnets and grab buckets, is used for unloading materials from cars to stock gallery. This material is transferred to the cupola by cupola-charging buggies and is then fed by hand.

The perforated bucket elevator shown in the background of Fig. 141 and near the wall, is one of the new slag-handling elevators, which will receive the granulated slag from the cupola slag conveyor and elevate it to the hopper from where it will be fed to dump body trailers for transportation to the cement plant.

The pillar jib cranes, monorail trolleys and chain hoists are used for handling heavy flasks, molds, etc., and materially assist the workmen and also make it possible to speed up a number of handling operations. These pillar jib cranes, being held to the columns on pivoted brackets, are able to serve a large area of floor space.

The sand slinger in this foundry is a complete unit in itself, consisting of a bucket elevator which discharges into a chute from where the material is fed direct to a high-speed belt, then to a centrifugal throwing wheel, which delivers the sand to the flask with such impact as to obviate the need of further ramming. The arm of this sand-throwing machine is arranged to swing radially and the operator merely pulls it across the flask, one pass being sufficient to completely fill the flask and at the same time ram it. Here we see materials handling equipment not only reducing the labor cost of handling materials but also performing a production operation.

The pigging machine in this foundry is used for the same purpose as in the other foundry, but the reader's attention is called to the small, compact unit here installed. This type of equipment installed in the average foundry would save a number of man-hours in the handling of residue metal.

Handling in the Paper Plant.

The manufacture of paper at the River Rouge Plant is entirely different from the average paper-making industrial operation, for the reason that it is really a by-products industry to use up refuse material from the saw mill and woodworking departments. In bringing this refuse to the paper making plant, which is located near Power House No. 3, large platform trailers are used and these trailers are hauled by gasoline tractors. Here the pieces are handled by hand direct to the first vats for the manufacture of pulp.

Raw materials such as soda ash, lime, etc., are received from cars on railroad sidings, adjacent to Power House No. 3. Hoppers, vats, tanks, etc., for the storage and preparation of these materials are located in the Power House Building. Here we find a system of vacuum pneumatic conveyor being used for unloading the pulverized and dusty materials; and bucket elevators and screw conveyors raise and transport all the materials to the various pieces of manufacturing apparatus. Here they are put in solution and pumped direct to the paper making plant.

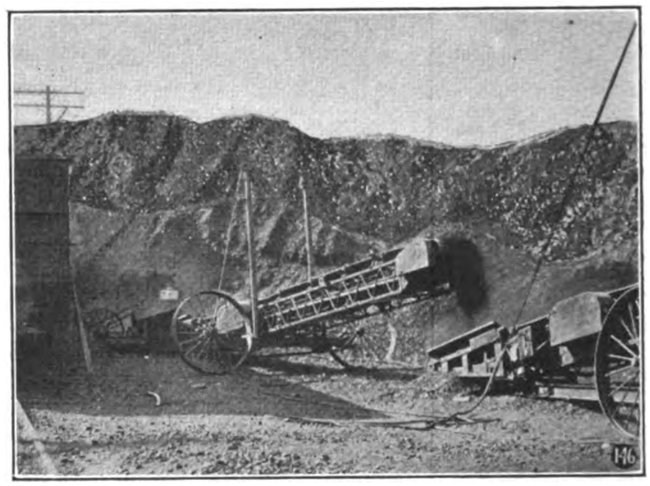


Fig. 146. Portable unloaders and conveyors, similar to that shown above, are reducing handling costs in the miscellaneous freight yard.

The paper produced in this plant is of one grade, namely, a heavy brown paper which is used as padding for the upholstery in Ford cars, and for this reason, it is cut into regular size sheets. These sheets are handled to different operations on platform hand trucks, castor trucks and even short lengths of gravity conveyor.

It will be noted that even in this paper making plant, which is small in comparison with some of the larger paper plants throughout the country, it has been found economical in operation to use various types of materials handling equipment.

About the Plant Yard.

The plant yard at River Rouge is so large, covers such an area and has so many operations being performed therein, that it would require another issue of this magazine to illustrate and describe all the types of materials handling equipment that are here employed. Such equipment as portable belt conveyors, portable car unloaders, portable bucket elevators for loading wagons, trailers, etc., locomotive cranes, gantry cranes, and all the various types of equipment listed on the panoramic view, are playing their individual part in reducing handling costs.

Frequently we forget that the plant yard is an important link in production activity but the Ford engineers have realized that the yard, in order to be efficient, must be as fully equipped with materials handling equipment as any one of their various buildings. It is not easy, in this large yard, to trace individual operations or to present a story in sequence or progression showing the relation of certain operations to certain buildings or industries, previously presented. Fig. 143 shows a gasoline tractor and only one short train of trailers. This equipment is receiving pea coal from the pulverizer building and transferring it to the foundry where it is used in connection with the manufacture of molds and cores. All day long two tractors are continually hauling these trains of trailers from this point to the point of use in the foundry.

In the transporting of materials between buildings, the gasoline tractor and various types of trailers are employed. The tractors themselves are nearly all equipped with rubber-tired wheels, as shown in Fig. 143, and a considerable proportion of the trailers are also equipped with rubber-tired wheels. The trailer bodies and chassis are of many different designs, some being short industrial trailers and others large wagon trailers. In fact, a good many regular bottom dump wagons, as used by contractors, have been equipped with trailer hitches so as to work with the tractors. A number of the trailers are of the fifth-wheel-steer type, especially those used on the long hauls. The short hauls or inter-departmental trailers are of the four-wheel-steer type. It is estimated by the writer that for haulage about the plant yard and within the buildings a total of about 124 gasoline tractors are used and approximately 138 trailers.

The tractors are not only used for transportation but are drafted into many other operations, such as that shown in Fig. 144, where the tractor is equipped with a large broom for sweeping the concrete roads. Tractors are also used to haul water wagons about the plant when sprinkling the dirt roads. Many other attachments and uses of this type of equipment could be mentioned if space would permit.

While certain raw materials are received by boat and hauled by various types of equipment, as previously described, there is also considerable handling of other raw materials which must necessarily be done. It is, therefore, at first surprising for the visitor, who has "covered" the outside storage bins, etc., to come upon the activity which is taking place in the railroad yard at the north end of the plant. Here, carloads of sand, gravel, logs, pig iron, sheet metal, coal, and many other materials, have to be shifted to various sidings for plant distribution and, at certain seasons of the year, they have to be unloaded and placed in temporary storage.

To present an entire picture of this plant yard would be difficult but a partial view is shown in Fig. 145, and here various carloads of materials can be seen and one or two pieces of materials handling equipment are visible. In the foreground is a self-supporting pillar jib crane equipped with an electric hoist, used for unloading or loading heavy car axles and trunks for use in the car repair department, which is located to the right.

In other parts of this yard different types of pillar jib cranes are also installed and are used for unloading sheet metal, structural steel shapes and heavy equipment.

In the background of the same illustration is a locomotive crane equipped with an electric magnet and used for unloading pig iron from cars to storage pile. In this same yard a number of locomotive cranes, equipped with

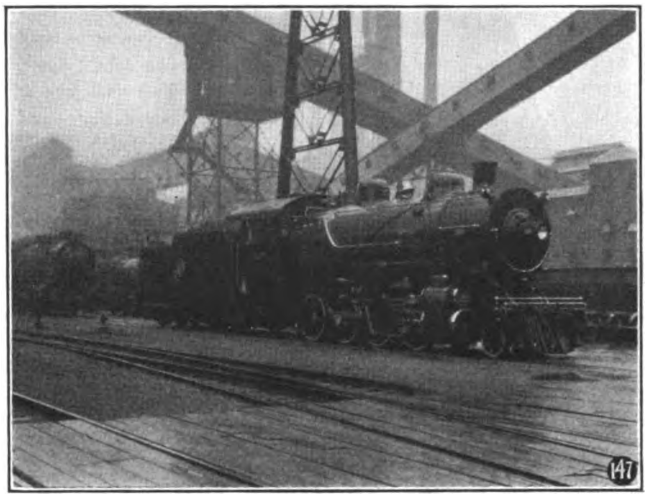


Fig. 147. A few of the D. T. & I. Railroad locomotives which form an important link in the Ford Motor Company's transportation systems.

grab buckets, orange peel buckets, crane slings, etc., are used for the loading and unloading of various materials, at different points.

At one point in the yard two large gantry cranes, upon which are mounted turntable boom cranes, are used for handling sand and other bulk materials within a certain limited area.

We also find, in the plant yard at the north, many portable pieces of equipment, such as gravity conveyors, industrial tracks and cars and portable belt conveyors and car unloaders. All the above mentioned pieces of equipment have been found of advantage in reducing handling costs and in this entire yard one seldom finds materials being handled by hand methods. If all industrial plant yards, throughout the country, were equipped with materials handling equipment to the extent that the Ford Motor Company equips its plant yards, it is safe to estimate that millions of dollars per year would be saved to industries and that hundreds of man-hours would be conserved for more productive operations.

D. T. & I. Railroad, a Unit of the Ford Motor Company's Materials Handling System.

Very few industrial plants are large enough to require their owning the railroad system which brings raw materials to the plant and distributes carloads of finished products to the various national railroad systems, but the Ford Motor Company has found it advisable to control all incoming and outgoing lines of transportation, for they know that the proper handling of their materials is the keystone to all of their production activities. Thus we find that they own and control the D. T. & I. Railroad and, as told in one of the preceding articles, they have now put into service their own Lake boats for transporting materials by water.

The owning of a railroad means shops for the repair of cars, locomotives, etc., and many other intricate details, but all these come under the head of the Ford organization and Ford engineers. Fig. 147 will show the reader a few of the locomotives standing near the locomotive shop in the yard of the Ford Motor Company's plant at River Rouge, while Fig. 148 shows an interior view at one end of the main locomotive repair shop.

In the repair and upkeep of locomotives an additional machine shop, located under high line, is set aside for the manufacture of small parts and the machining of all necessary medium sized pieces. Here also forgings are made and sheet metal boiler plate and tube work is taken care of. In the locomotive shop, shown in Fig. 148, large castings are machined and assembly work is carried on.

In the handling of materials in such shops, various types of pillar jib cranes, equipped with I-Beam trolleys, rope hoists, chain hoists, electric hoists, etc., are found adjacent to practically every machine to assist the operator in lifting and transporting heavy parts. In addition, overhead systems of I-Beam monorail tracks are installed so as to facilitate the transportation of heavy parts to and from the shop doors. Various types of platform hand trucks are also used, where only short hauls are required.

While the locomotive repair shop under high line is practically the only building not equipped with overhead traveling cranes, of some type or other, this class of equipment comes into its own in the main locomotive re-

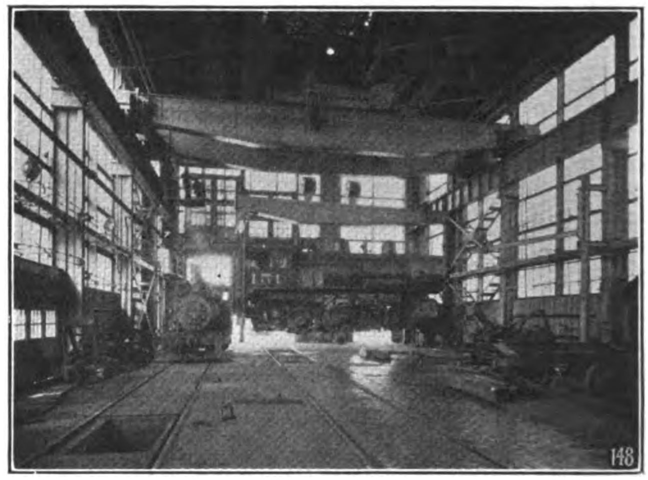
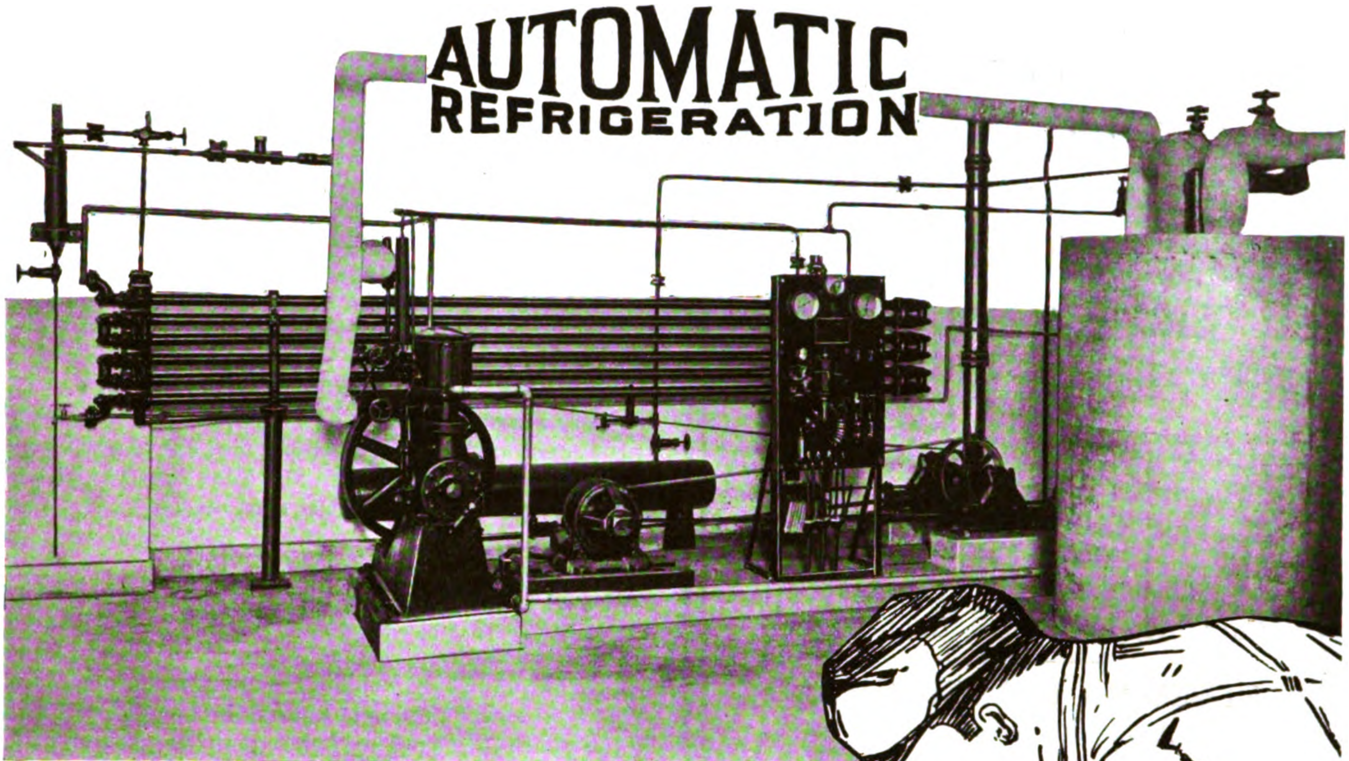


Fig. 148. View in the general locomotive repair shop, showing an overhead traveling crane, equipped with a turntable hoisting unit.

pair shop or assembly building. Here, in addition to all the equipment mentioned in the preceding paragraph, we find four overhead traveling cranes of various capacities, being used for the lifting and transporting of materials from small castings to complete locomotives. The most important of these cranes is shown in Fig. 148. This crane is equipped with a turntable hoist trolley and by using a special crane hook arrangement it is possible to lift up an entire locomotive and turn it to any angle desired, even making a complete circle should conditions require.

Thus we find in the complete description of the Ford Motor Company's materials handling methods at River

(*Continued on page* 188)



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(*Continued from page* 186)

Rouge all types of materials handling equipment, from the smallest type of hand truck to the large type of overhead traveling cranes and gantry cranes. It is hard to conceive at first glance that one organization could possibly apply all of the materials handling principles described in this series of articles, but experience gained by the use of this type of equipment in all of the various Ford industries, has taught the executive staff and the engineers many valuable lessons; lessons which could well be studied and applied by executives in every industry.

Have You Gotten "Yours" Yet?

Every reader of Industry Illustrated is entitled to get at least one big money making idea out of each issue. If you get what is coming to you your subscription will be one of the best investments ever made.

Go through every issue of this publication with the idea of finding and making use of this idea.

If you cultivate this attitude in reading this publication and others you will greatly multiply the benefit of all of your reading.

The big motive in reading technical magazines of all sorts is to secure ideas and knowledge of practice. Life is too short to get all of our experience at first hand. Some of us think it is too short to read text publications. That is the reason we are publishing Industry Illustrated where ideas are compressed into pictures.

Our purpose in presenting material to you in this way in Industry Illustrated is to take you on personally conducted tours through the best and biggest plants in America.

If you were given the privilege of visiting the plants of the Ford Motor Company you would be on the alert to seize upon any idea that you could use profitably in your own business.

If you were permitted to spend an entire month at the great River Rouge plant you would not be able to see one-half as much as you can see through our editor's eyes in this issue of Industry Illustrated.

Go through this issue carefully.

Search every picture for its idea message.

See if some slight modification might make the idea suitable in your own plant.

Remember that during the past three years American factory executives have awakened to the fact that a thorough knowledge of handling materials and product parts by modern machinery is as essential to the manager as is a thorough knowledge of processes and producing machines.

Remember that the practice illustrated and described in this issue is the most advanced of any to be found at home or abroad.

Remember that Henry Ford is no magician, and that he makes his remarkable low cost records because of his knowledge of where and when to use machinery.

This issue tells the story of when and where Henry Ford uses machinery for shop transportation. It tells it completely. It is the most thorough technical article on this subject that has yet been published. We want you to get your idea—the profitable idea in this issue—that is coming to you. Our editors are willing to help you find it. So if you have some problem in mechanical handling and cannot find the answer to it in this issue, write to the editors and they will help you solve it.

Index to Advertisements

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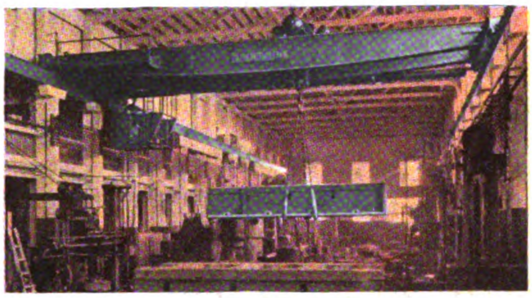

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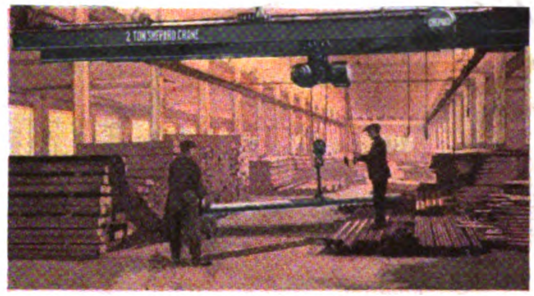

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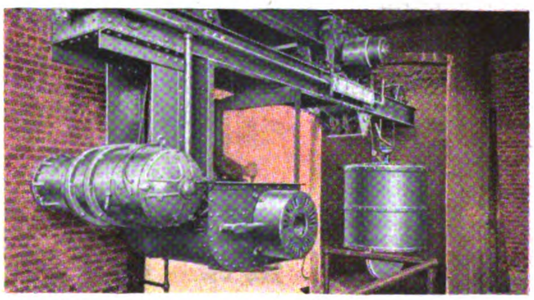

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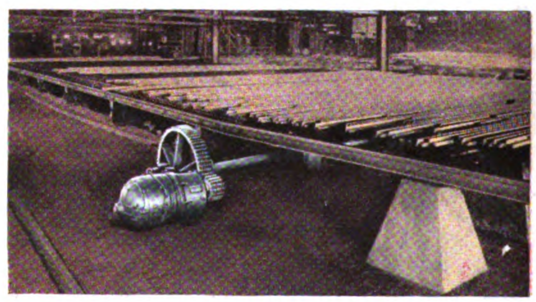

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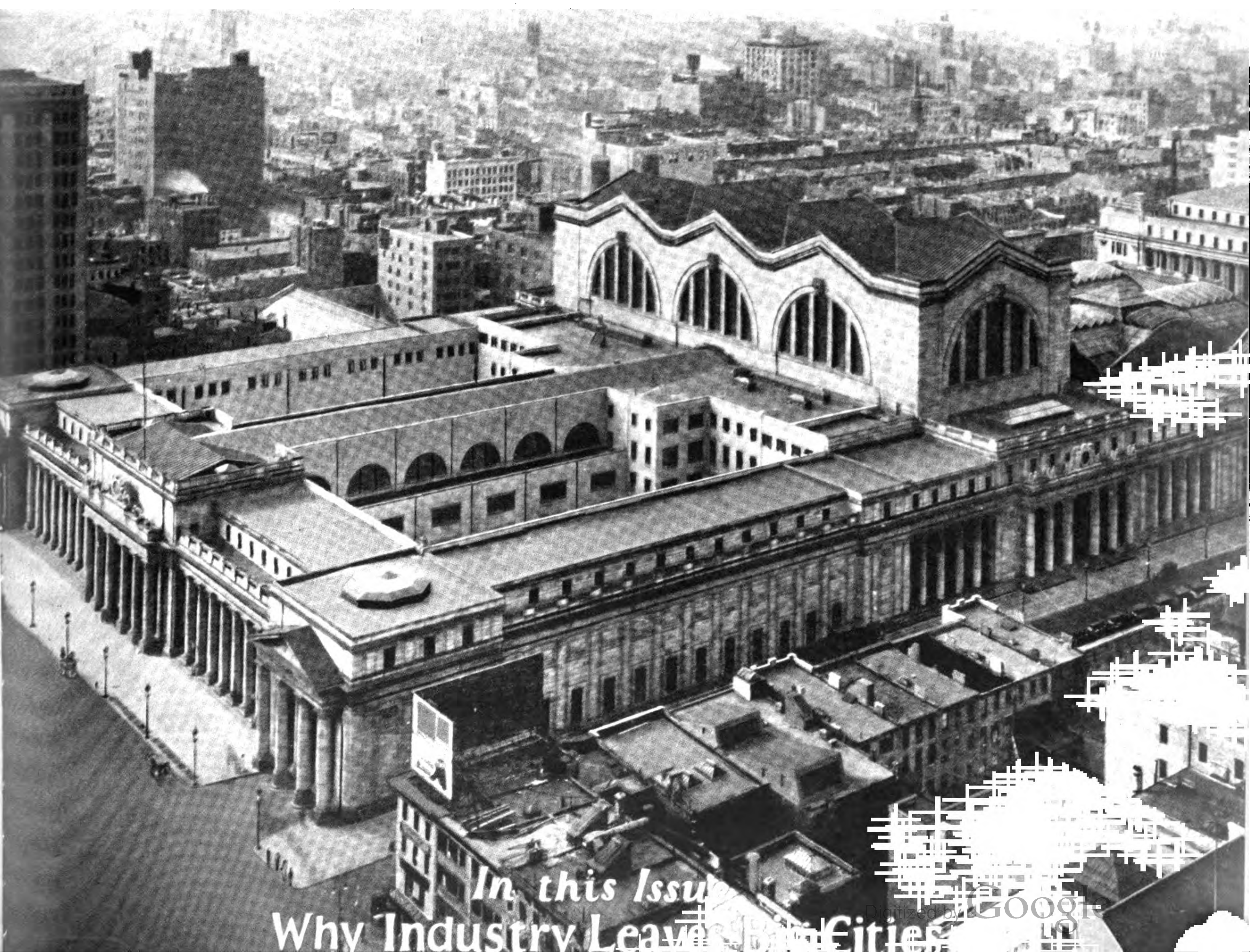

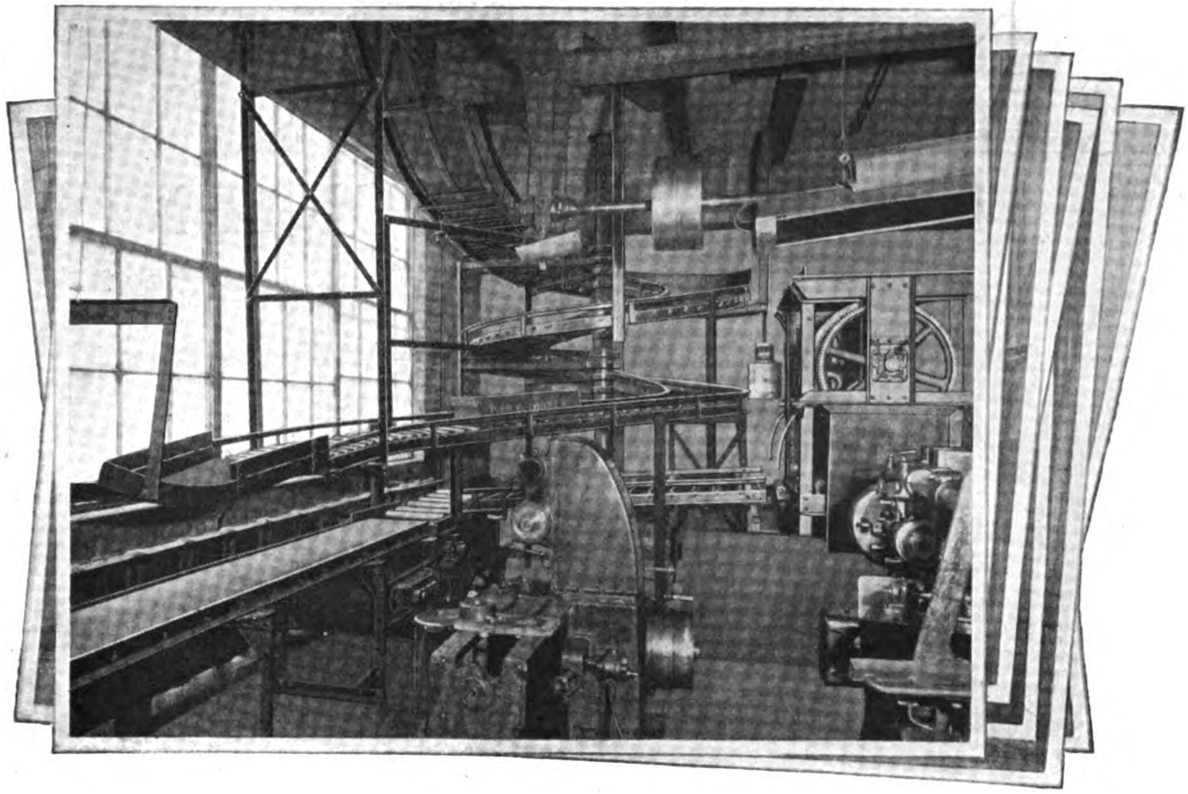

Industry Illustrated
The Pictorial Presentation of Practical Management

CONTENTS

September, 1924

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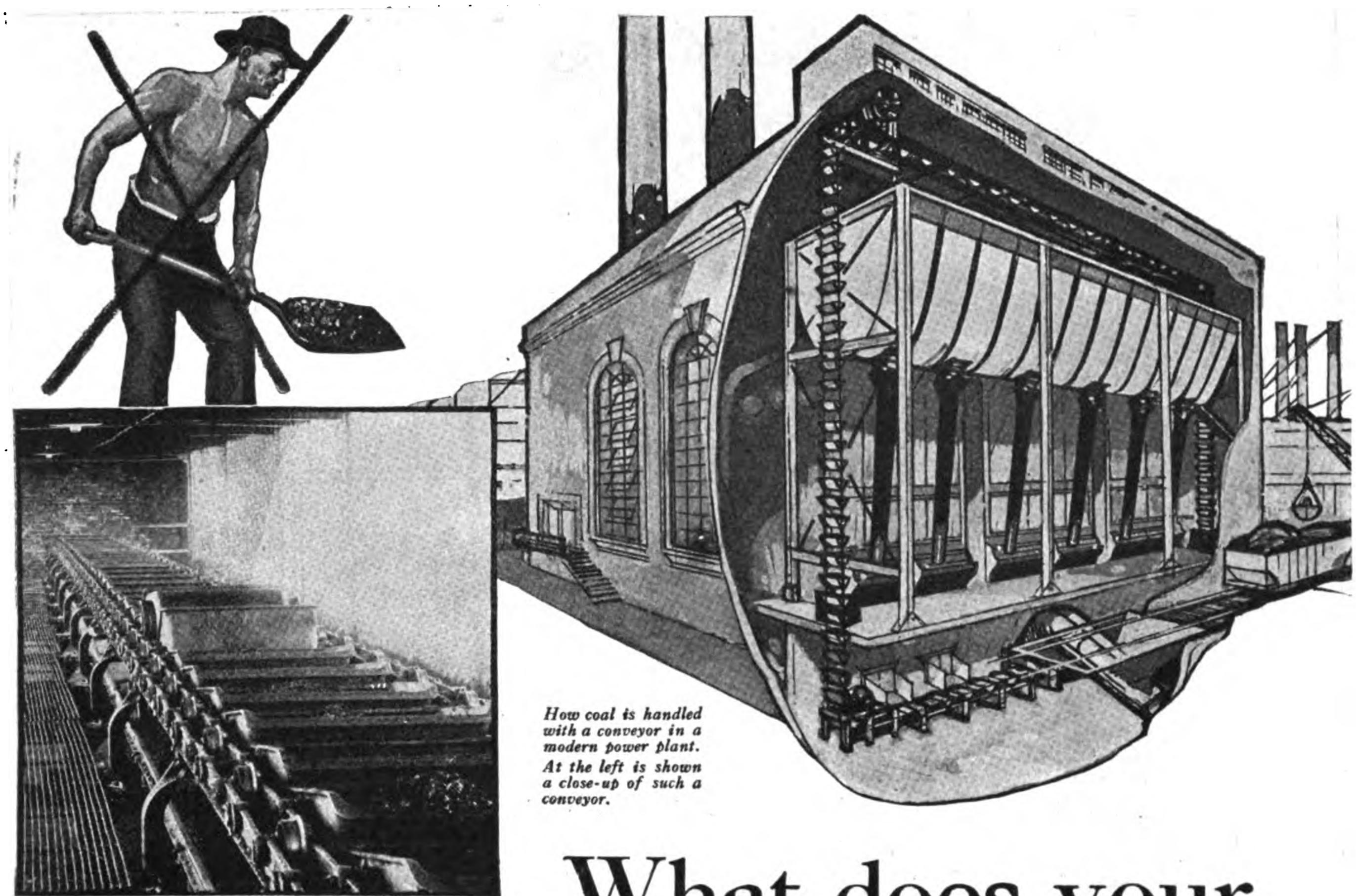
Index to Advertisers see page 104



How coal is handled with a conveyor in a modern power plant. At the left is shown a close-up of such a conveyor.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1—This Barber-Greene Coal Loader saved the Independent Coal Company of Toledo $.68 on every ton of coal loaded. It screens out slack as it loads.

2—Showing the Barber-Greene Coal Feeder discharging to Conveyors. It unloaded a 50-ton car in 55 minutes to inside storage.

3—Close-up of the Barber-Greene Bucket Loader in action. Note how the disc feeder is digging into the coal. This machine replaced a steam shovel at the Pennsylvania Edison Company.

4—The Barber-Greene Coal Loader, designed especially for handling mine run or lump coal. It handles 1½ tons of coal a minute, and can also be used for coke, cinders, dry clay or similar material.

5—A Barber-Greene Conveyor and 2 men unload a carload of coal in 95 minutes at the Diamond Coal & Coke Co. of Detroit.

Storing 150 Tons an Hour with One Conveyor

A single Barber-Greene Conveyor, 24" x 60', handles steam-size anthracite coal for the D. L. & W. Coal Co., Dover, N. J., storing it at the rate of 150 tons an hour.

Taking the coal from the car, the unloading equipment feeds direct to the conveyor. In this manner, 25 battleship cars can be unloaded and stored in a day.

At the Tampa Coal Co., Tampa, Florida, 3 Barber-Greene Conveyors performed a task one morning, which deserves the attention of any one concerned with the handling of coal or other bulk materials.

Before 9:30 they had coaled a ship; before 10:30 they had loaded a car with gravel; and before noon they had unloaded a car of coke.

The layout was an interesting one. A bin was kept filled with gravel by a stiff leg boom and bucket. Beneath the bin, working at right angles and simultaneously, were two conveyors. One took the fines and stored them in a hopper for retail sales, while the other loaded 1-inch gravel to a car for shipment to the interior.

Thus 3 rather difficult and widely differing jobs were completed in 5 hours.

The speed, endurance and versatility of the Barber-Greene Conveyor make it peculiarly valuable for clearing up difficult material-handling problems. Send for Catalog E, which will give you an idea of the savings you can realize on every ton it handles.

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This Test Showed Him He Was Wrong

We placed the recording thermometer bulb in a chilled bath so that the pen registered 52°. Then we immersed the entire 20 feet of connecting tube in the water at 180° Fht. and the pen didn't move from 52°.

He was convinced.

Foxboro Recording Thermometer bulbs are filled, according to the range and service required, with a gas or a highly volatile liquid. Mercury is never used. The volume of vapor or gas in the fine capillary tube is so small compared with that in the bulb that connecting tubes more than 250 ft. long are now in use under conditions of extreme heat or cold with perfect assurance of accuracy.

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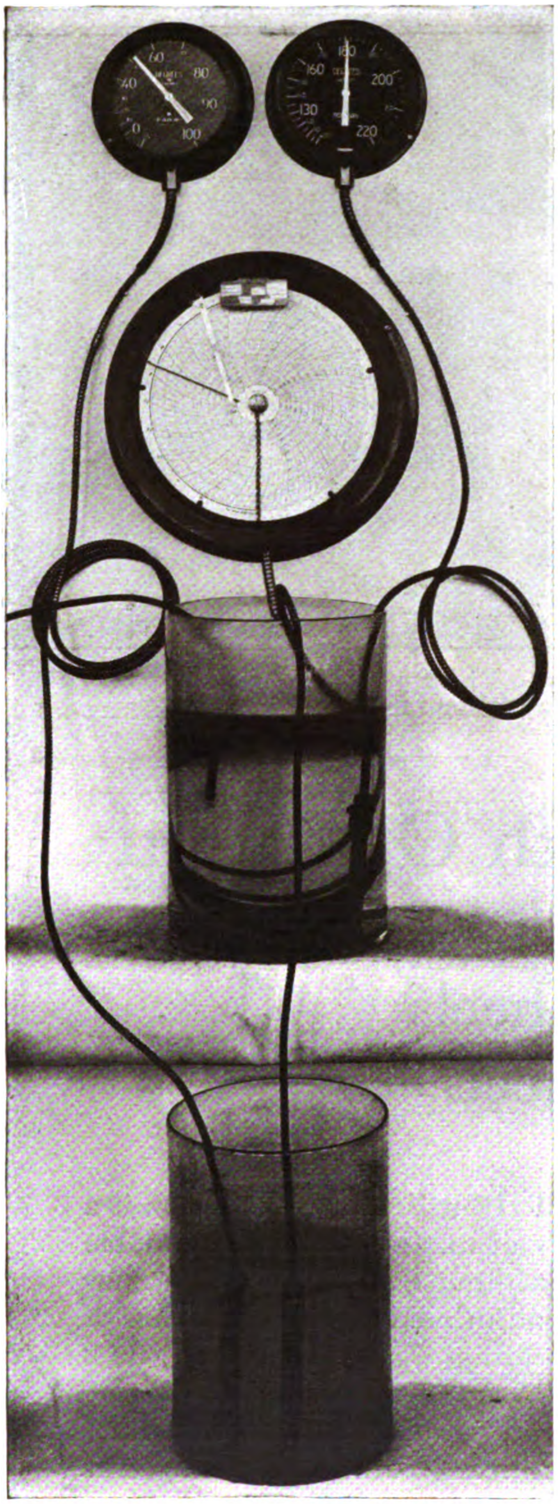

The indicating thermometer—upper left—reads 52° Fht., the temperature of the bath in the lower jar, in which the recording thermometer bulb is immersed.

The indicating thermometer—upper right—reads 180° Fht., the temperature of the water in the upper jar, in which the 20 feet of connecting tube is placed. The steam line which is used to heat the water is shown emerging from the left hand side of the jar.

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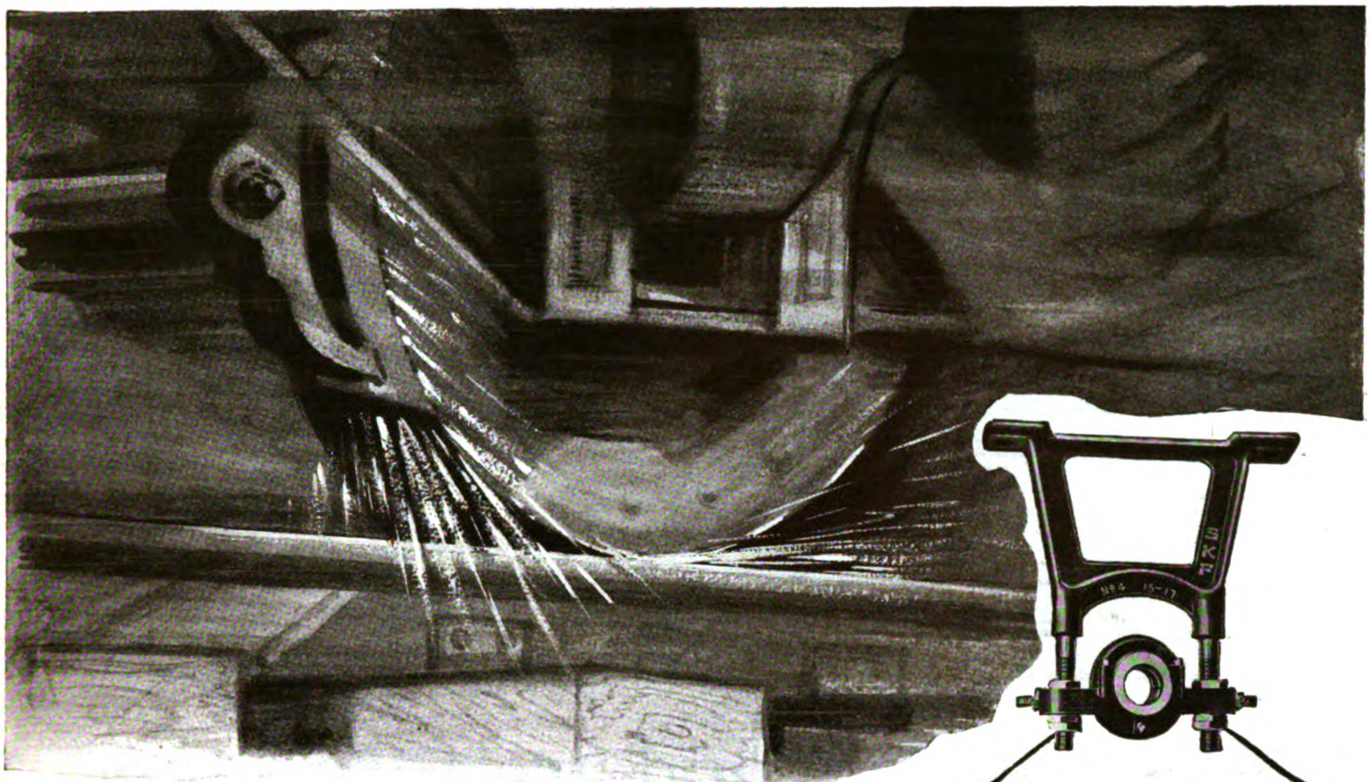

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YOUR train approaches your station. You feel the grinding of the brakes as friction is applied to the wheels. And you alight with never a thought to the fact that it cost the railroad $4.05 to make the stop!

But then there are hundreds of industrial executives too, who give never a thought to what it costs to apply "brakes" to their power transmission systems. All day long, in some plants, plain bearings are "braking" against power, against production, against efficiency. They are applying FRICTION to line shafting just as surely as the brakes of your train apply friction to the wheels. And at a far greater cost, too.

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1st Saving Skayef Hangers save from 50 per cent upward of the energy which plain bearings consume in friction. This means a saving of 15 to 35 per cent of your power cost.

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3rd Saving Lubricant consumption reduced 60 to 80 per cent as compared with plain bearing hangers. Lubricant required only at infrequent intervals and it cannot leak out and ruin belts or product.

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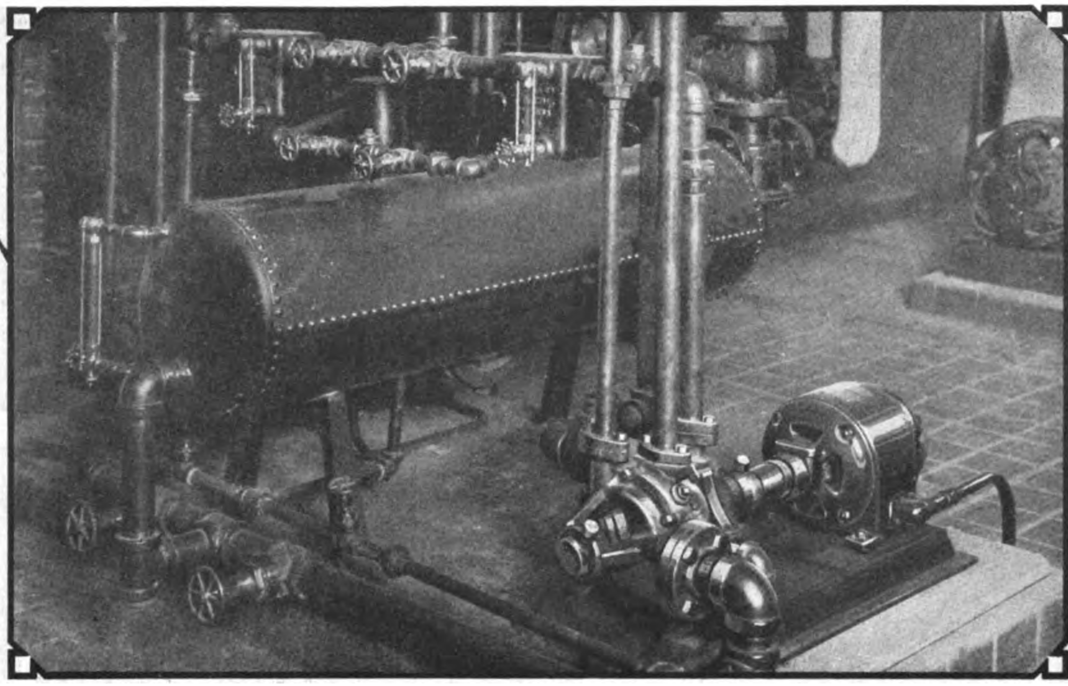

Where the good are forgotten

Sectional view of Jennings Hytor showing unique principle of operation

The rotor, consisting of a cylindrical hub around the periphery of which are chambers or spaces formed by heavy shrouds cast integrally, revolves freely in an elliptical casing or housing filled with water. As the rotor turns, it carries the water around with it. The water, under the influence of centrifugal force, is compelled to follow the contour of the casing, and alternately to enter and leave the rotor chambers, twice in each revolution.

As the water recedes from the rotor, air is drawn into the chambers through the inlet port. As the water is subsequently forced back into the rotor by the converging casing, the air is compressed and then discharged from the rotor through the outlet port.

Mr. W. J. Ward, Chief Engineer of the New York City Plant of Lehn & Fink, Inc., manufacturers of the well-known Pebeco Tooth Paste, says that ever since the Jennings Hytor Vacuum Heating Pump was installed in his plant, several years ago, it has given unfailing service. Not a bit of trouble in all that time. In fact, he is hardly aware that the pump is in the plant at all,—so well does it function, year in and year out.

This is typical of the efficient performance for which Jennings Pumps are well known.

Jennings Vacuum Heating Pumps, as well as all other Jennings Pumps, are simple in design, compact in construction, safe and dependable in operation. In materials and workmanship they are in keeping with the best modern developments.

Air and vapor, representing about four-fifths of the fluid volume ordinarily handled in return line heating work, are continuously exhausted to the atmosphere without back pressure. The steam condensation is removed independently by a separate unit, the water pump, and discharged into the boiler or hot-well. Only the water is discharged against boiler pressure,—hence at least 50% of the pump motor power is saved. Both the water pump and the air pump are combined in one casing, thereby saving about 60% in space occupied.

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Industry Illustrated
The Pictorial Presentation of Practical Management
JOHN H. VAN DEVENTER, EDITOR
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ADOLF SCHILDKRAUT, Art Director

Editorial

Wealth and Human Labor

FROM time immemorial the demagogue has appealed to the discontented element of society by citing half-truths and by predicting calamity. Especially during the stress of a great political campaign the voter is bombarded with a bewildering mixture of facts, theories, panaceas and predictions: predictions on the one hand, that a change in the existing order spells chaos; on the other hand, that only a complete change can avert ruin. Yet, strangely, the country survives. Not only does it survive; it progresses—steadily, irresistibly onward and upward.

A recent investigation conducted by the National Industrial Conference Board discloses some interesting facts. Going back to the year 1850, and reviewing the seventy years from that time to our last national census, we find that the population of the United States increased 3.6 times. During the same seventy-year period, the physical production of mining increased over 77 times; of manufacture, 28 times; of agricultural crops, 5.2 times. Note that these increases are in terms of physical production, and not in terms of money values; in other words, they are free from any artificial factor.

The amount of gold in our treasury and in bank vaults, the dollar value of our domestic trade—these are, in a way, but secondary indications. Because in the final analysis our standard of living depends upon the fruits of our collective labor, and we prosper according to the productiveness of our labor. Anything which multiplies the effective result of man's labor, therefore, is a three-fold contribution to our wealth: directly increasing production, lightening the aggregate labor burden, and raising the general standard of living.

Let us look at the above quoted figures in another way. The population of 1920, to maintain its food standard at the 1850 level, required 3.6 times the 1850 agricultural production; but it had instead almost half again as much. The population of 1920, to maintain its standard of living at the 1850 level, required 3.6 times the manufacturing production of 1850; whereas it had in fact *more than seven times* 3.6. And, if we ask how these things were possible—we have but to look at the first figure cited above—the increase of 77 times the physical production of mining.

Iron and coal; not gold, which of itself is valueless; not silver or platinum or jewels. Iron, to make the machines which multiply man's productiveness; coal, to supply the power which emancipates him from drudgery. Within our borders we produce 52 per cent. of the world's pig iron and one-half of the world's production of coal. These two basic raw materials, plus the brains which put them to intelligent use, are the basis of our national wealth. These—and not any political panaceas—are the guarantee of continued well-being and advancement for this and future generations.

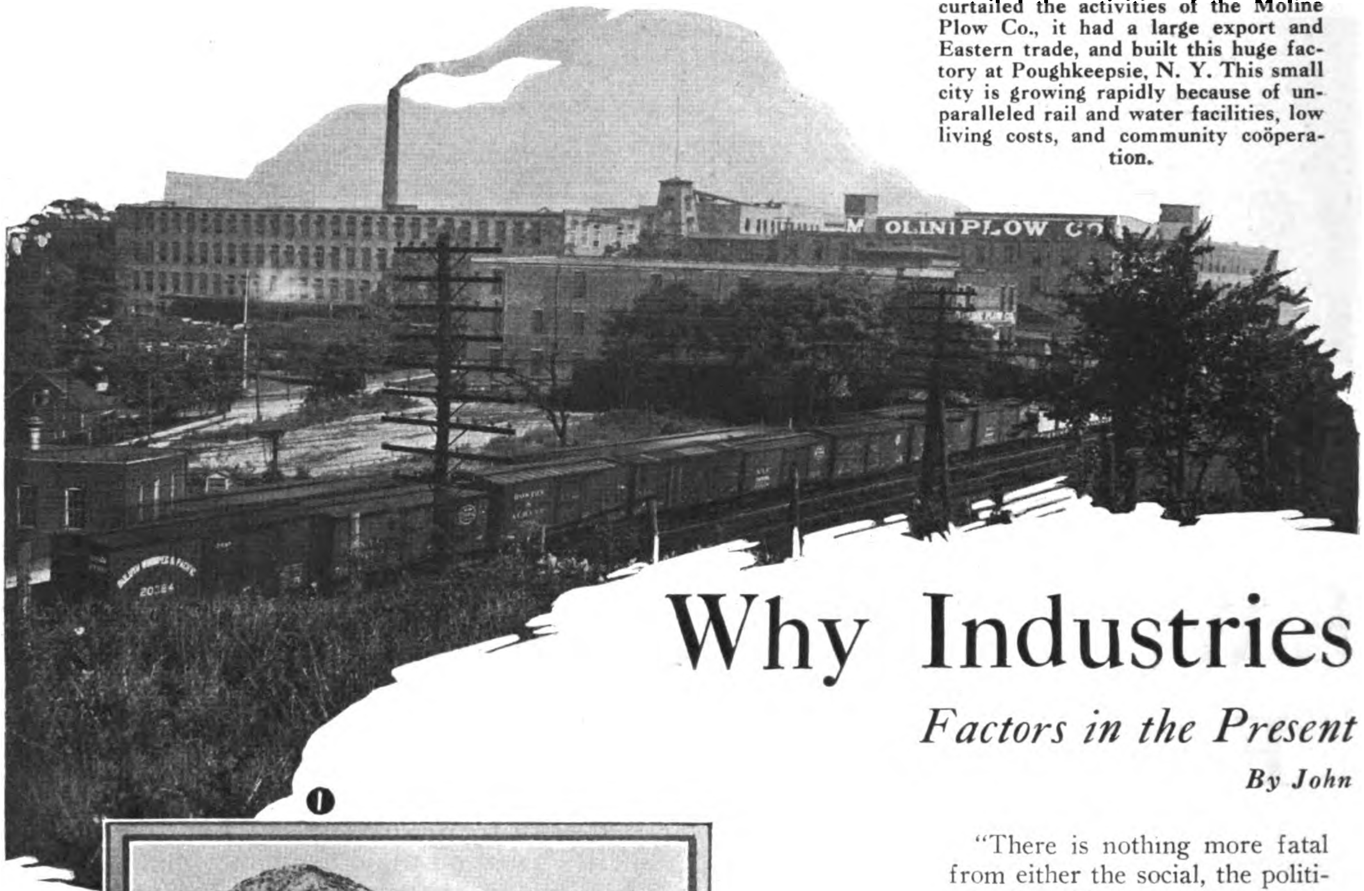


Fig. 1. Before the recent depression curtailed the activities of the Moline Plow Co., it had a large export and Eastern trade, and built this huge factory at Poughkeepsie, N. Y. This small city is growing rapidly because of unparalleled rail and water facilities, low living costs, and community coöperation.

Why Industries

Factors in the Present

By John

"There is nothing more fatal from either the social, the political, the ethical, or the governmental standpoint, than to get more people into one place than ought to be there."

(*Delos F. Wilcox, in "Great Cities in America"*)

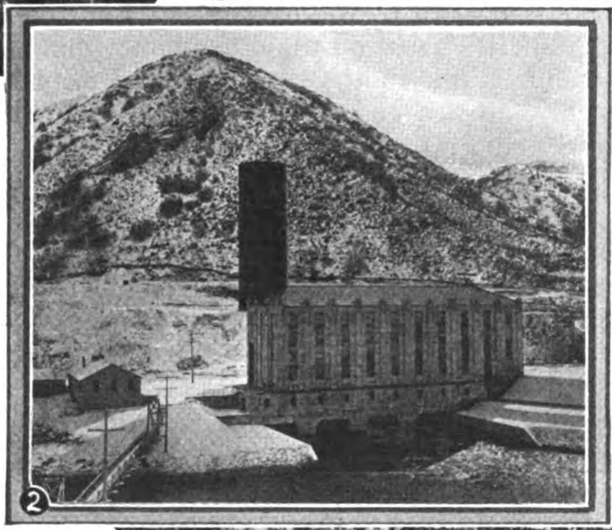


Fig. 2. The Coal Age herded industry in large centers where fuel supplies were concentrated. Now the Electrical Age guarantees power throughout the countryside, whether by waterpower, as shown here, or from coal burnt at central powerhouses.

Fig. 3. A great carpet concern in Philadelphia, the carpet city, erected this plant in a small town, where healthy surroundings and lower living costs have given them **more stable and efficient labor.**

THE eighteenth century saw the political revolution, in which the age old feudal system was overthrown; the nineteenth century saw the industrial revolution, when individual handcraft industries gave way to large-scale power machine production; and the twentieth century bids fair to witness another change, in which ruthless and concentrated accumulation of wealth will be displaced by a fair industrial civilization based on the needs and aspirations of the people.

The coal age, immature transportation, and specialization gave us our great industrial cities. The electrical age, universal transportation and communication, and diversification, is building up the smaller places. Furthermore, the big cities are actually losing industries to the suburbs and smaller cities.

Fig. 4. Lehn and Fink of New York moved across the Hudson into New Jersey near Newark to get more room and other facilities.

Fig. 5. The Bloomfield plant of the American La France Co. This suburban town in New Jersey is attracting many industries from New York and Newark.

Fig. 6. An unprecedented rush of industries from nearby Manhattan and Brooklyn in the City of New York to Long Island City is caused by its combination of nearness to city population and its open spaces and rail and water facilities. This is the White Truck plant.

Leave the Big Cities

Industrial Evolution

A. Piquet

The race for wealth built up our leading industrial centers and the race for wealth is destroying them. Labor unrest is one of the chief causes driving plants out. That unrest is due to many causes. The historic contrast in every metropolis between wealth and poverty, or between large incomes and small ones, is the greatest, in the opinion of the writer. Differences in material station are everfruitful causes of unsatisfied ambition, radical agitation, and political turmoil.

The high cost of living in our big cities has added to labor discontent. Specialization means an intricate machine of middlemen to supply the worker with food, housing and amusement. Past a certain population point, the cost per unit of such a machine seems to go up and up. Transportation and traffic problems become enormously difficult.

Specialization in production has also built our one-industry towns, such as Lowell, Paterson, and Akron. The multiplicity of similar employers and skilled workmen has resulted in highly organized groups on both sides. Confidence in their own strength has handicapped coöperation and increased contest. This type of industrial center shares the labor troubles of the big cities and is also losing industries to other places.

The automobile is responsible for

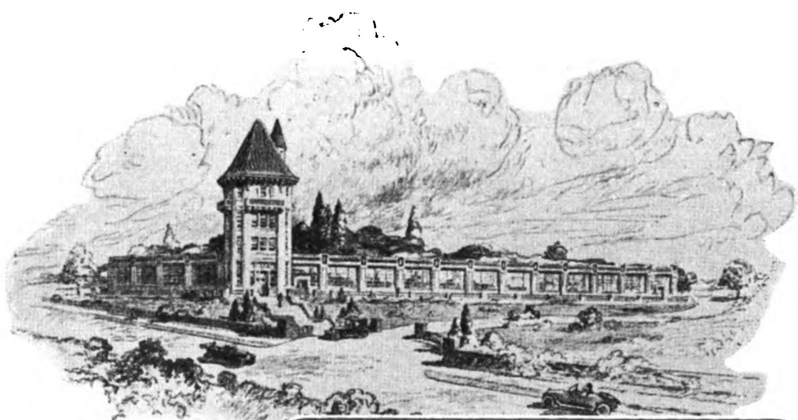


Fig. 7. Conde Nast, publisher of "Vanity Fair," moves from New York to Greenwich, Conn., where he erects this exquisite plant, and where in time he will develop a better labor force than in the metropolis.

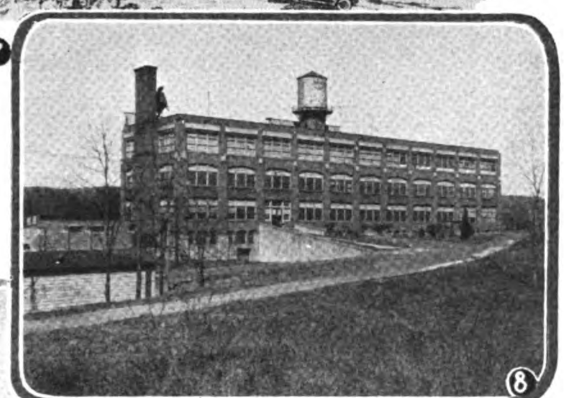


Fig. 8. Henry Ford located this parts plant at Poughkeepsie, N. Y., a country metropolis with many industrial advantages.

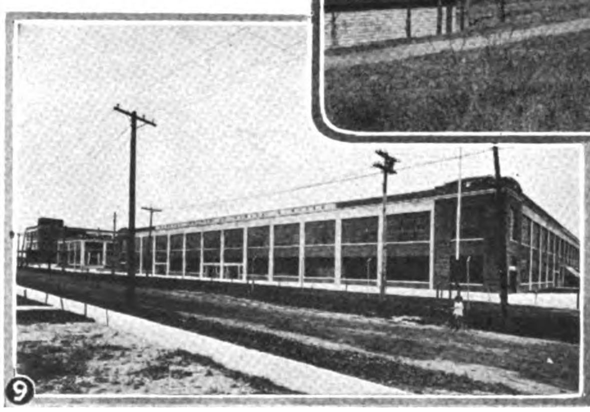


Fig. 9. General Motors has established a Canadian branch at Oshawa.

two more causes of labor discontent in large cities. The streets, immemorial playground of city children, are menaced by a turbid traffic of trucks and cars which add daily to the death toll of the young. Again, the availability of the low-priced car to larger numbers of workers increases their desire to labor where they can use one without traffic delay or hindrances. There is not room here to show how in many other ways the automobile is decentralizing the nation industrially and residentially, and advertising to the city man the benefits of the "great open spaces." It is one more example of how better transportation spreads human activity over a larger number of localities.

Bad working conditions is still another cause of labor discontent and turnover. Spacious daylight factories, such as are shown in illustrations accompanying this article, are not possible where mounting land values and already occupied spaces bar the way, and force industries adopting better manufacturing methods or increasing their capacity outside the city.

Railroad facilities are also inadequate in many parts of a great and growing city, and this important cause is responsible for the movement of our heavy industries, such as metals, to the suburbs.

Fig. 10. A typical industrial village, where labor finds adequate and low-priced housing, fresh air, and attractive recreational surroundings.

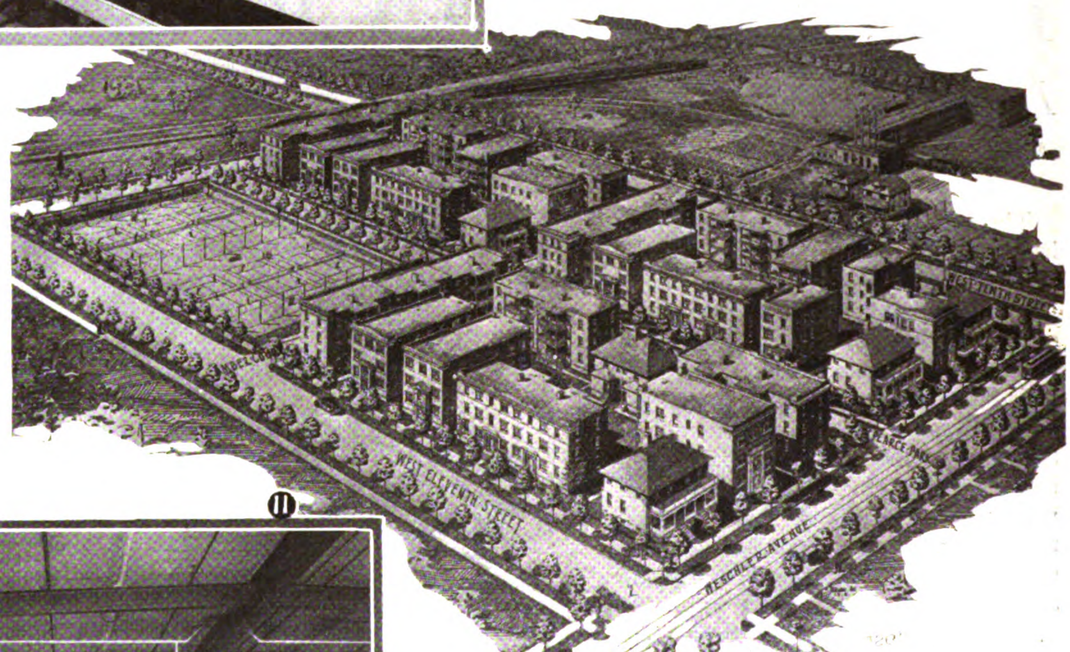
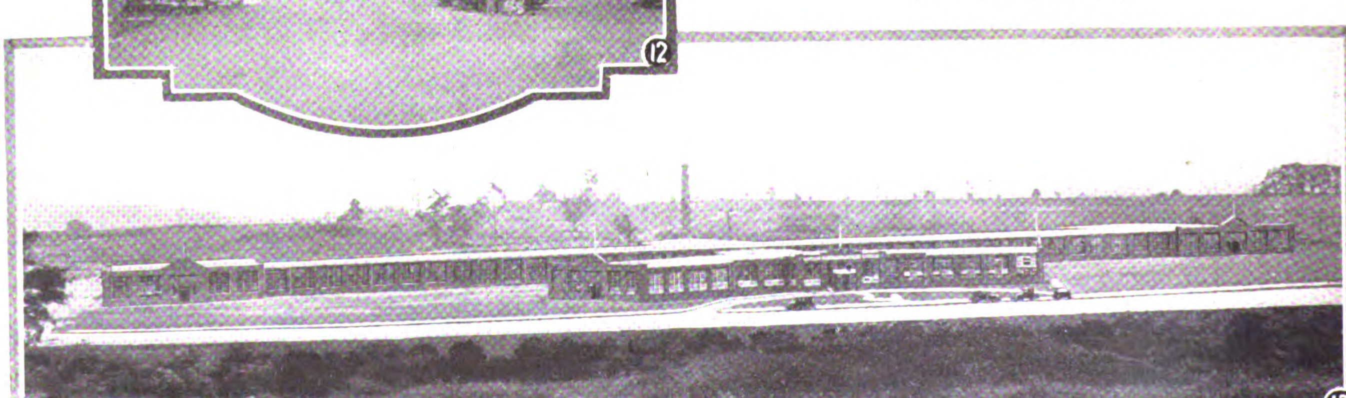
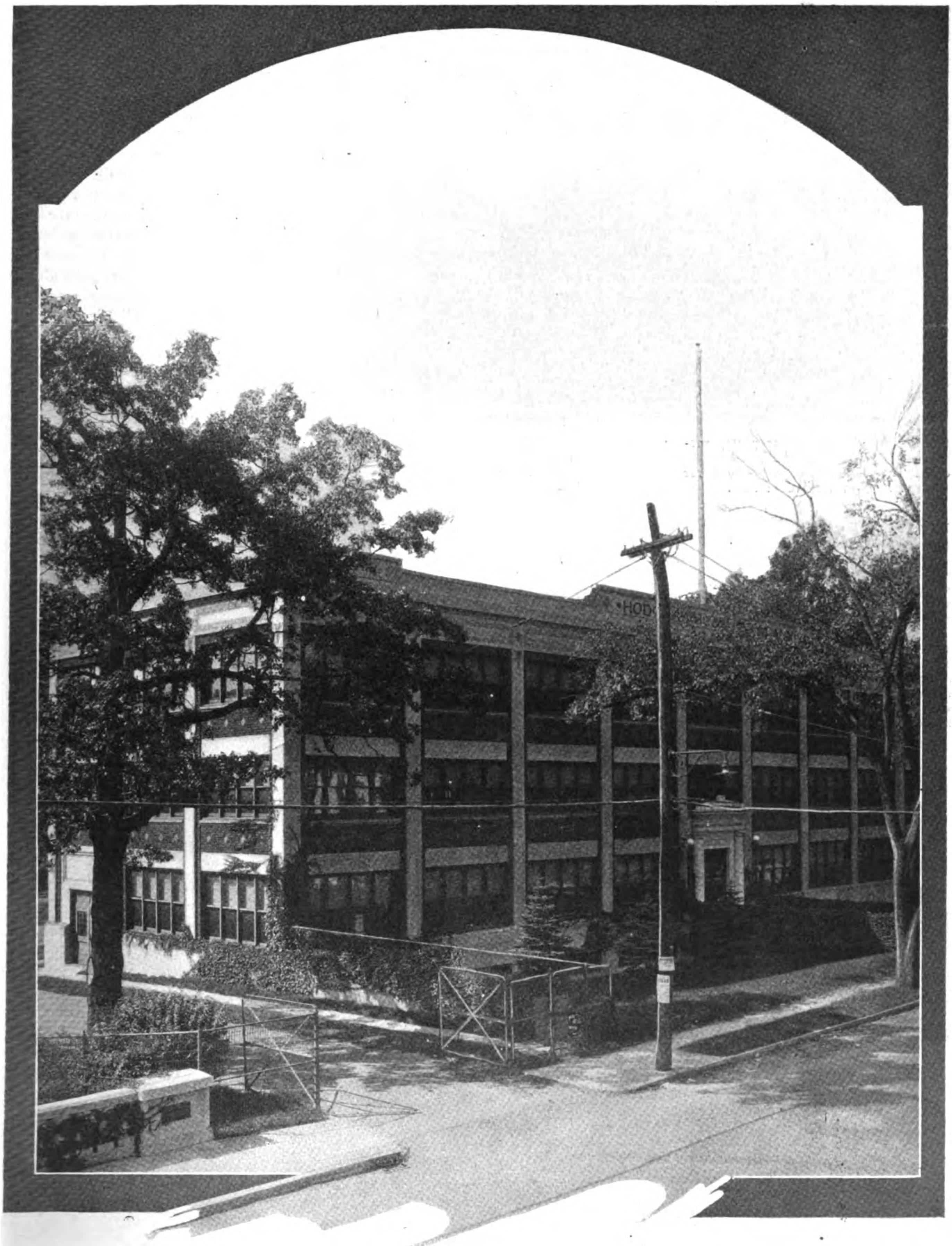


Fig. 11. Slum housing in congested industrial centers means unstable labor. Here in Erie, Pa., the American Brake Shoe and Foundry Co. had plenty of room to erect this model housing development, heated by a central plant, and with recreational facilities.



Figs. 12 and 13. A plenitude of space and light, both exceedingly rare in large cities, made possible the erection of this beautiful, one-story factory in Bethlehem, Pa., by a manufacturer who located there from New York City.



Fine products require fine places. Burroughs-Wellcome & Co., Inc., of New York, high-grade manufacturing chemists, moved to Tuckahoe, New York, from the big city because of the clean open surroundings and absence of dirt and smoke. This beautiful plant and town is an excellent example of the advantages of the country to fine manufactures.

Fig. 14. Workers in these pretty residences in Erie, Pa., are more interested in industry than big city labor living in flats or slums.

Lathrop Stoddard in his book, "The Revolt Against Civilization," asks whether our material civilization has become so huge and complex that the average man cannot work smoothly in it. Have New York, Chicago, Boston and other large cities become too big?

The answer is difficult, but the movement of industry points the way out. Our population giants are developing rings of industrial suburbs around themselves, five, ten, and up to thirty miles out, while from about that distance on smaller places are no longer "modest violets," but are rapidly developing industrially and attracting plants from the cities.

Poughkeepsie, N. Y., is an excellent example of the latter. Situated seventy miles up the Hudson from New York, it remained for a long time a quiet town of small manufactures despite almost all the advantages of an ideal industrial location. Deep water shipment on the Hudson, the junction point of main line railroads from New York to Chicago and from New Eng-

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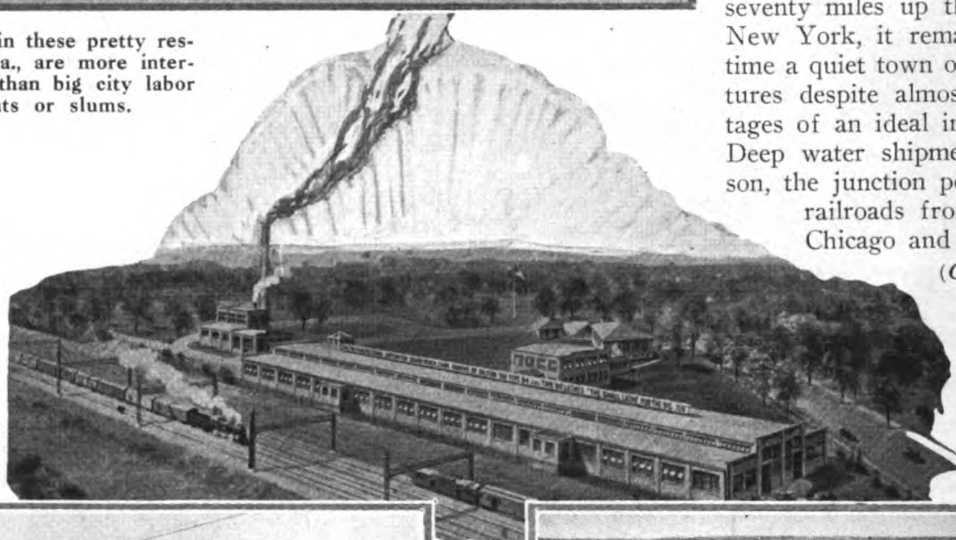

Fig. 15. Stamford, Conn., outdoes New York: rail facilities, and adjacent labor with low living costs.

Fig. 16. The high labor turnover among single men and women labor was cut by the erection of these dormitories in Erie, Pa., by the American Brake Shoe and Foundry Co., in the housing group shown.

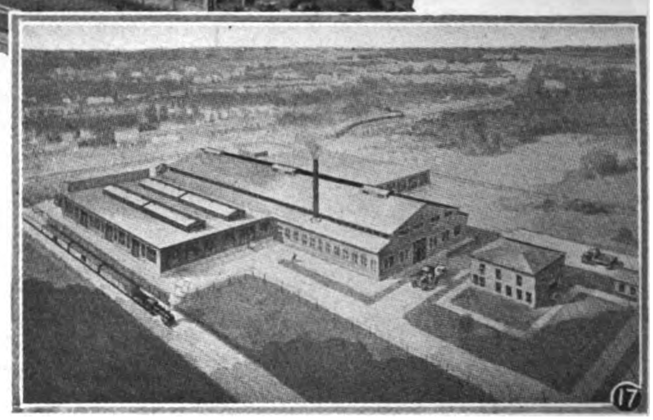

Fig. 17. Batavia beats Brooklyn. The little New York state town got this big branch of the Doehler Die Castings Co. of Brooklyn, because of cheaper fuel, gas, and better labor conditions.

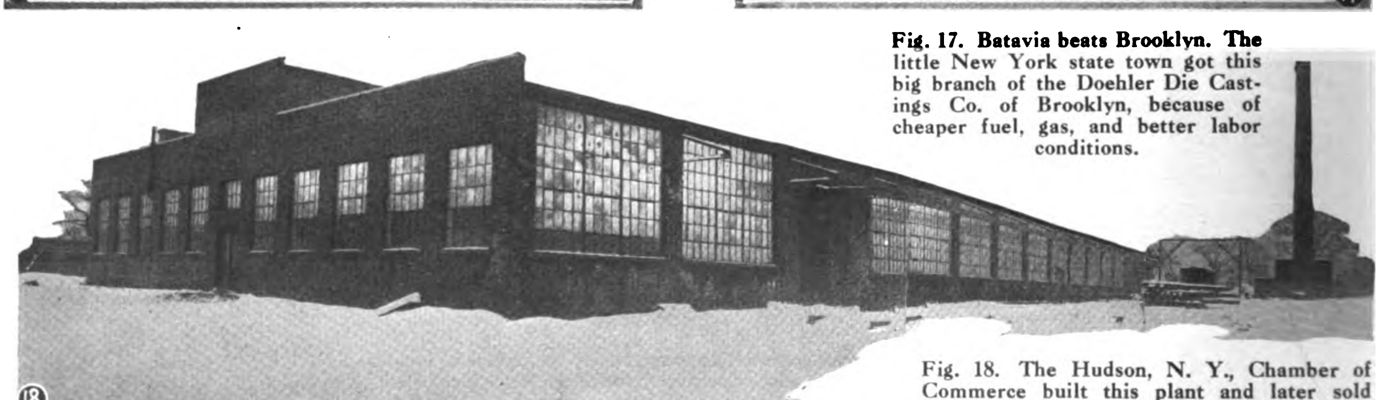

Fig. 18. The Hudson, N. Y., Chamber of Commerce built this plant and later sold it to the Canadian Dry Gingerale Co., **which was establishing an American branch.**

Steel, Our Greatest Servant

What Are We Doing to Lengthen Its Life?

By Roy C. Sheeler

IT has been said that civilization is built upon the use of iron and steel. And it is a fact that those nations or peoples who have shown greatest development along industrial lines are those who have had the greatest natural supplies of the precious ores from which the finished metal products are made. No matter how brilliant along mechanical lines a people may be, nor how much genius they display in manufacturing, unless they have a plentiful supply of such raw materials, they are severely handicapped in making progress and are entirely at the mercy of other nations who are more generously blessed by nature.

Fig. 1. A great forward step lies in the use of identifying colors for pipe lines; but the more important factor of protection against rust should not be neglected.

Messrs. Cushman and Gardner, in their publication, "Corrosion of Iron and Steel," have this to say:

"How much of the enormous and constantly increasing world's production of iron and steel is wasted for lack of adequate protection? Where will the growth of demand stop, and how many years will the world's ore supply stand the drain upon it? These are questions of vast importance, the answers to which can only be vaguely guessed. One thing seems certain, namely, that civilization must learn to conserve more efficiently its store of iron and steel already manufactured, and seek methods to prevent the almost resistless tendency of iron to return to its lethargic union with oxygen."

And it is with the idea of giving some practical

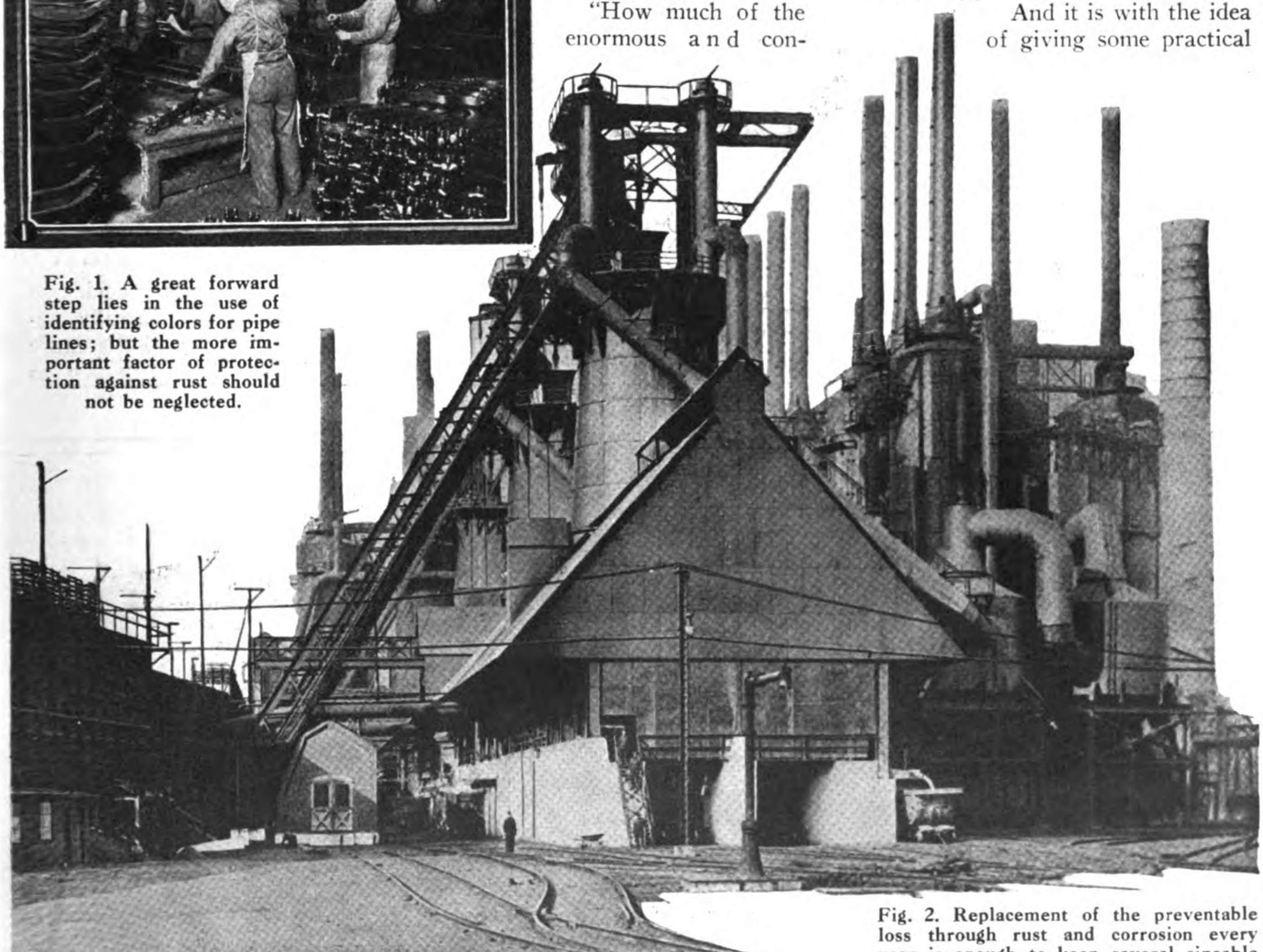

Fig. 2. Replacement of the preventable loss through rust and corrosion every year is enough to keep several sizeable steel plants busy—this loss alone running into several hundred million dollars annually.

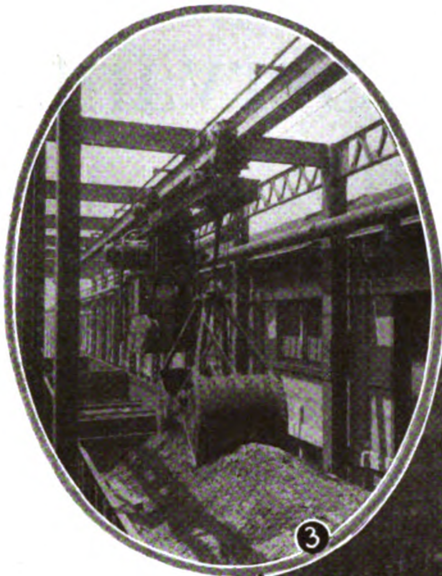

Fig. 3. Coal and ashes have an unhappy habit of producing acids, when wet; introducing additional problems in protecting steel work such as that shown above.

information regarding the methods of preserving iron and steel surfaces in industrial plants that this article is written.

Various estimates have been made of the loss sustained by America alone each year through, for the most part, the preventable causes of decay. It is reasonable to believe that this loss reaches the staggering sum of $600,000,000.00,—a figure given by good authority. The tragic part of this matter is that *most of this loss could have been prevented* by precautionary measures taken in time. This unnoticed and unseen loss falls on every individual, and has to be reckoned with in the cost of living .

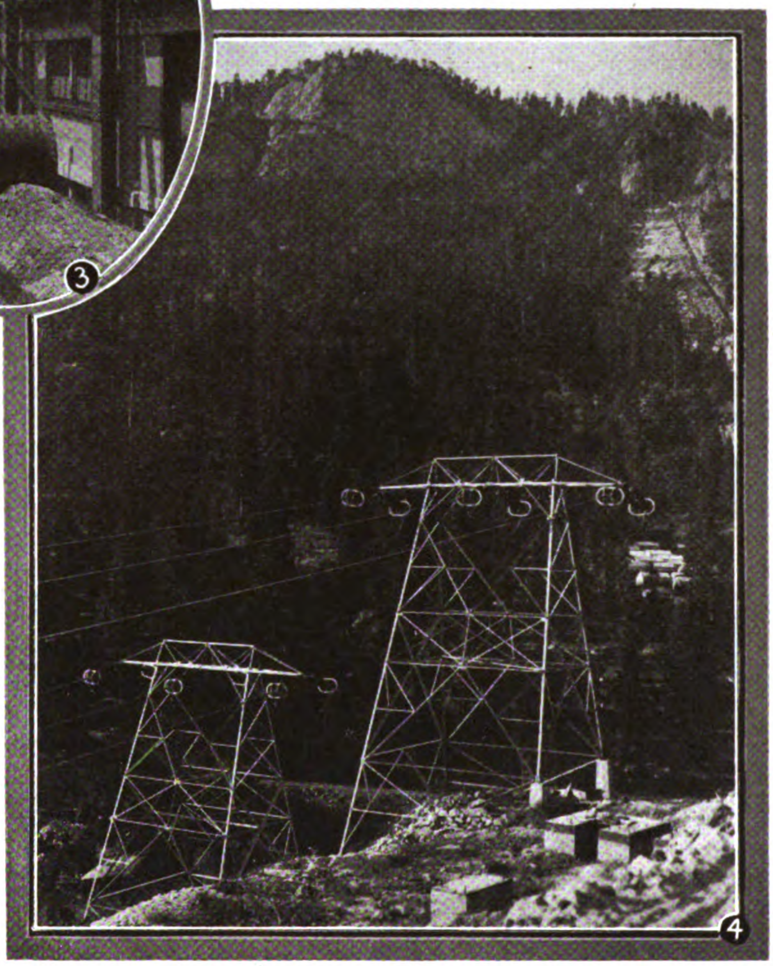

Fig. 4. The towers which carry high voltage wires must not only be protected against atmospheric corrosion, but they also have to contend with electrolysis.

In order to prevent rust and corrosion, it is first necessary to understand the basic principles which cause it. Many theories have been advanced. The familiar rusting of metal surfaces is the first evidence of the beginning of corrosion. Mr. Frederick H. Fay, in his "Protection of Metal Surfaces," has this to say:

"Iron will not corrode in air unless water is present and it will not corrode in water unless air is present. The agents present in the air which accelerate corrosion, especially in air near cities where much fuel is consumed, are numerous: but sulphur dioxide and soot are probably the most destructive, because together in the presence of moisture, they conspire to produce sulphuric acid."

The most generally accepted theory of the cause of corrosion is known as

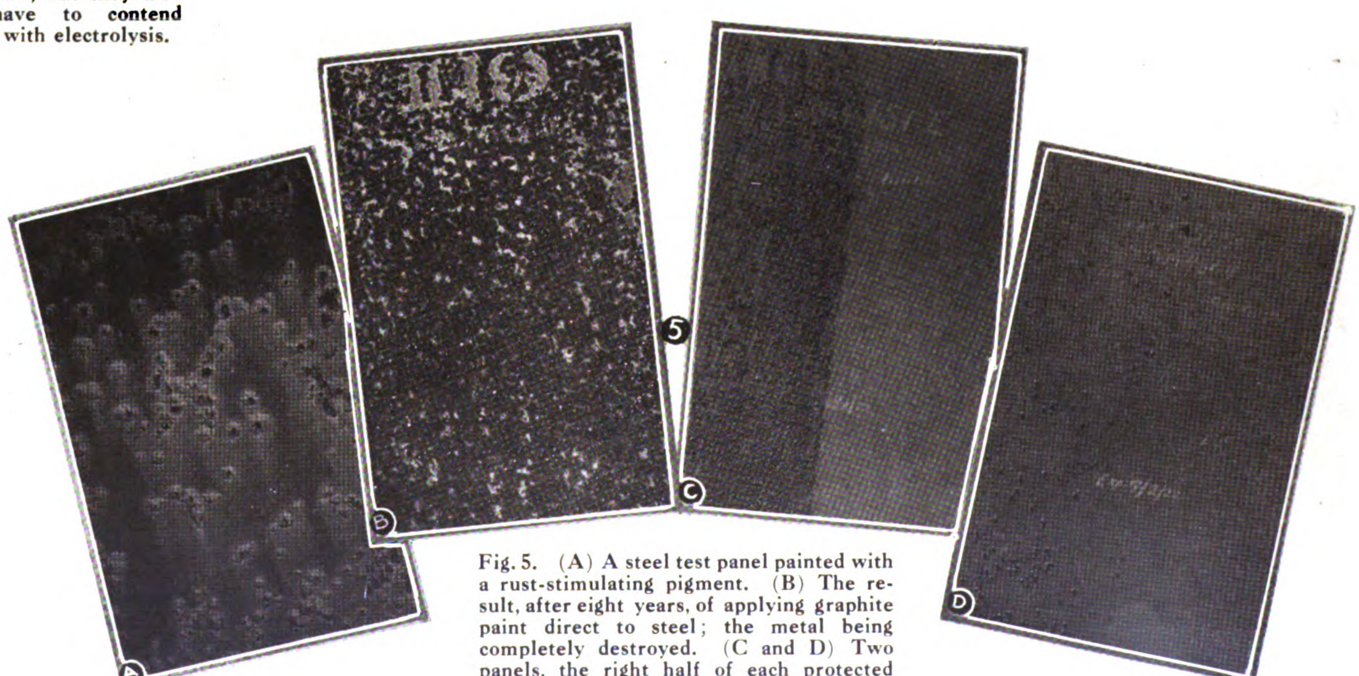

Fig. 5. (A) A steel test panel painted with a rust-stimulating pigment. (B) The result, after eight years, of applying graphite paint direct to steel; the metal being completely destroyed. (C and D) Two panels, the right half of each protected by a rust-protective coat.

the "Electrolytic Theory." Dr. H. A. Gardner, of the Institute of Paint and Varnish Research, Washington, D. C., in his publication,—"Paint Technology and Tests," states:

"'Auto-electrolysis' is the term used to define the peculiar tendency of iron to be transformed from a metal possessing a hard, lustrous surface, high tensile strength and other useful properties, to a crumbling oxide that falls to the ground.

"When iron is brought into contact with moisture, currents of electricity flow over the surface of the iron between points that are relatively pure and points that contain impurities. These currents stimulate the natural tendency of the iron to go into solution, and the solution proceeds with vigor at the positive points. The air which the water concontains oxidizes the iron which has gone into solution, and precipitates the familiar brown iron rust. Thus water, which acts as an acid, and air, which acts as an oxidizer, have combined together to accomplish the downfall of the metal."

The experience of electric lighting companies, of railroad companies who have electrified their lines, would seem to bear out the electrolytic theory. They have found that many of their supporting steel structures, even though apparently well painted, show advanced corrosion underneath the paint coat. This is undoubtedly due to the presence of escaping electric currents from high potential or feed lines, which, particularly in the presence of moisture, set up the reactions causing accelerated corrosion. Many industries, due to manufacturing processes, have particularly severe problems of metal destruction to meet. In some instances it seems to be impossible to follow any method to offset this state of affairs, causing frequent replacement of expensive parts. But, at the same time, in the largest majority of industrial plants, metal surfaces of both plant and equipment are woefully neglected, causing an enormous amount of unnecessary replacement, and consequent

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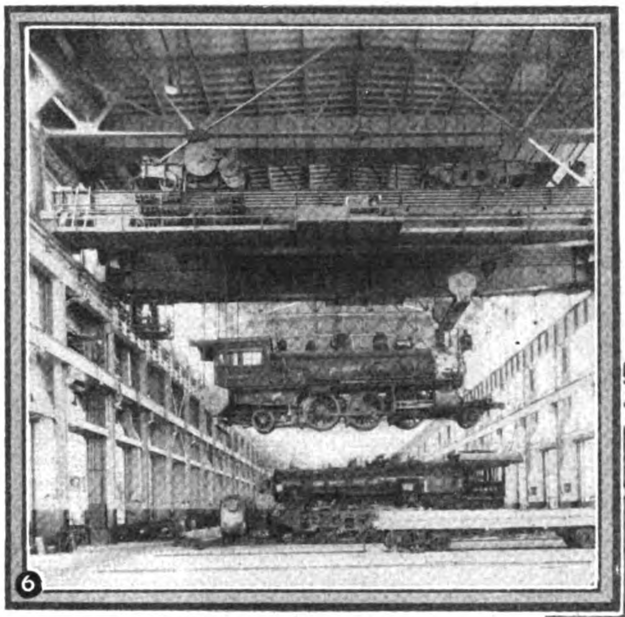


Fig. 6. This has been truly called the age of steel; but, much as we have learned about making and using steel, we are only beginning to learn how to keep it from returning to a crumbling oxide.

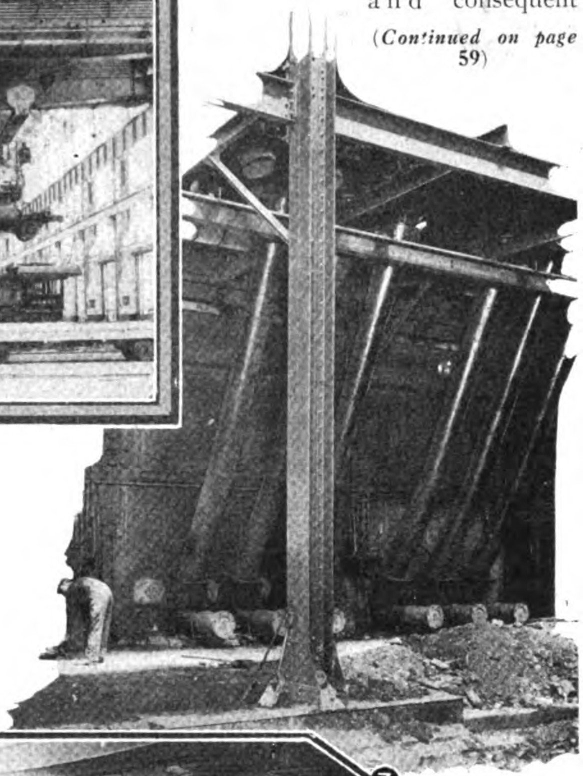


Fig. 7. The boiler room, with its temperature changes, moisture, and fumes, calls for special paint formulas evolved to meet these conditions.

Fig. 8. In a foundry, craneways and steelwork, as well as auxiliary apparatus, disintegrate all too quickly if they are not properly protected.

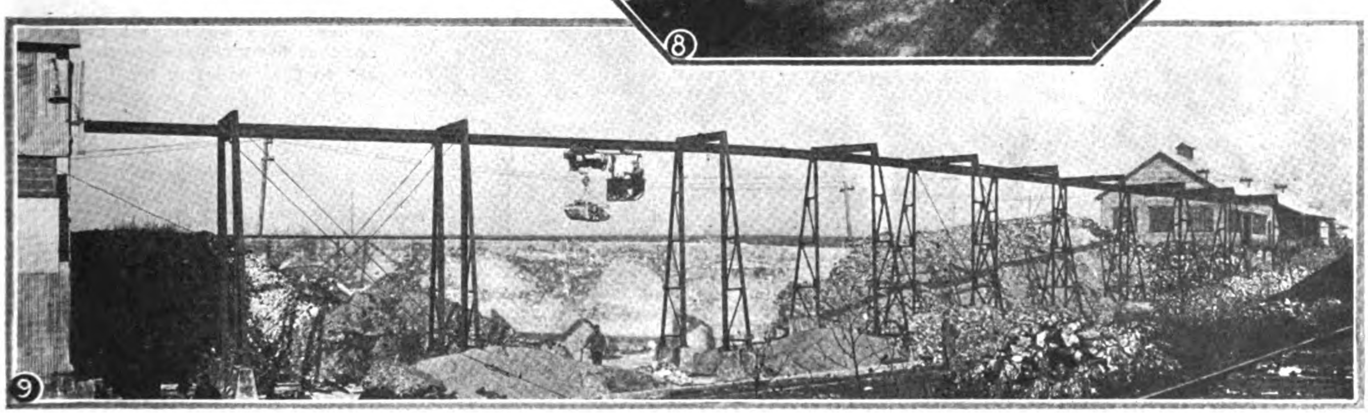
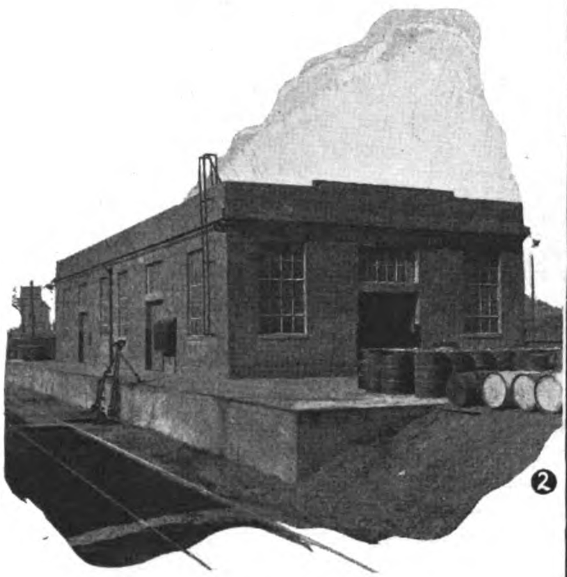


Fig. 9. Given the right kind of paint, properly applied, structural steel work has little to fear from weather exposure.



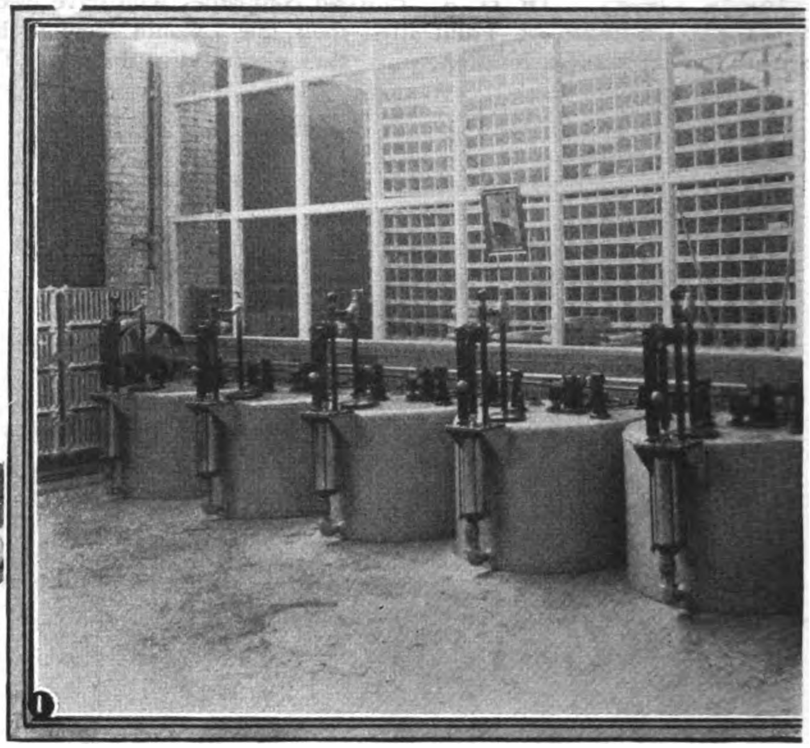


Fig. 2. Exterior view of an up-to-date oil house built in the most approved manner, fireproof throughout, with steel frame windows, and full opening doors. The unloading platform, on an approximate level with the floors of railway freight cars, allows barrels to be rolled directly into the house with little or no lifting.

Fig. 1. It is advantageous wherever possible to partition off the oil room from the rest of the storehouse or other part of the building in which it is located. Generally a heavy wire netting will be satisfactory, although a solid partition is, of course, conducive to greater cleanliness.

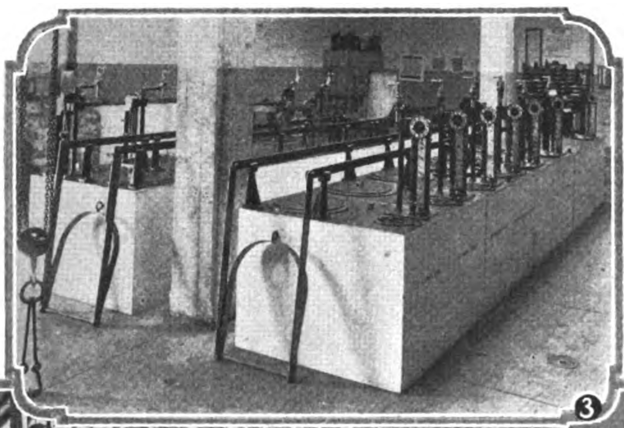


Fig. 3. Interior of a modern oil room, showing the tops of the permanent storage tanks with their respective measuring pumps, drains, and barrel track. The hoist at the left renders the handling of barrels and drums a simple matter and involves a minimum of labor.

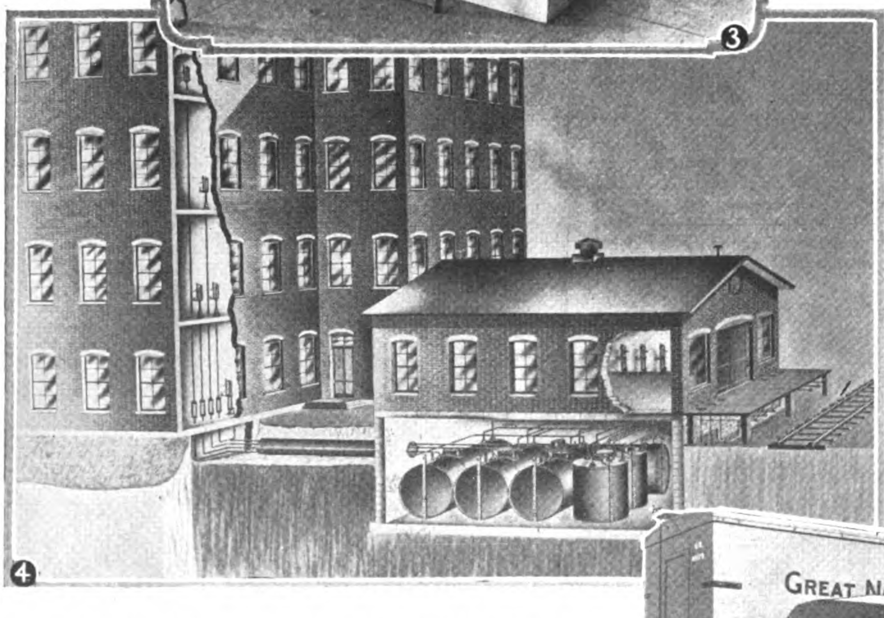


Fig. 4. Cut-away view of an oil house and adjacent plant building, showing the manner of oil distribution to the various floors of the latter, and the necessary pumps involved. For a large plant or one using quite a volume of oil this is an admirable layout and conducive to the requirement of a minimum of labor and waste. We can also see that the main storage tanks are set on their sides in the basement of the oil house in accordance with approved practice in this respect.

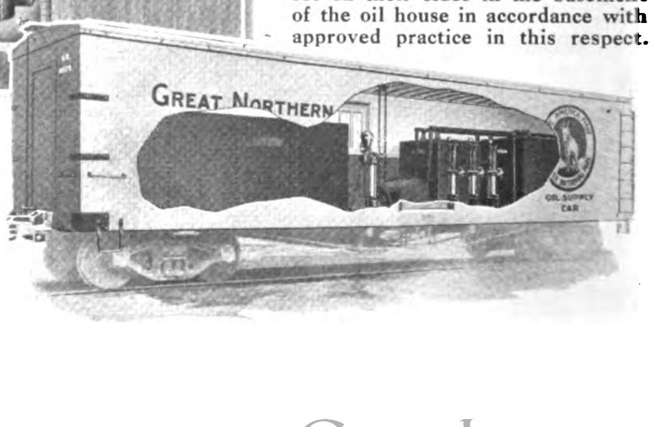
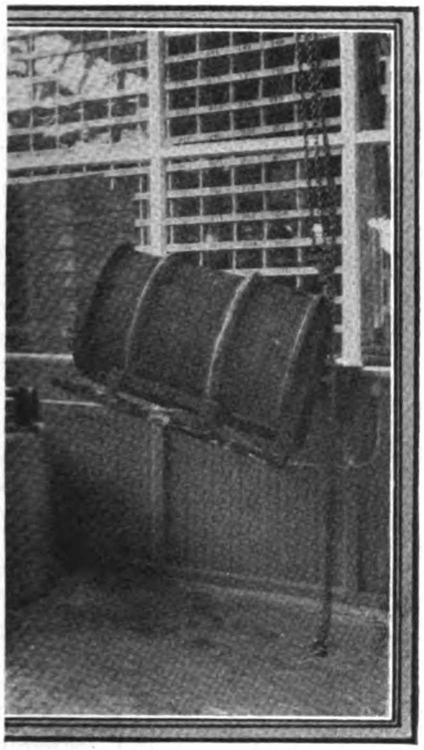


Fig. 5. The railroads have also found it beneficial to observe the utmost care in the storage and handling of their various grades of lubricants. Usually a central oil house is involved, but an oil supply car is often employed as well, to enable rapid distribution of the products. The manner in which such a car is laid out can be readily noted as above.



Clean Oil—The Secret of Effective Lubrication

By Allen F. Brewer

NOT so many years ago a trip through the average engine room, or, in fact, any plant where machinery was in operation, required a good deal of "watch your step" exhortation. You were just as apt as not to ruin a perfectly good suit of clothes, or skid gracefully into a corner, for oftentimes there was more oil on the floor than anywhere else. Not only that, but it dripped and splashed merrily from almost every bearing. In effect, the operators worked under the time honored impression that "oil was cheaper than machinery," therefore, they oiled in a wholesale manner. In these days the matter of storage of lubricants was naturally given a negligible amount of consideration. Barrels of oil or cans of grease were dumped promiscuously wherever there was available space. During their period of storage they were often treated to a hosing, or perhaps the sweepings of the entire room were brushed surreptitiously behind them when the Chief wasn't looking. For oil was only a necessary evil, after all. Why treat it with "kid gloves"?

And so things went on,—in fact they are still going on thusly in many plants where the officials have not awakened to the fact that many of their breakdowns are directly due to faulty lubrication, or contamination of their lubricants. In all probability conditions of this nature will never be entirely eliminated, for production in certain plants will never become the predominating factor of operation. As it does increase in proportion, however, we can rest assured that methods of lubrication and the storage of lubricants will undergo marked changes. In other words, production, whatever the plant or commodity produced, hinges directly upon keeping the machinery in operation. A unit out of line means just that much less pro-

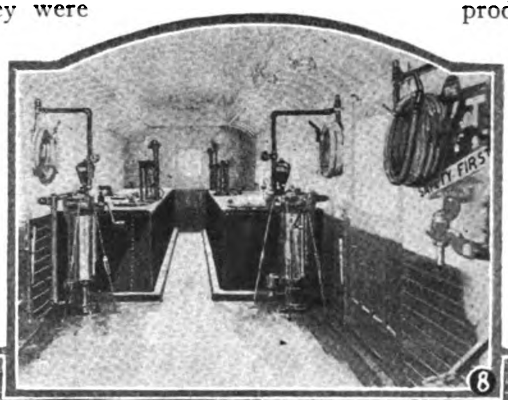


Fig. 8. Another view of the interior of a railroad oil supply car. While the equipment is extensive there is still ample space for the employees in charge to move around without being cramped.

Figs. 6 and 7. Two types of cabinet oil storage tank which are not only serviceable but also efficient. Individual storage tanks are extensively used in many plants where it is not absolutely necessary to go to the expense of installing an extensive oil house layout. Especially is this true where but a few grades of oils are used, and these in but small quantities.

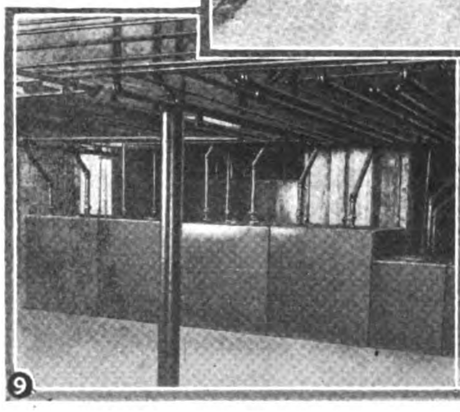


Fig. 9. The basement of an oil storage house is of interest due to the necessary amount of piping involved and the arrangement of the tanks. These tanks can be filled from the first floor through fill boxes located in back of the pumps.

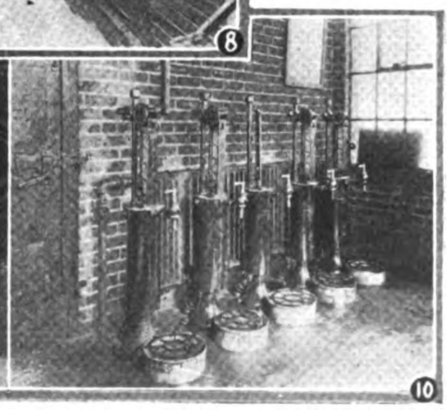


Fig. 10. An installation of lubricating oil pumps of the self-measuring type. Waste and slopped oils in such a layout is practically eliminated due to the efficient method of draining the oils back to the storage tanks.

duction over the long run, oftentimes regardless of subsequent overloading or overtime work.

But why should a unit have to be shut down? Modern machinery is certainly built to operate, not to undergo repairs. The reason, in the majority of cases, is faulty lubrication. No moving part subjected to friction can run indefinitely; wear will be bound to occur. True, we can lubricate it, even flood it with oil or plaster it with grease, but if these products are contaminated with dust, dirt, metallic particles or water, they often become nothing else but abrasive mediums, and wear goes on, perhaps not as rapidly, but certainly too rapidly to insure any extensive period of efficient operation.

Lubricants are sold in sealed containers, and if bought from reputable refiners they are usually pure and u n c o n t a minated when delivered to the c o n s u m e r. Then how does dirt and other foreign matter gain entry? Nine times out of ten, *in your plant, Mr. Consumer,* through n o b o d y else's fault but your own. Can you expect anything but sloppy handling of your lubricants on the part of your employees if you do not set them an example by providing means of storage which will protect these lubricants as much as possible, and insure their purity when applied to your machinery?

In brief the storage and handling of lubricants is one of the features of modern industrial plant operation. It is generally agreed that in the attainment of high speeds, power and continuous operation lubrication is a direct factor, oftentimes being even the controlling factor. But only can this be true if the lubricants in use are capable of giving a maximum of lubrication. It must be borne in mind that any oil or grease, whatever its intended function, is really only as good as the care it received prior to usage. The care exerted in refinement is practically of no avail if the lubricants are to be subsequently handled in such a manner as to enable them to become contaminated before they

Figs. 11, 12, 13. What not to do. In the first place, don't drill out a hole in a good barrel; not only may the shavings contaminate the oil, but also you lessen the re-sale value of the barrel. Secondly, don't smoke in the oil room. Third, guard against spilled oil, for it is a fire hazard as well as being a hazard for you personally should you slip in it and perhaps injure yourself.

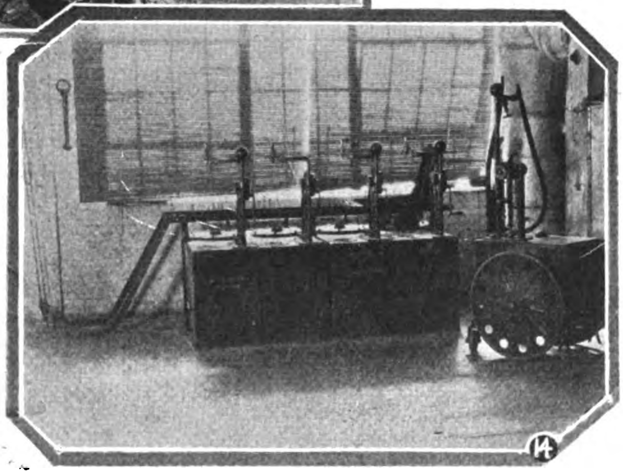


Fig. 14. A battery of oil storage tanks with their necessary pumps and barrel emptying track. Also a portable tank with pump and hose attached. The portable tank is a decided adjunct in many plants.

Fig. 15. An extensive oil house installation, showing the relation of the storage equipment to the rest of the plant. Such an arrangement renders the matter of handling as practically automatic as possible.

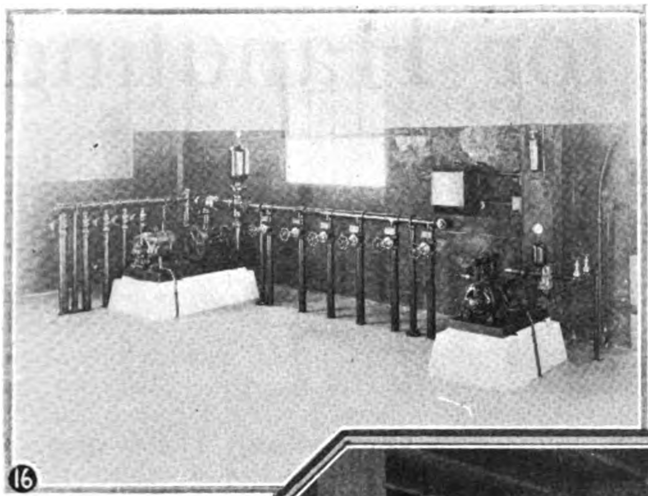


Fig. 16. Pumping equipment is an important feature in any oil storage installation. Where the volume of lubricants warrant it, motor driven pumps will be found to be decidedly economical and saving of labor.

Fig. 17. Some plants even go to the extent of mixing certain of their own compounds, in which event automatic agitating devices will be necessary. Belt drives have been found to be advantageous in both grease mixing and compounding plants, although, of course, the electric motor is also extensively used.

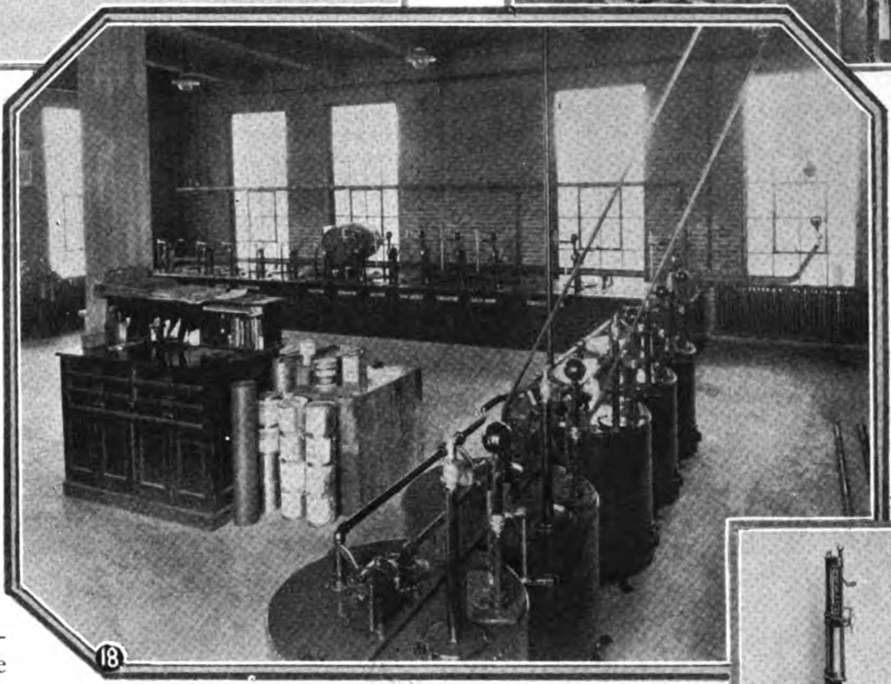


Fig. 18. Not only is it necessary to exercise the best of care in handling lubricants in order to keep them free from foreign matter, but also oil house records must be kept up and regular inventories taken of stocks on hand, etc. Therefore the oil house superintendent should have a suitable office and be afforded every opportunity to keep his records of consumption up-to-date.

are actually put into the machinery. Therefore, the purpose of this article is to bring out the more important points to which attention should be given in the storage and handling of lubricants.

The first essential is to provide for a central oil storage room or building. In other words, we should endeavor to keep all bulk lubricant containers out of the operating rooms of the plant as far as possible. By their concentration in a central point of storage consumption records can not only be kept in more complete detail, but also there will be far less chance of wastage, sloppy handling and contamination. From this point lubricating oils and greases can be issued to the various operating departments of the plant as needed and in suitable though not excessive quantities. All new supplies of such lubricants should, in turn, be delivered here for storage until required.

(*Continued on page* 75)

Fig. 19. Showing the manner in which a small basement or underground oil storage tank can be located. All the necessary accessories such as pump, drain, gauge, and manhole, etc., are installed, making such an equipment ideal for low volume storage.

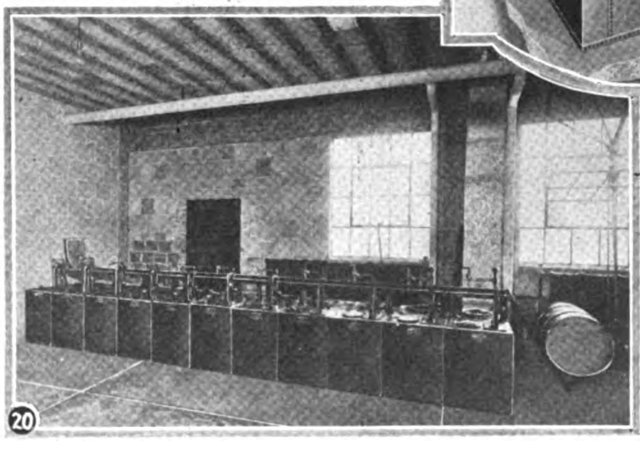


Fig. 20. A view of a set of oil storage tanks, showing the manner in which barrels or drums can be lifted to the unloading or emptying track which extends along their tops. The type of construction of this building is clearly shown, especially as to the steam pipe installation and the windows. It can be readily appreciated that such an oil room can very easily be kept clean. In fact it would be unpardonable for the employee in charge not to see to this important matter. Cleanliness, after all, is a most effective form of insurance against fire, as well as a protection for lubricants and bearings.

Cable Systems for Handling Materials

By Matthew W. Potts

THE field of application for various types of materials handling equipment using cables as the power and carrying mediums is very extensive; but the actual installation of this type of equipment is limited at the present time, for the reason that a number of engineers seem to consider the use of cables in industrial plants, for other than platform elevators, as obsolete. In England and Europe, engineers are now developing a number of new applications of cable conveyors and one company has found it possible to use cables in place of chains on platform conveyors, pivoted bucket carriers, and pan conveyors.

In this country, we find various types of cable equipment, for handling materials, some of which are illustrated in the accompanying pages. Those shown in Figs. 1, 2, and 3 are known as cable flight conveyors and operate in a trough. They are similar to screw conveyors, except that the flights push the material instead of carrying it forward with a screw motion. A number of installations of this

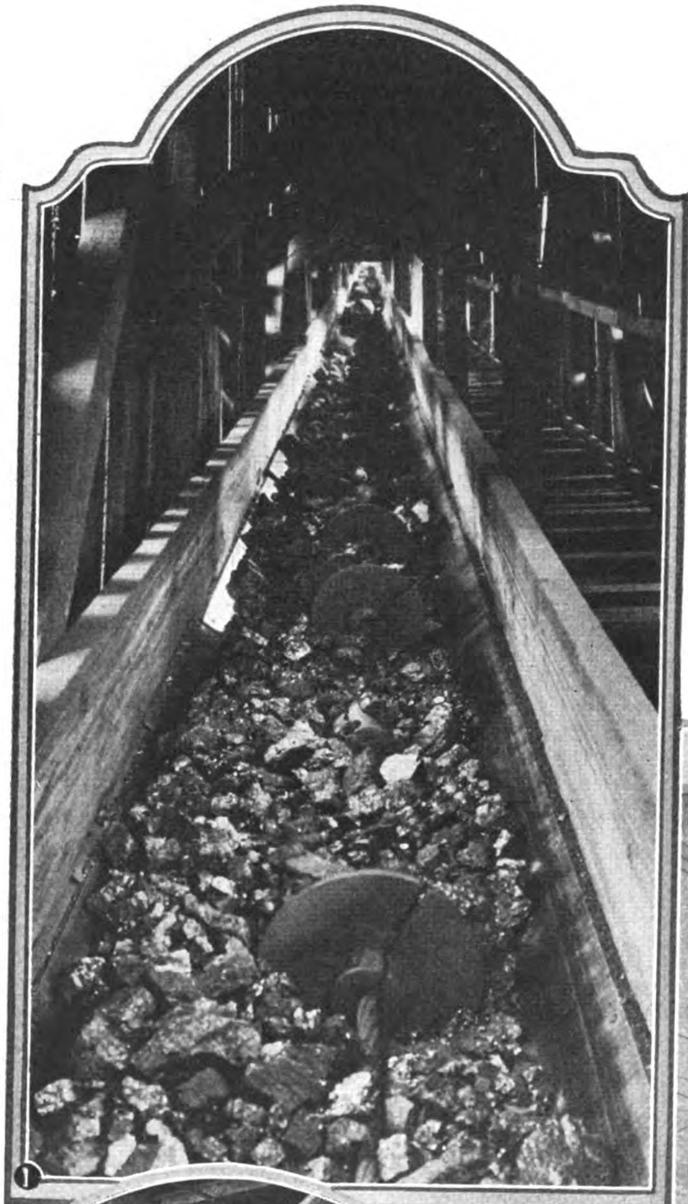


Fig. 1. Coal mines use cable flight conveyors of considerable length for handling coal down the mountain sides. In these cases, the conveyor is really a retarder.

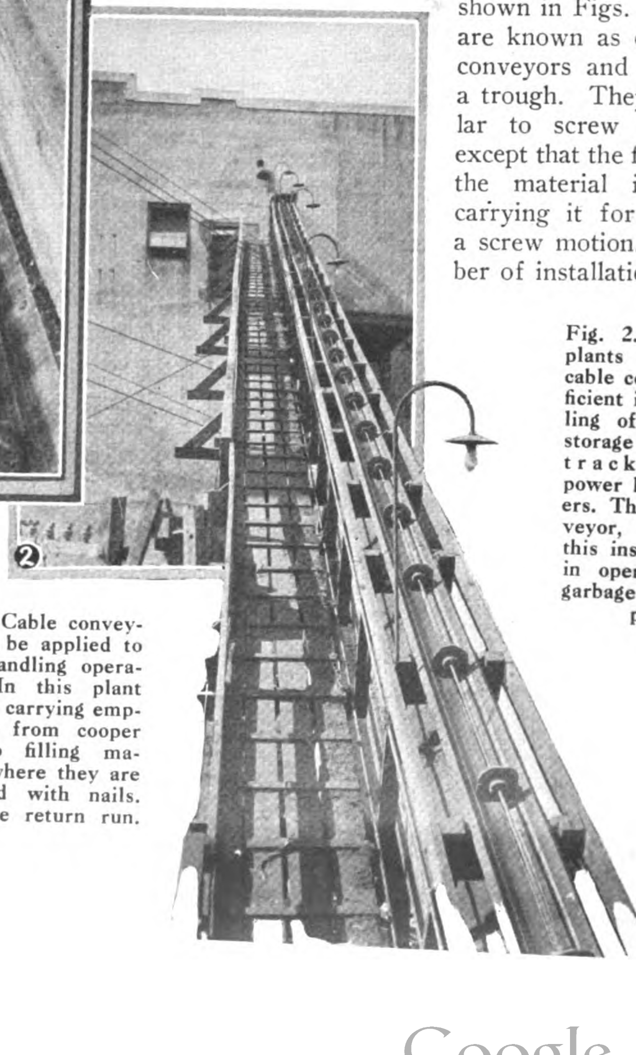


Fig. 2. Industrial plants have found cable conveyors efficient in the handling of coal from storage pile and track hoppers to power house bunkers. The cable conveyor, shown in this installation, is in operation at a garbage reduction plant.

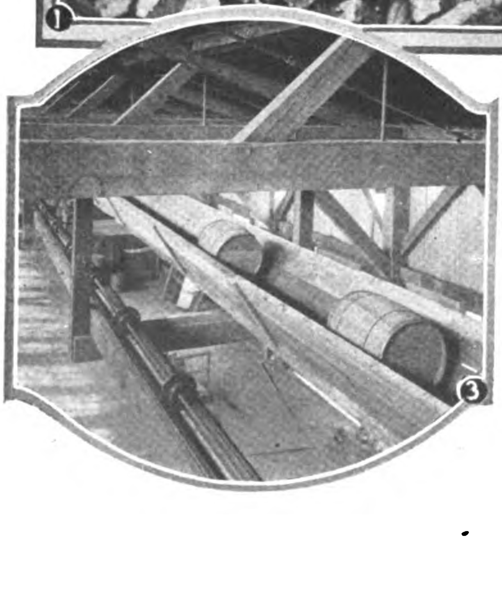


Fig. 3. Cable conveyors can be applied to many handling operations. In this plant they are carrying empty kegs from cooper shop to filling machines where they are loaded with nails. Note the return run.

type of equipment have been made in various coal yards and coal mines. In the latter, the conveyors are used as retarders for lowering coal down the mountain sides. This type of conveyor will lower coal in large quantities up to 300 tons per hour.

Installations of cable flight conveyors are most economical for long hauls of loose bulk material as the construction is quite simple, consisting mainly of a series of circular or other shaped disks mounted at intervals on a steel cable. The reason for recommending this equipment for long hauls only is that the terminal sheaves are necessarily of large diameter, thus making the first cost comparatively high for short conveyors; but where the length is sufficient to absorb the cost of terminals this type of conveyor provides one of the best means of handling non-abrasive bulk material.

Cable flight conveyors are used for handling other things besides coal and the illustration in Fig. 2 shows such a conveyor installed in a garbage reduction plant, while the one shown in Fig. 3 is handling empty kegs from cooper shop to filling machines in a large nail mill. In the manufacture of paper, a considerable amount of pulp wood is also handled by this same type of conveying equipment. These conveyors are economical to oper-

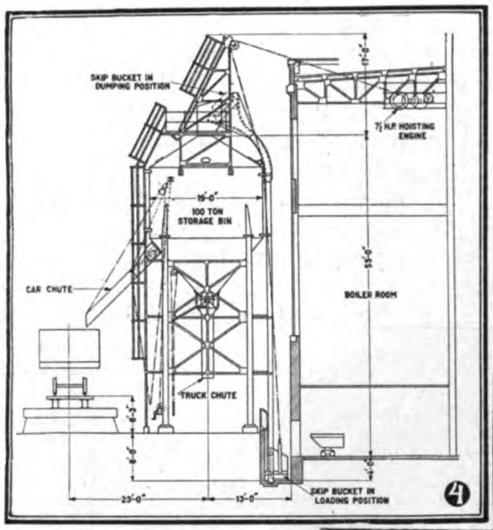


Fig. 4. Outline drawing, showing location of driving unit, skip hoist bucket pit and other parts of the ash handling equipment shown in Fig. 5.

Fig. 5. Actual installation of equipment, shown in Fig. 4. This installation is of a semi - automatic skip hoist and storage bin for ashes installed at the Steele Lighting Plant, City of Jamestown, N. Y.

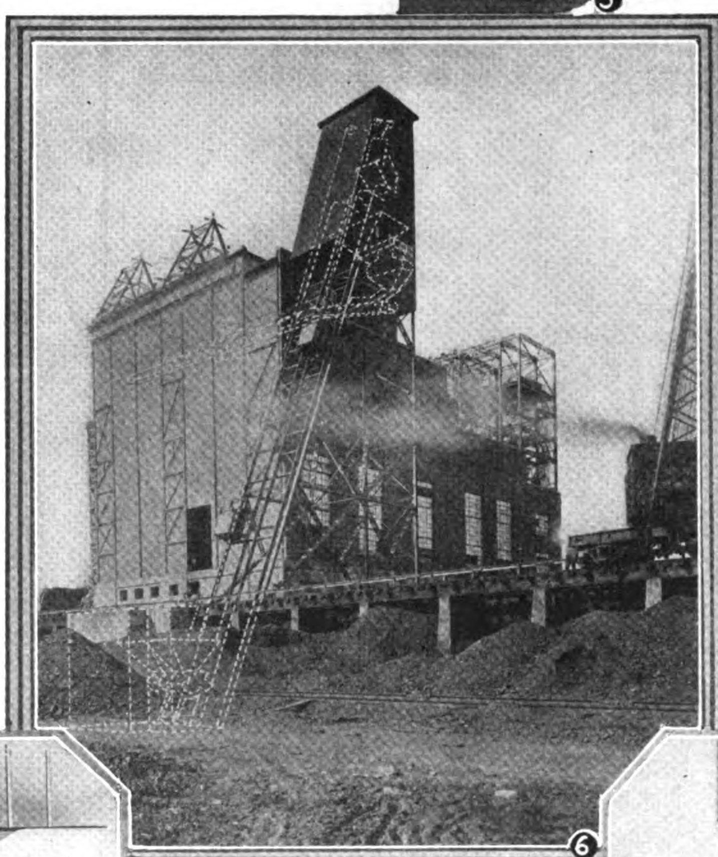
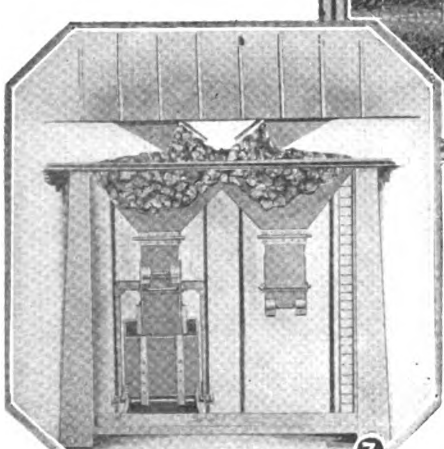


Fig. 6. A composite view of the coal handling equipment at the American Construction and Securities Company, Williamsport, Md. Note the feeding and discharge of the balanced skip hoist and the belt conveyor with tripper over the bunker.



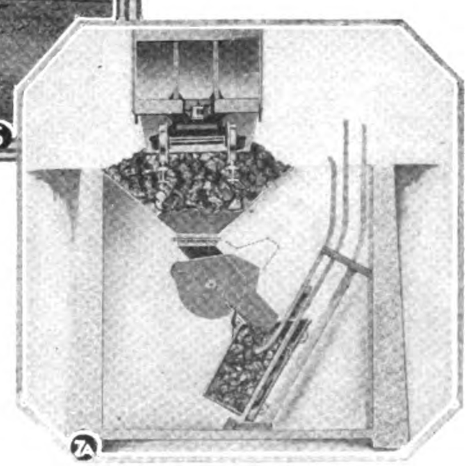
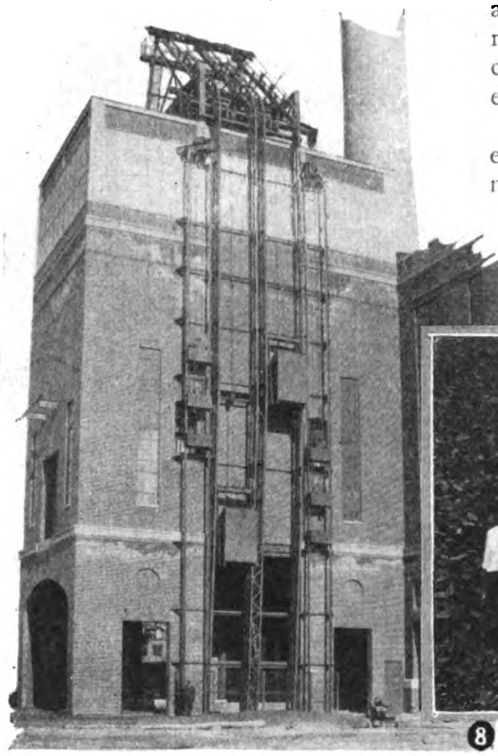


Fig. 7. Many feeding devices have been designed to care for the two cars on balanced skip hoists. These two views illustrate the arrangement at the track hopper and skip hoist loading pit.



ate for the reason that the carrying run consists of little more than a cable and the wearing parts are easily replaced at a minimum cost.

Another type of cable operated equipment, which can be seen in many power houses throughout the country, is the skip hoist, and the modern installations are equipped with many improvements which have been made within the past few years.

Figs. 4, 5, 6, 7, 7a, and 8 show various types of skip hoists in operation.

The diagrammatic sketch in Fig. 4 is of the actual equipment which is illustrated in Fig. 5. By closely studying this outline drawing, the reader will see the method of loading the skip bucket and discharging to the top of the hopper. Attention is also called to the hoisting unit, which is located in the roof trusses of the power house proper, where it is well protected from weather condi-

Fig. 8. While the balanced skip hoist, shown in Fig. 6, is on the incline this equipment can be erected to operate on vertical runs.

Fig. 9. A close-up view of the cable drag scraper handling run-of-mine coal in the actual installation of the equipment shown in Fig. 10.

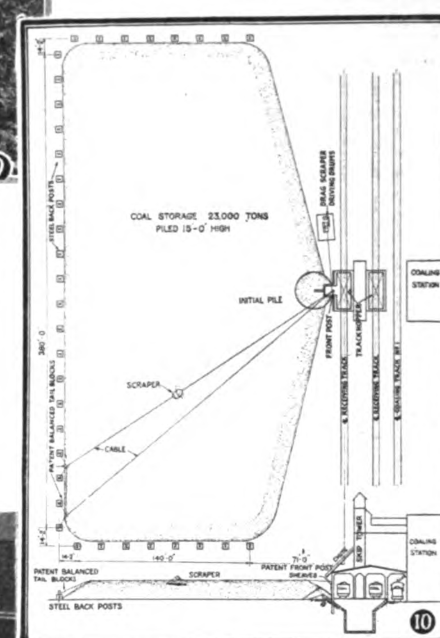


Fig. 10. Cable drag scraper conveyor installations are now being made in connection with the storage and reclaiming of coal and other materials. This diagrammatic arrangement shows the coal storage layout of the Richmond-Fredericksburg and Potomac Railroad, Richmond, Va.

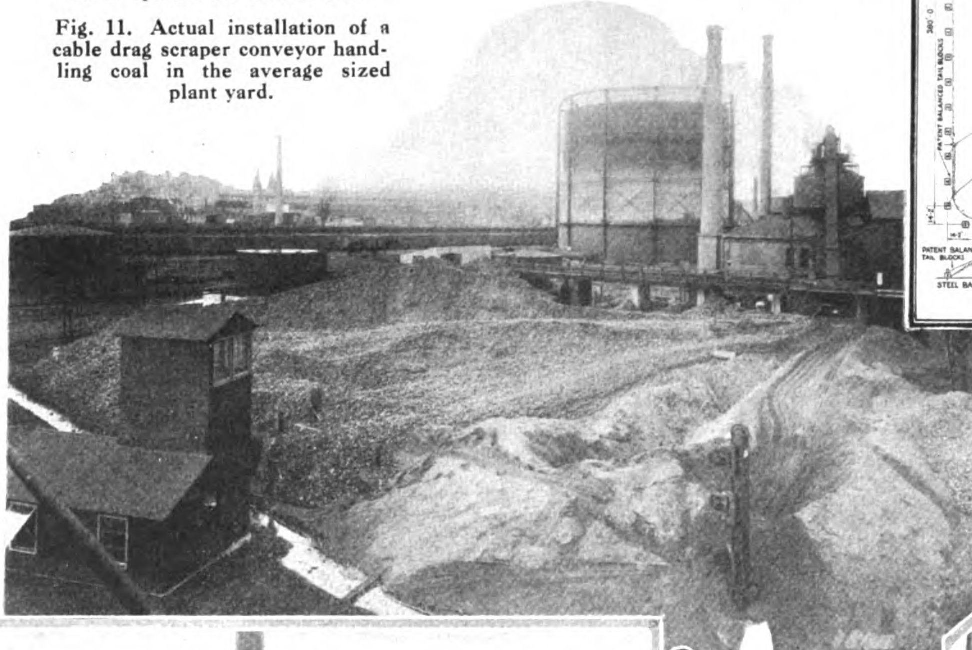


Fig. 11. Actual installation of a cable drag scraper conveyor handling coal in the average sized plant yard.

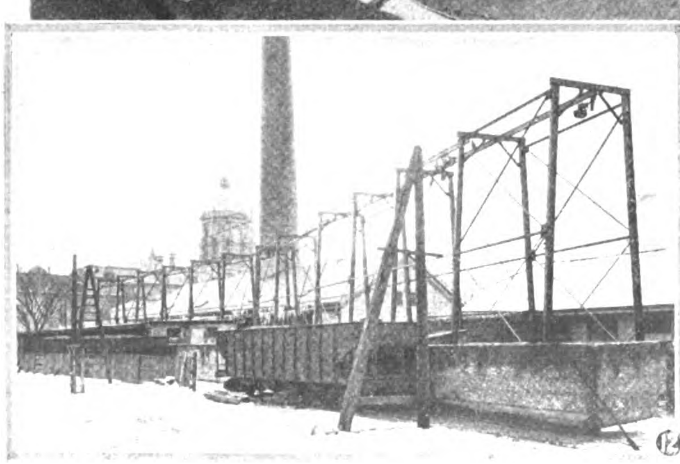


Fig. 12. By means of the overhead structure, which supports I-Beam trolleys, a system of cable propels a bucket the full length of the structure and transport various materials.

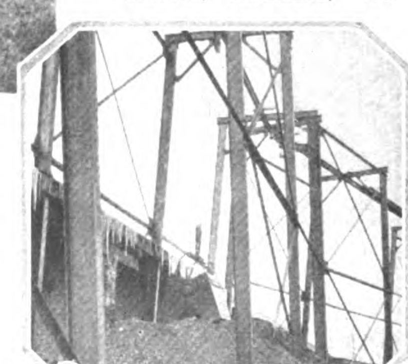


Fig. 13. This view shows the bucket discharging material to the storage pile and is a companion picture to Fig. 12.

Fig. 14. This illustration shows a battery of fourteen cableways, used at the Portsmouth, New Hampshire, yards during the War. These cableways were so arranged that the masts at both ends could lean from side to side so that the cableways could reach any part of the ships on the ways.

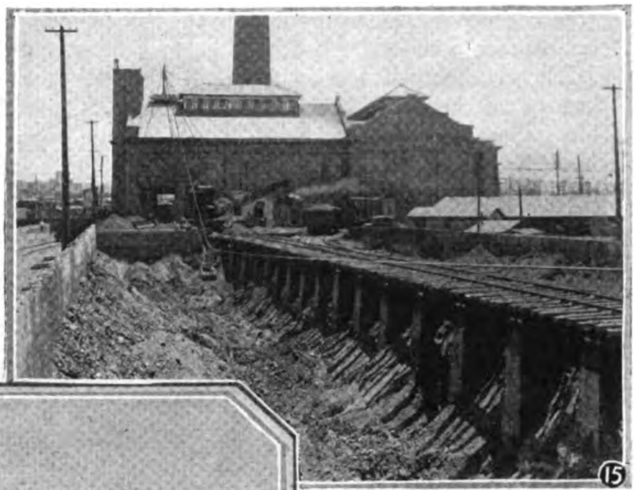


Fig. 15. View of a cableway equipped with a bucket and used for reclaiming coal from the storage pit, transporting same and delivering it to the hopper in the roof of the power plant.

Fig. 16. Many industrial plants have found cableways of great assistance in handling materials on long hauls. This one is reclaiming copper tailing from hill-side dump and delivering same to car loading hopper at an Arizona refinery.

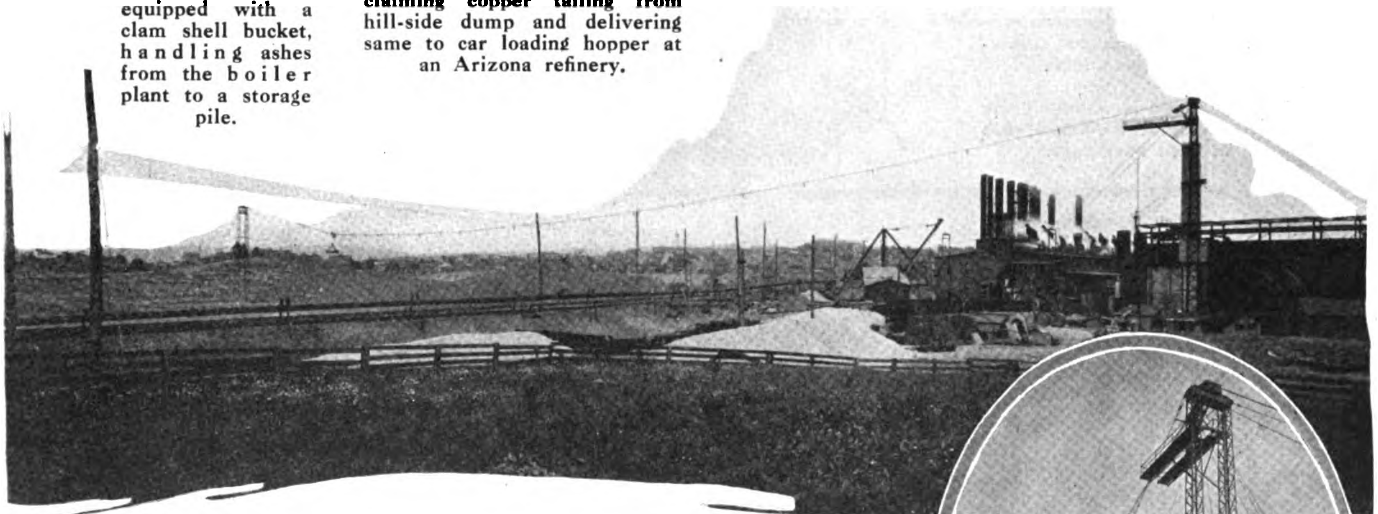


Fig. 17. General view of a cableway equipped with a clam shell bucket, handling ashes from the boiler plant to a storage pile.

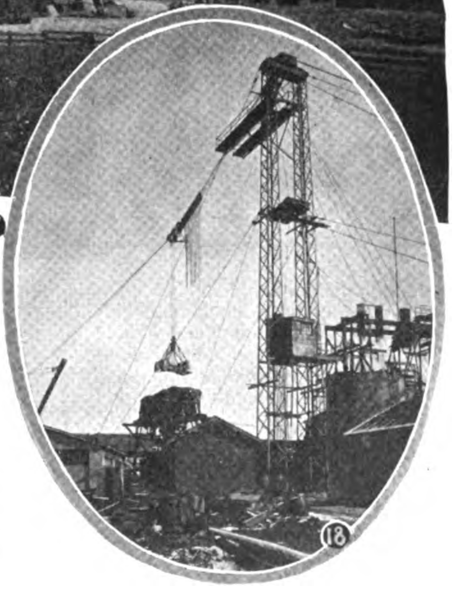


Fig. 18. Close-up view of one of the towers shown in Fig. 17. The operator is located in the building a third of the way up the tower.

tions. This equipment is known as a single bucket skip hoist, and can be installed under various building and operating conditions.

All skip hoists are essentially elevators, except that instead of being equipped with platforms they carry buckets so as to facilitate the handling of bulk materials. The field of skip hoists begins where the chain or belt bucket elevator reaches its limitations and frequently they are installed in preference to bucket elevators. Skip hoists will be found operating under very severe conditions and are invariably installed when the tonnage to be handled is large, when the materials are abrasive, hot, or corrosive, and when the lift is high.

The skip hoist is one of the simplest types of materials handling equipment, as it consists of a bucket, cable, and the hoisting engine which raises the bucket. We do find, however, that different installations vary, as some are operated vertically while others operate on an incline. We also find that the skip buckets are made in several different styles, so as to take care of different classes of materials and to fit conditions in industries where this type of equipment is to be installed.

The arrangement shown in Fig. 4 has the advantage of low initial cost but is best adapted for small capacity skip hoists and where uniformity of motor load is not important. Occasionally, this type of equipment is fitted with a counterweight equal to the total weight of the skip bucket, plus half of the weight of the material in the bucket. With this arrangement, the unbalanced load on the hoisting unit is only half of the weight of the material in the bucket. When this arrangement is used there is a load on the hoisting engine, both when the bucket is raised and when it is lowered, thus permitting the size of the hoisting unit motor to be small as the load on the motor is nearly constant.

Many skip hoists are arranged with balanced buckets, as shown in Fig. 6, and this arrangement is an adaptation of the counterweight idea, but instead of using a counterweight, two buckets are used in balance, one going up while the other is coming down. This type of skip hoist has been found most

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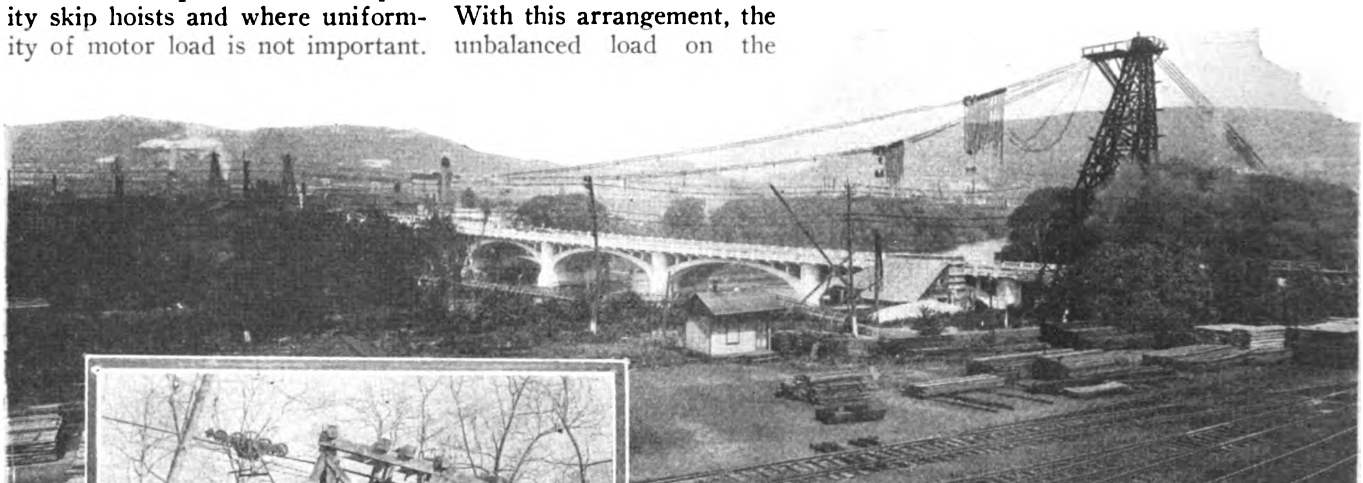

Fig. 19. Cableways are of great assistance on all new construction work. This shows such equipment operating on the construction of a new bridge.

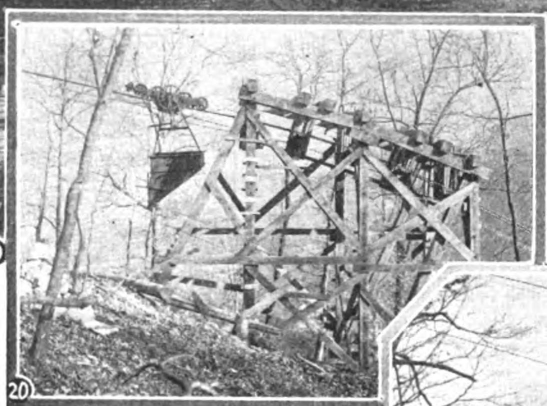

Fig. 20. For handling waste products over long distances, cableways are economical.

Fig. 21. For mid-air dumping the front door discharge buckets have a decided advantage.

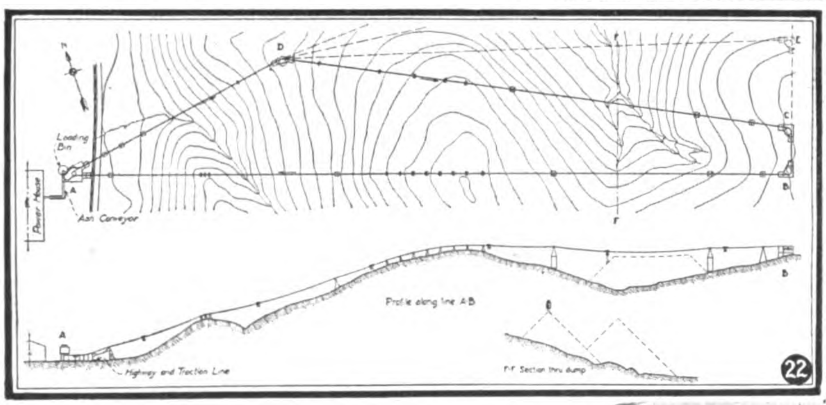

Fig. 22. This diagram shows the general layout of an aerial tramway for the West Penn Power Company at their Windsor Station for the disposal of ashes. The capacity is 100 tons per hour.

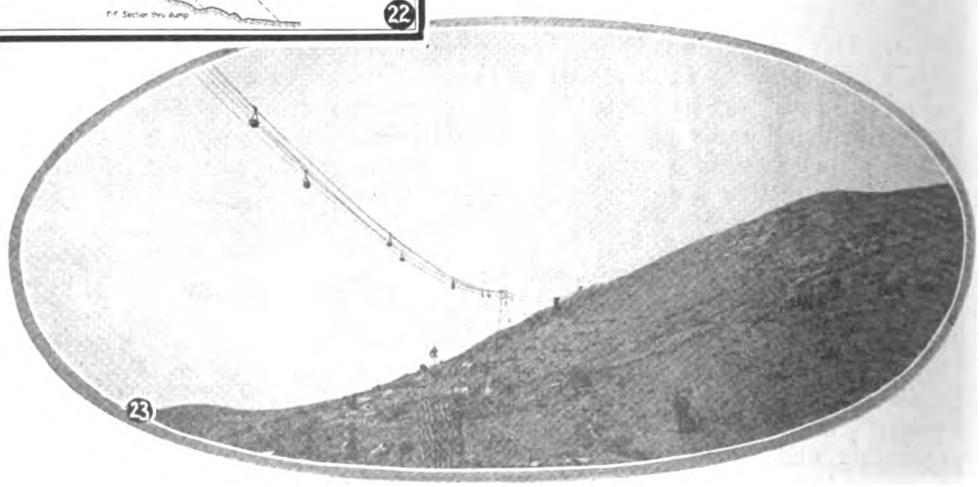

Fig. 23. In foreign countries, and in some places in the United States, aerial tramways are used for long hauls. This is a partial view of a four mile installation which handles a hundred tons of silver ore per hour over the mountains at Pachuca, Mexico.

Establishing Industries in Australia

By William F. Svec

THE entrepreneur everywhere in any industry must necessarily familiarize himself with general conditions before undertaking to build up an enterprise intelligently and constructively. The purpose of this article will be to try and in a general way to act in that capacity for American and foreign concerns contemplating establishing industries in Australia.

Such information as appears has been gathered from personal experiences of the writer or other Americans doing business in Australia. The idea is dealt with in a broad way for the purpose of general information, describing conditions as they actually exist and personal opinion restricted as much as possible.

It is well to remember that Australia is slightly larger than the United States in size (Aust. 2,947,581 sq. miles) and has a population of five and one-half million, the greater portion of which is found in cities along the coast. More than three-fifths of the population is

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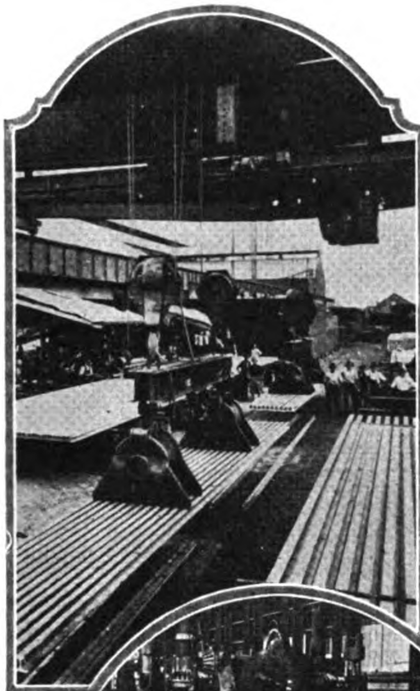

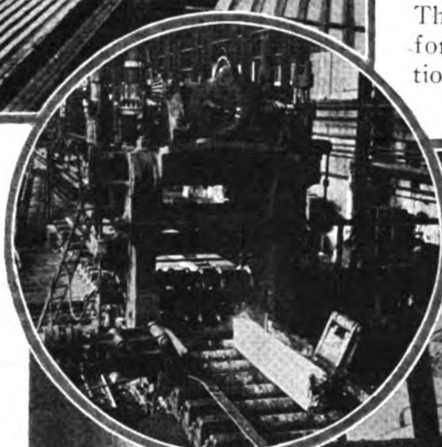

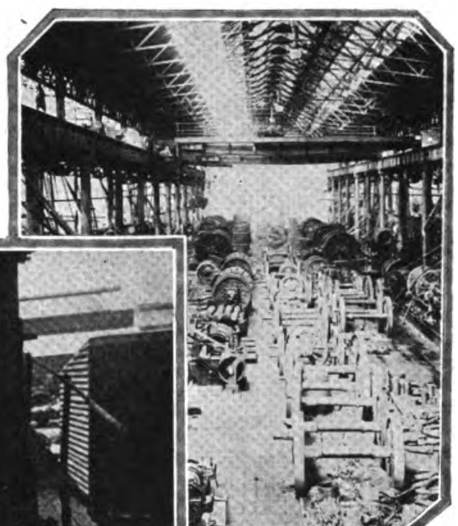

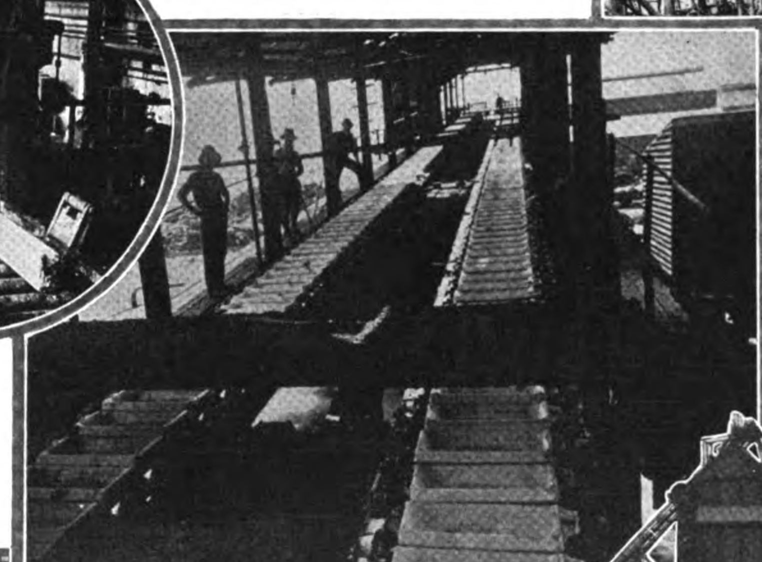

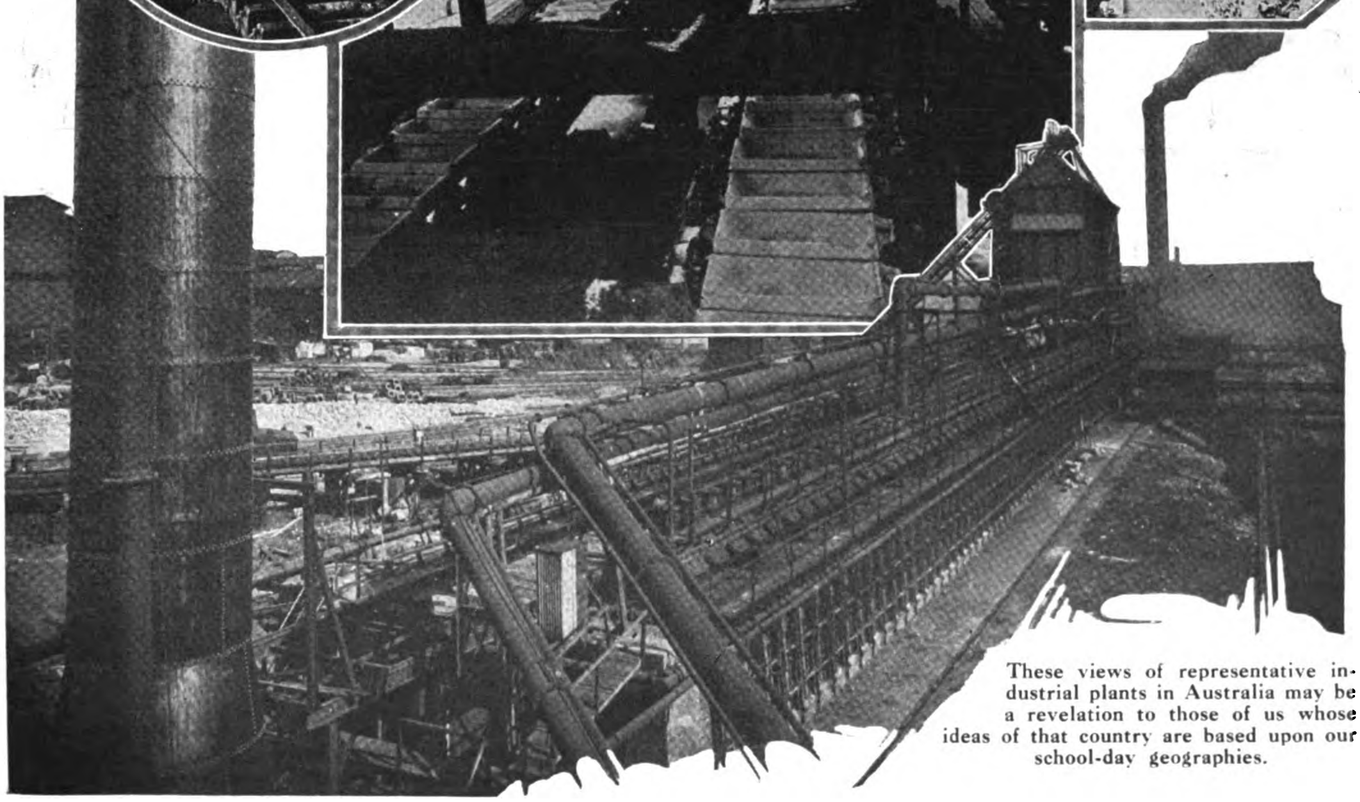

These views of representative industrial plants in Australia may be a revelation to those of us whose ideas of that country are based upon our school-day geographies.

How to Sling Heavy Loads

Time-Saving Kinks that Have Proved Practical

By F. C. Eibell

TO those who are familiar with the handling of materials of any sort by the use of hoists or cranes, it goes without saying that sling ropes or chains should not be passed over sharp edges without a suitable protection such as bagging, waste or wood being placed between the sling and the edge. Nor is it desirable to wrap the load chain around the load and catch the hook back over the load chain itself. Such a procedure halves the capacity of the load chain.

Another point which should be borne in mind is in regard to attaching the hook of a hoist load chain to the sling. The sling should be placed full in the saddle of the load hook—not on the tip, nor bearing excessively on that side of the hook. It is not unusual to open up a hook without taxing it to its full rated capacity by simply setting the sling carelessly so that the load bears too far out on the point of the hook.

Sometimes, in slinging the load too many strands of the sling are passed through the hook. This causes the hook to open up, due to the side strain of the sling when the hook really has capacity enough to carry $3\frac{1}{2}$ times its rated capacity, if the load is properly slung and suspended.

To lay down set rules and regulations is impossible, but accompanying pictures serve to illustrate safe practices in slinging.

Fig. 1. A good pair of tongs and a piece of strong chain make an excellent combination for the speedy handling of u variety of bulky loads.

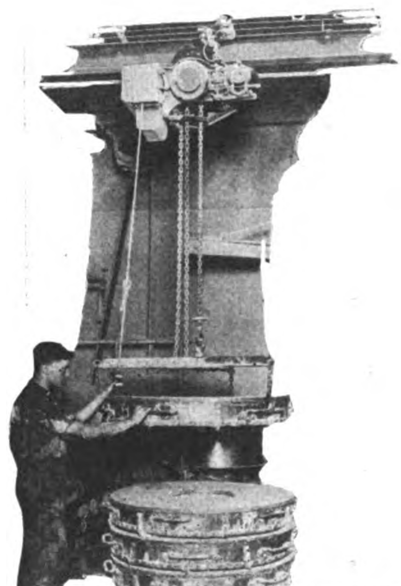

Fig. 2. The safeness of this special type of sling for handling reels of wire to and from annealing ovens, together with push button hoist control, give the operator freedom of movement.

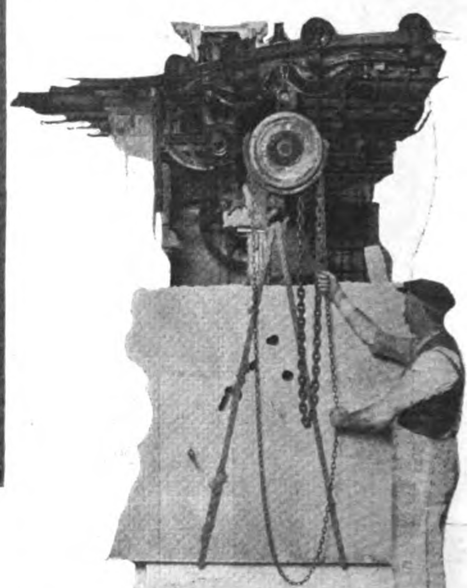

Fig. 4. Here the use of rope protects the brittle edges of stone slabs and statues, whereas chain slings, unless properly protected, would not. Even a careless workman can be depended upon not to injure the work.

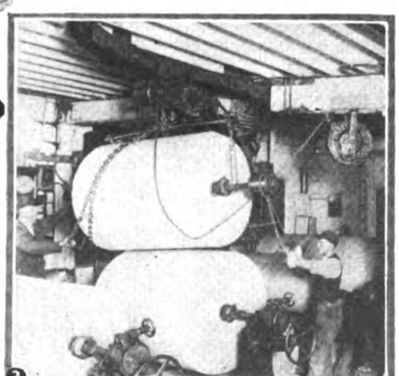

Fig. 3. Here the problem was one of head-room. The lower hook has been removed and a ball bearing sheave mounted on the cross-rod.

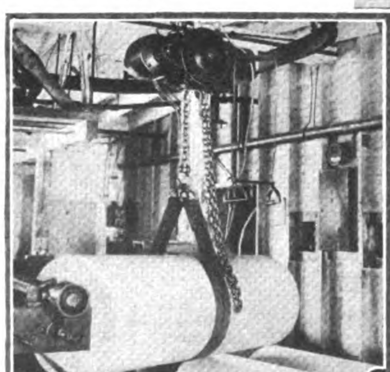

Fig. 5. This six-inch canvas strap sling entirely does away with the danger of cutting into the roll of paper, and at the same time suspends the roll with sufficient firmness.

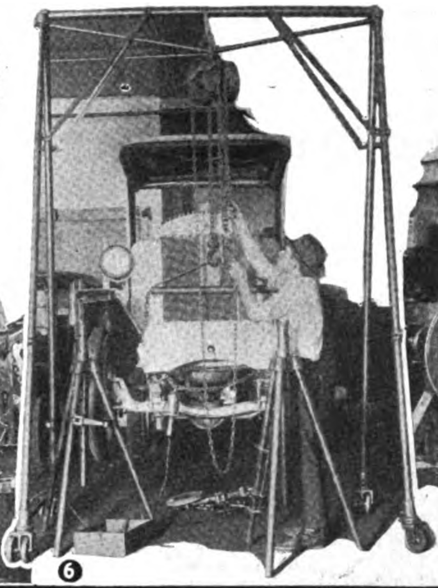

Fig. 6. Here a pipe length is used as a spacer for the chain sling, in order to protect the body of the car.

Fig. 7. At the left is a special slinging contrivance used by a large electrical equipment manufacturer for the safe handling of delicate motor parts.

Fig. 8. Handling junk. Here, convenience and speed are more important than any consideration of protecting the load.

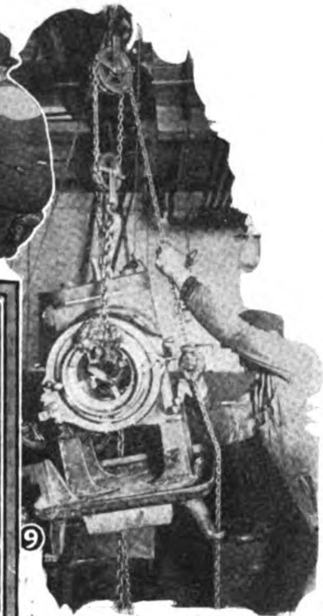

Fig. 9. A handful of waste, a block of wood, or some rags should be inserted between the sling chain and sharp edges of the machine to be lifted, as shown here.

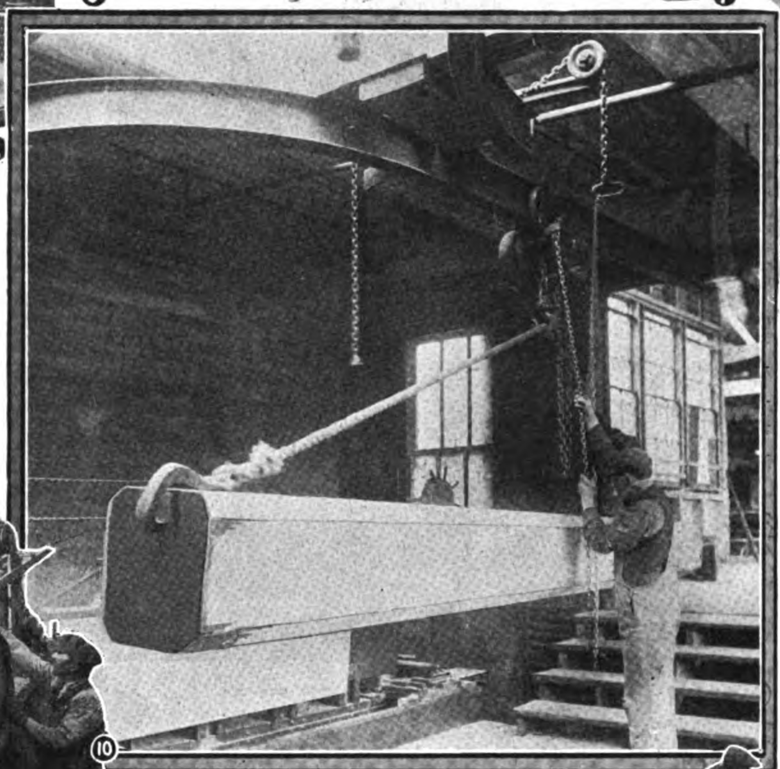

Fig. 10. Thousands of heavy logs are handled quickly and easily in a large woodworking mill by means of this simple device, consisting of two hooks and a rope.

Fig. 11. There is no danger of dropping a barrel hung in this fashion so long as the sling is properly tightened about each end of the barrel.

Fig. 12. In loading rails on the electric industrial truck shown here, note the block of wood used to keep the strands of the sling chain apart so that the rail is properly balanced.

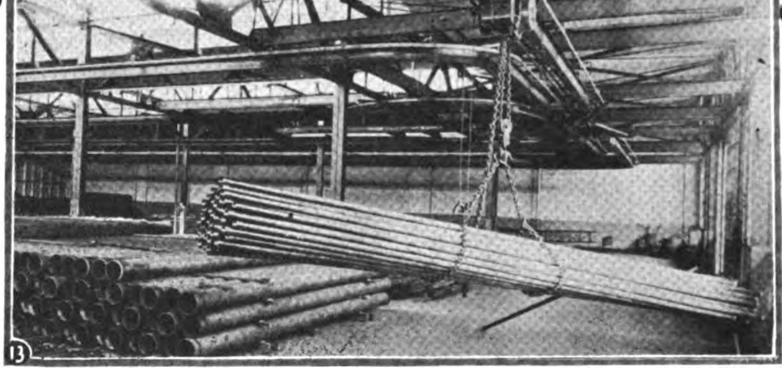

Fig. 13. A slinging arrangement and electric hoist installation which has saved the wages of four men who previously handled pipe in this warehouse.

The Maintenance of the Power Plant

By William G. Ziegler

MAINTENANCE work in the power plant is largely of a routine nature, and not very much is thought about it by the management unless an emergency occurs. Then expense is considered secondary and the job is completed as quickly as possible, usually after a large amount of labor and material has been expended. A power plant should have regular schedules of maintenance, and they should be strictly lived up to. It is poor policy to neglect maintenance on equipment that may cause an emergency. Many industrial plants buy electric power in the form of high tension alternating current, and have transformers located either in the power plant or at a convenient location. In these cases steam is used for heating and in the manufacture of the product and for such auxiliaries as are desired or needed. The method of handling maintenance work varies so much with the size and type of the plant that it is not possible to do more than suggest ways and means of doing this work. If regular maintenance men can be used on power plant work, it is often advisable to do so, especially in small and moderate-sized plants. In this way the regular power plant force may be kept reasonably small. However, a small labor cost in a power plant does not necessarily mean a low unit cost, because a poorly paid crew can burn up a lot of coal without getting the value out of it, and in the end will cost more than highly paid men.

The decision as to whether to have the electricians or the power plant men do electric repair work should be carefully considered. This can only be

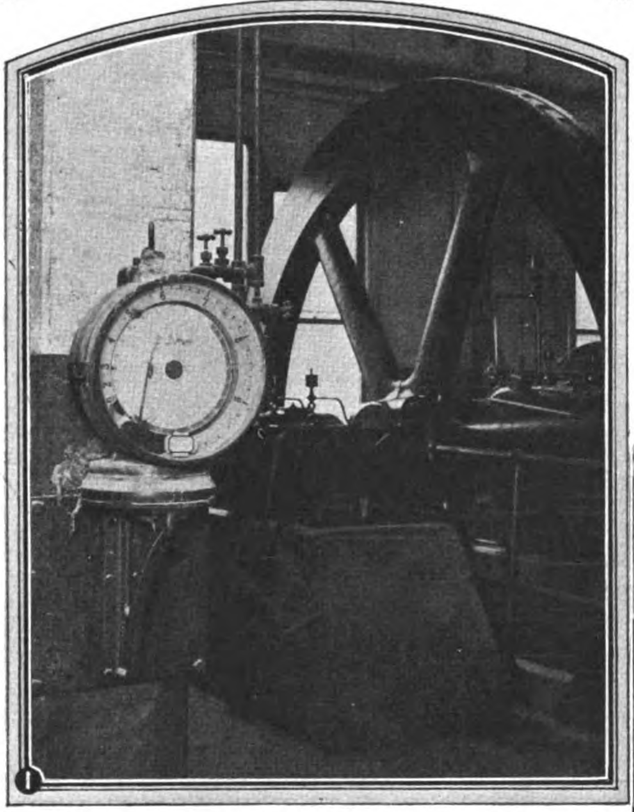

Fig. 1. Recording instruments are an absolute necessity, and, with a reasonable amount of care, will give the reliable records which are essential.

Fig. 2. When forced draft is used, the bearings on blowers should be well oiled.

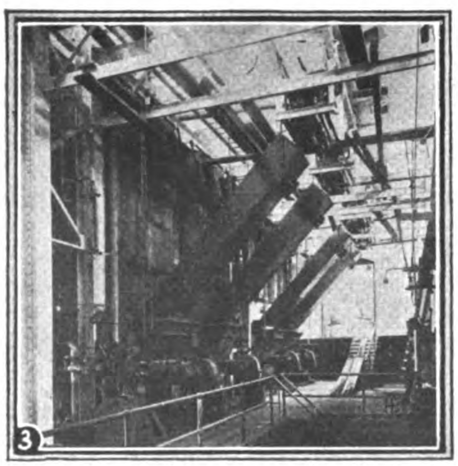

Fig. 3. Mechanical stokers must function under severe conditions, and should be examined and repaired whenever a boiler is off the line.

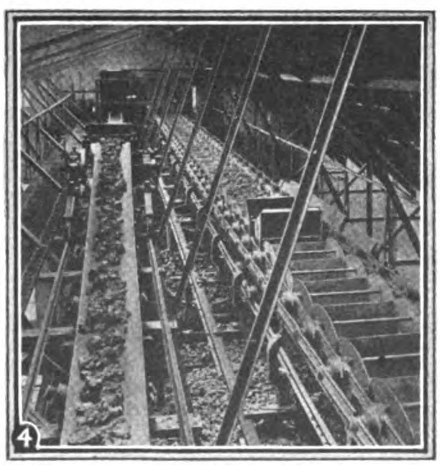

Fig. 4. Coal dust gets into bearings, making the maintenance of coal handling equipment an important item.

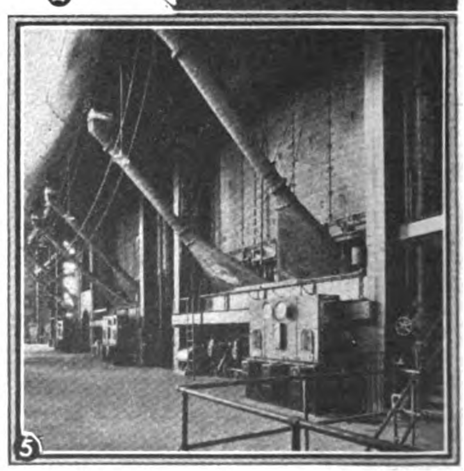

Fig. 5. Gear drives, belt drives, and chain drives, as well as direct steam or motor drive, are used on stokers. Each type requires special maintenance.

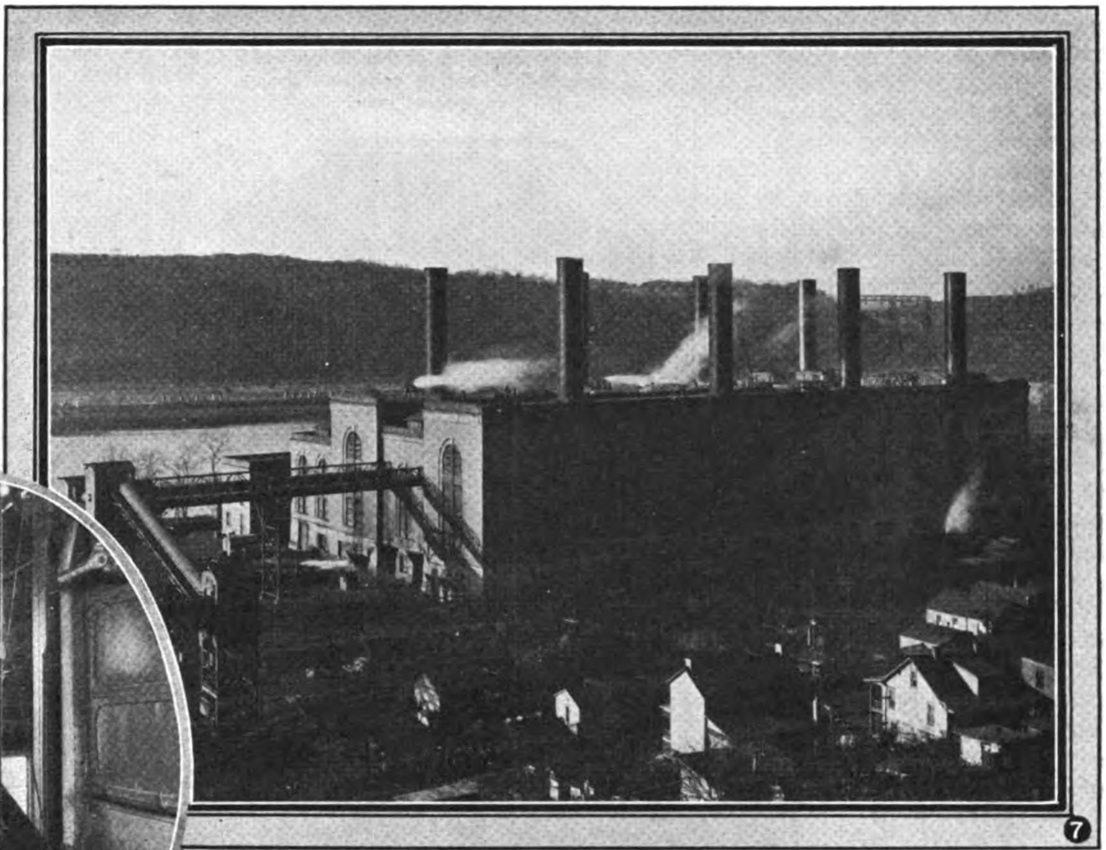

Fig. 7. Maintenance problems on fuel handling systems, though similar, vary with each individual system. The important thing is to see that adequate inspection and repair is scheduled.

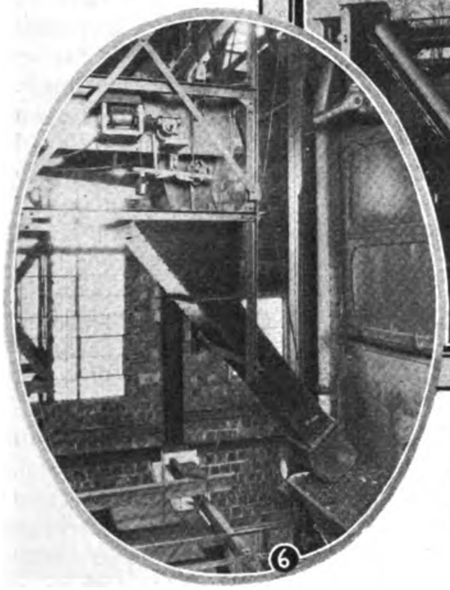

Fig. 6. Wet coal, whose sulphur content forms sulphuric acid, attacks the steel plates of chutes; a point to watch carefully.

decided after a careful study of conditions. The same is true of pipe fitting, mason work and millwright work.

The maintenance of the boilers and their auxiliary and subsidiary plant will be considered first because of their importance. Boilers should be shut down and carefully inspected and repaired as often as is deemed necessary. It is good policy not to wait for trouble to develop, but to inspect and repair before they become serious. The fact that state insurance inspectors make annual or semi-annual inspections of the boilers is certainly a good thing, because they show up defects that might otherwise be overlooked. After shutting down, a boiler should be carefully inspected all over before any work is done on it. Then the regular cleaning and repairing should be done, and then a final inspection should be made before it is fired up. Corrosion of plates and tubes is probably one of the most troublesome things experienced in boiler maintenance. With tube cleaners and tools for rolling tubes the job of cleaning and tightening tubes is one which men can be trained to handle quickly, as it is a regular occurrence. Scale is responsible for burned tubes and it should not be allowed to accumulate. All parts subjected to high temperatures should be carefully inspected and kept clean of scale. No set length of time between clearings can be suggested. This is dependent on the scale-forming constituents in the water, the facilities for soot blowing, and other factors.

Mechanical stokers are of various types and designs but as all of them

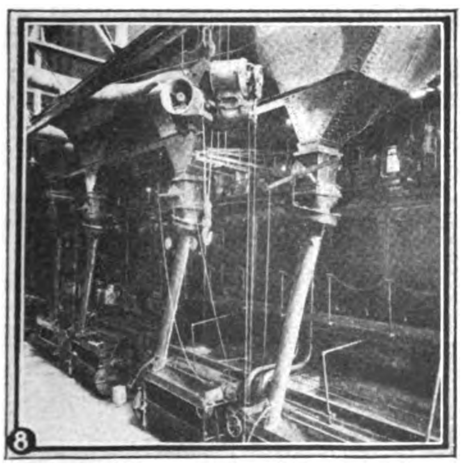

Fig. 8. Motors for fuel handling systems should either be totally enclosed, or otherwise protected from dust.

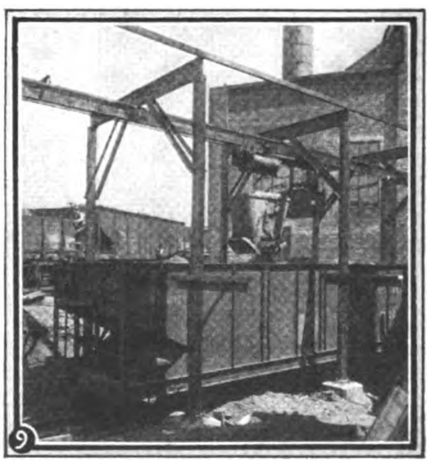

Fig. 9. Ash conveyors require the same care in maintenance as coal conveyors; wet ashes being quite as corrosive as wet coal.

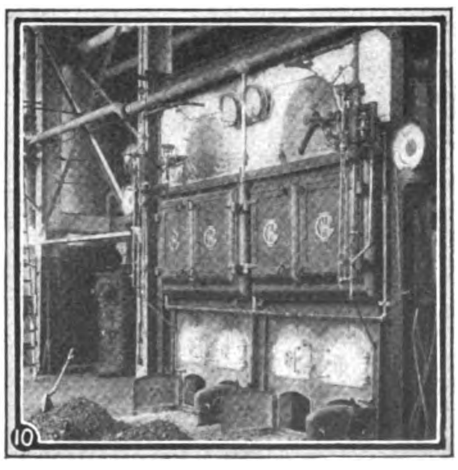

Fig. 10. The doors on hand-fired boilers should be kept in repair, as constant slamming tends to rack them.

are dependent on driving mechanisms that have to function under conditions that are often severe, they should be carefully examined for wear, and any worn parts replaced during the time that the boiler is off the line. Whether driven by steam stoker engines or by motors the drives should be carefully attended to. Gear drives, belt drives and chain drives are all used for this work and each requires maintenance. The area of air space should be kept correct for efficient combustion and the grates should be carefully watched for burned spots. New parts should be inserted when spots get badly burned. With hand fired boilers the grates should be watched just as closely. It is much harder to keep excess air from the top of the fire in hand-fired boilers on account of having to open the fire doors so often; but these doors should be kept in repair so as to fit well when they are closed. The natural tendency to slam these doors racks them in short order. Wet ashes are very corrosive. This point must be watched especially where ashes are allowed to remain under the fire. When forced draft is used, the bearings on blowers should be well oiled. This is about all the maintenance that is necessary on this equipment if the motor or engine is directly connected. The fittings and mountings on the boiler should be carefully inspected and overhauled periodically. The importance of tight valves and tight joints all over cannot be stressed too much. While a boiler is down all these things should be taken care of, so that when it goes into service it will be in perfect condition. Cracks or breaks in the heat insulating covering can usually be easily patched up. This work will more than repay itself in the saving in fuel. The heat losses from steel or iron surfaces at high temperatures amount to much more than generally realized, and the tendency toward higher steam pressures and superheat temperatures makes the problem of maintaining the heat insulation a very important one. Soot blowers can usually be repaired with interchangeable parts to replace those burnt out in the hotter portions of the boiler. The grade of metal used in these parts is important if long service is to be given.

Cracks in brickwork should be filled up as tightly as possible. For

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Fig. 11. CO_2 recorders are an important check on proper firing, and should be kept in condition by a competent man.

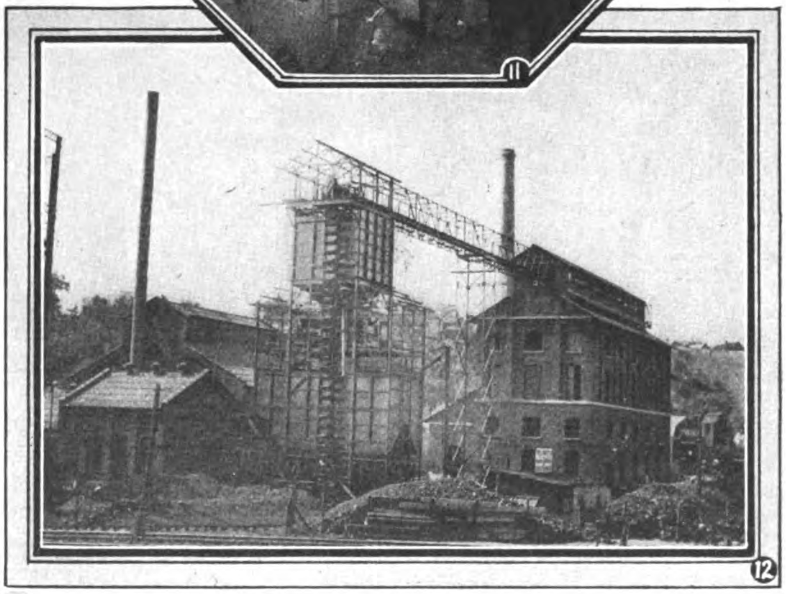


Fig. 12. Long runs, in fuel or ash handling systems, involve systematic inspection and lubrication.

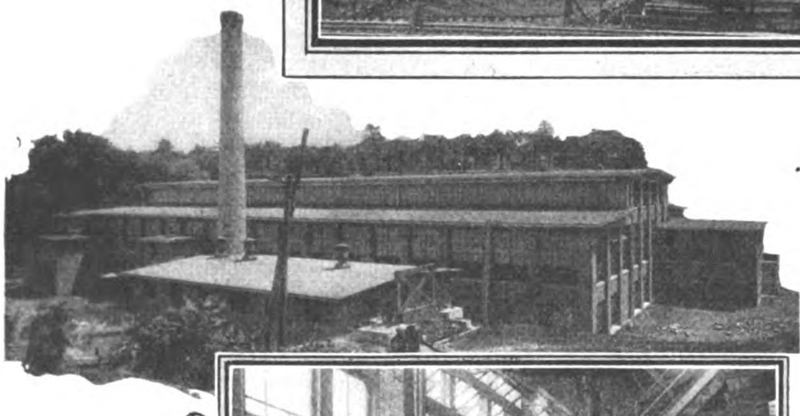


Fig. 13. Isolated plants, especially, require the carrying of spare parts to avoid costly delay in repairing breaks.

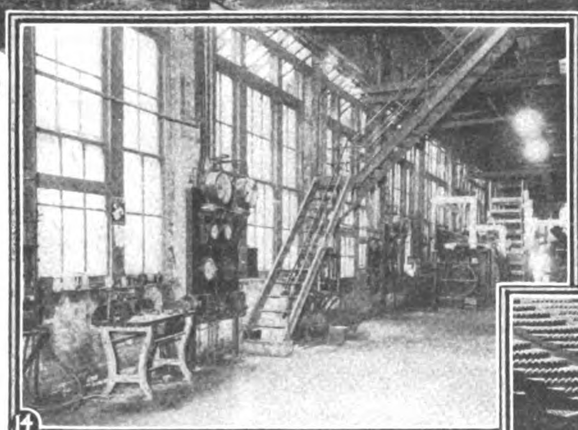


Fig. 14. With flow meters on the steam lines, the load carried by each boiler is shown. A combination indicating and recording type is especially useful.

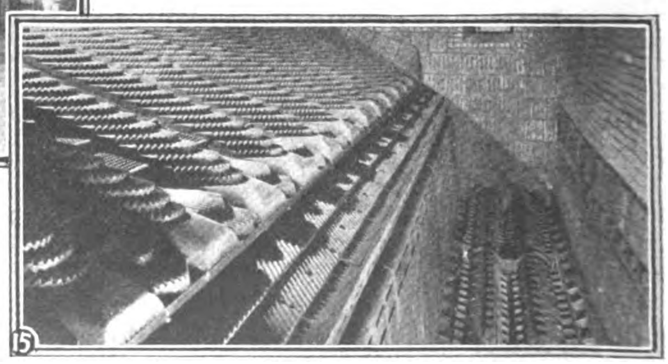


Fig. 15. Grates, whether of mechanical stoker or hand-fired boilers, should be carefully watched for burned spots and new parts inserted before failure can cause a break-down.

Cable Systems for Handling Materials

(*Continued from page 30*)

satisfactory for large capacities and it is claimed by the manufacturers that this type takes less power than either the single bucket, or the counterweight skip hoist.

The method of feed for a balanced type skip hoist is shown in Figs. 7 and 7a and it will be noted that the discharge spout feeding to each bucket is self-closing and self-opening; thus reducing the spillage in the pit frequently encountered when material is discharged to the buckets manually, or through the ordinary hopper gate. This type of gate can also be installed on single bucket equipment to avoid delay at the loading point.

Control of materials handling machinery is important and, in this connection, we feel it advisable to mention the two general methods of controlling skip hoists. These methods are classified under the heading of semi-automatic and fully-automatic controls. In the semi-automatic equipment, the operator after bringing the material to the loading point, either in industrial cars or wheelbarrows, or by means of track hoppers, feeds it directly into the bucket and then pushes the button on the starting switch. The entire operation from this point on until the bucket is once more in position for a new load, is taken care of by the electrical control of the hoisting engine. The bucket accelerates to full speed, slows down gently when it approaches the dumping position, remains at this point long enough to discharge clean, and then automatically reverses and travels back to the loading position, where it comes to rest ready to be loaded again.

In fully-automatic skip hoists, the material is elevated entirely without human assistance by means of various mechanical arrangements in connection with the feed gates in the skip hoist pit. One such arrangement is as follows: When the skip bucket drops into the pit, it automatically opens the gates on the loading hopper and then comes to rest on a supporting beam, which is connected through a series of levers to a counterweight. Attached to this beam is a rod which operates the latch which holds the gate open. The counterweight lever is adjusted so that the fully loaded bucket will just overbalance it and cause it to rise. In doing so, the supporting beam drops slightly, releasing the gate latch and permitting the gate to close. In this manner the flow of the material is cut off and while closing, the gate operates a switch which controls the hoisting engine and the bucket immediately starts upward. The operation is the same as in the semi-automatic skip hoist.

When the last load has been carried up and there is no more material in the bucket hopper, the bucket comes down in the usual way, opens the gate of the loading hopper and comes to rest on the supporting beam; but as there is no material to flow into the bucket and the weight of the empty bucket is not sufficient to overbalance the counterweight, there is no closing of the gate or starting of the motor, and the bucket therefore remains at rest. As soon as material is put into the hopper, however, the automatic control immediately comes into operation. Other arrangements have been devised, and the same result is accomplished in divers manners by each manufacturer. The full automatic arrangement and the self-opening and self-closing gates can be installed on either the single bucket or balanced bucket type of skip hoist.

Much has been written in the past two years on the advantages of storing coal adjacent to the industrial plant during the summer months, so as to take care of the winter requirements without depending on railroads to transport same from the mines during the busy season or when there is a car shortage. Many industrial executives have recognized the advantages which can be obtained by having their coal supply insured, but they have felt that the additional expense which would be necessary to install proper mechanical handling equipment was not warranted. Many felt that it would be necessary to install large gantry cranes or several locomotive cranes, if they intended to store more than a few thousand tons at a time. It has now been proven that the cable drag scraper method of coal storage can be economically installed and that this equipment compares favorably in operation with installations which consist of cranes, conveyors, trestles, etc. While this method of handling and storage has only been under development since about the year 1915, it has been extensively installed because of its low cost and economical operation.

A drag scraper installation is shown in Fig. 10. Here the coal is received from railroad cars and discharged into hoppers below the tracks. A skip hoist picks up the coal and delivers it down a chute to form an initial pile, ten feet high, adjacent to the railroad track. A machinery house contains power driven drums to which are attached the ends of a steel cable, extending over the storage yard in the manner shown. A scraper, similar to that shown in Fig. 9, is attached to this cable. The scraper is dragged back and forth over the coal pile. On the outrun it fills itself at the initial pile and discharges the coal over the storage pile. It will be noted that around the three sides of the storage yard are steel-back posts to which can be attached the tail blocks through which the cable passes in making a complete circuit. To store coal in any portion of the yard, the tail blocks are changed from one post to another, so as to permit the scraper to feed all portions.

In order to reclaim the coal, the scraper is simply reversed on the cable and the coal is scraped back to the reclaiming hopper and delivered to the skip hoist from which it is discharged to railroad cars or to the boiler house bunker. It will be seen that in an area approximately 200 x 400 a storage of 23,000 tons can be obtained with a pile only fifteen feet high.

Another arrangement of the same type of equipment is shown in Fig. 11 and in this installation various grades of coal are stored in segregated areas. This is made possible because of the direct line of travel of the scraper. Coal is not the only material that can be handled by this method. Other bulk materials can also be handled if desired, and the drag scraper method can be installed under cover in large storage sheds as easily as it can be installed in the open. Under such conditions it makes an economical handling method for fertilizer, etc.

If a locomotive crane is already in operation in the industrial plant, a drag scraper attachment can be applied which permits the boom to answer the purpose of the driving drum. This simple arrangement greatly facilitates the handling of coal and other commodities over a large storage area.

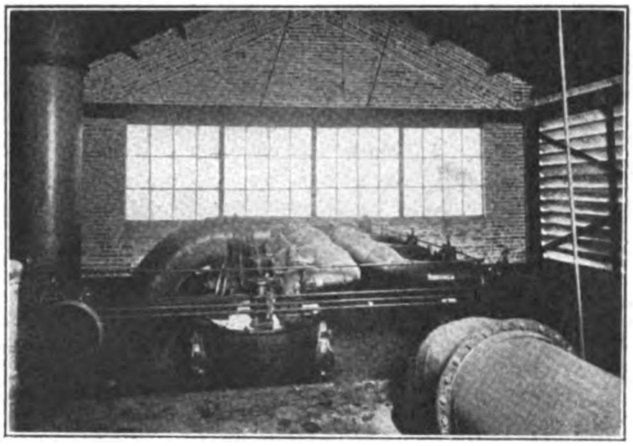
Another type of cable operated equipment for handling

(*Continued on page 40*)

DRACCO SYSTEM of DUST RECOVERY

EFFECTS a COMPLETE SAVING of MATERIAL in GRINDING MILLS

These illustrations on this page show part of a Dracco installation in the mill of a large western mining company. It is a good example of what Dracco methods are doing for a variety of grinding operations and can do for a still greater variety.



FREES the AIR, FLOOR and EQUIPMENT from DUST—and ITS HARM

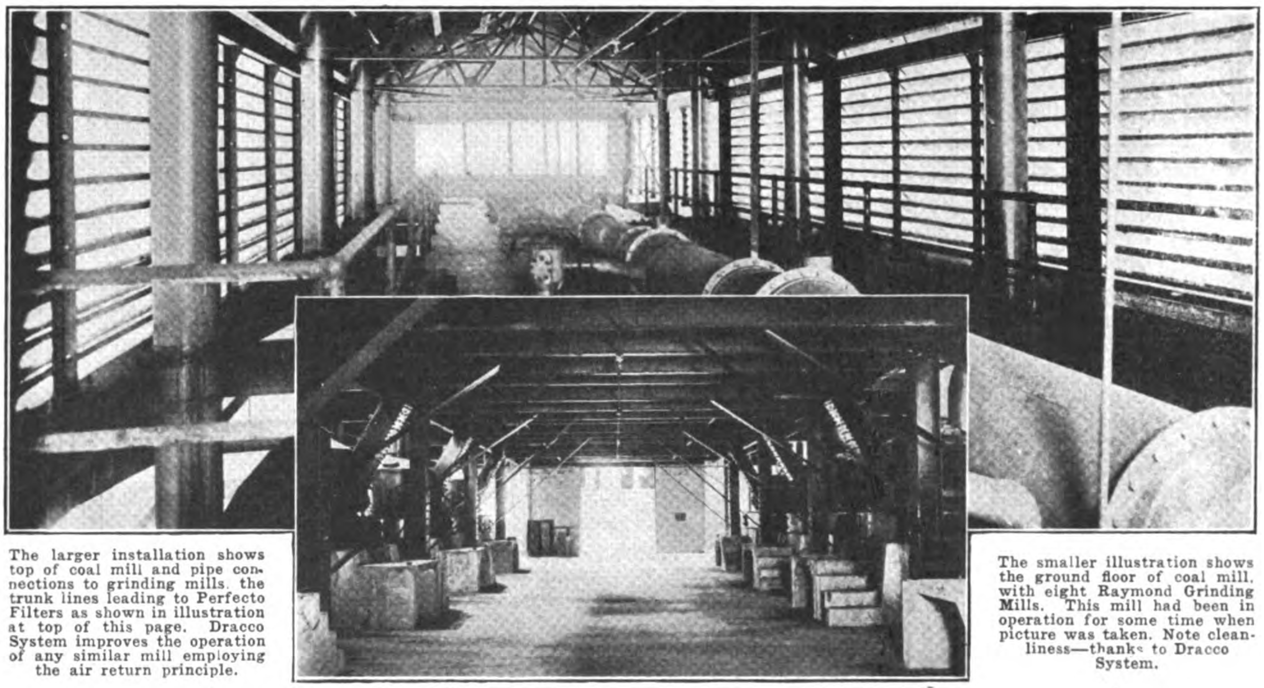
This particular illustration shows the top of six Perfecto Filters. Through pipe at right they are connected with eight Raymond Grinding Mills that grind coal.

Here is just one instance of the efficiency of the Dracco System of dust recovery. In this coal mill, where the material is ground to extreme fineness, the cyclone would not be satisfactory, owing to its inability to collect fine dust efficiently. Bag filters, on the other hand, are subject to clogging, owing to a certain amount of back pressure that is always present.

Materials, such as lead oxide, lime or phosphate rock (particularly if a certain amount of moisture is present) are especially liable to clog. The excess air, unable to find its regular outlet, escapes through any opening that it can find, *contaminating the surroundings with dust.*

The Dracco System remedies this difficulty by drawing the excess air completely out of the system and filtering out the last particle from same through Perfecto Filters connected to the vent pipe.

Whatever your particular dust collection or fume recovery problem may be, our engineers can solve it. A request from you will bring prompt response and full particulars.



The larger installation shows top of coal mill and pipe connections to grinding mills, the trunk lines leading to Perfecto Filters as shown in illustration at top of this page. Dracco System improves the operation of any similar mill employing the air return principle.

The smaller illustration shows the ground floor of coal mill, with eight Raymond Grinding Mills. This mill had been in operation for some time when picture was taken. Note cleanliness—thanks to Dracco System.

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

(*Continued from page 38*)

bulk material is shown in Fig. 12 and Fig. 13. This is, in the true sense of the word, a cable operated monorail system and has been found particularly adapted to the handling of ashes, coal, sand, crushed rock, gravel and similar materials. Due to the fact that the hoist and operator do not travel on the monorail with the load, a much less expensive construction is needed than with other types of monorail systems. The loading and unloading of this equipment is a particular feature as it is different than with other monorail systems. In these installations, the coal empties out of the car and falls by gravity through a specially constructed steel chute into the conveying bucket, which is suspended from guide rails in a pit on the side of the track. When the bucket is filled, the hoist operator closes the gate in the chute, thereby shutting off the flow of material into the bucket. The hoisting drum is then engaged which raises the bucket to the required height. The operation of the traction drum of the hoist then moves the bucket along the monorail track to the point where the operator wishes to dump the coal. The bucket is then lowered until it comes in contact with the coal pile. This contact releases a latch on the bottom of the bucket which opens it, permitting the material to flow out gently, without any breakage, and consequently no degradation. The bucket can be lowered or hoisted at any point, no stoppers or trippers being required. After the material is emptied the bucket is raised, the bottom closes automatically and is again hauled by cable over the monorail track and returned to the pit for a second loading. Hundreds of small industrial plants and coal dealers have found this method of handling very advantageous.

There are many types of cableways and aerial tramways in operation throughout the country and these devices will be found in shipyards, power plants, copper refineries, chemical plants and on construction work. In Fig. 14, we see a simple type of cableway installed during the war and placed in operation at the Portsmouth, New Hampshire, yards for shipbuilding. In this installation, fourteen cableways unloaded railroad cars, distributed materials in storage, transported and elevated all the necessary parts to each shipway; thus reducing the handling cost and conserving a large amount of common labor, of which at that time there was a considerable shortage. This could not be met by any other but mechanical means. A unique feature of this installation is the masts which suport the cableways. These are so arranged that they can be made to lean in either direction so that the direct line of travel on the cableway can cover the entire deck of the ship being served.

Using the same idea of leaning towers, but with improved mechanical features a cableway, known as the rocking type, is another adaptation of the suspension type cableway. With this arrangement, both a longitudinal and transverse movement can be obtained. The movement of the rocking towers is all controlled mechanically by the operator, who also controls the movement of the bucket. The advantage of using rocking towers at both ends of the cableway is the increased storage space which can be obtained over a rectangular area. Frequently, through reduced installation costs, only one tower is designed for rocking, while the other tail tower is held rigid. It will readily be seen that this type of installation will only serve a triangular shaped area instead of a full rectangular area. A few installations of these rocking cableways have been made in industrial plants for the handling of coal from storage yard to power house but there is still a number of industrial applications which could be made using this type of equipment.

Figs. 15 and 16 illustrate a different type of cableway, known as the drag line type. The installation shown in Fig. 15 is handling coal from the outside storage bunkers to the power house. The discharge in this case is directly through the peak of the roof. In Fig. 16 equipment is used for reclaiming copper tailings from hillside dump at an Arizona refinery. This equipment is operated on a somewhat different principle than the other type, as it has a track cable and a load cable, which is really a hauling cable. In operation, the track cable is erected on an incline, and is taut when the empty bucket is near the discharge end. As the operator releases his load cable, the bucket travels down the track cable by gravity until it reaches a point from where the material is to be dumped or reclaimed. In reclaiming, the operator stops his load cable and the bucket is lowered to the material by slacking off the track cables. The load cable is then hauled in and the bucket picks up the material. When it is filled, the track cable is again pulled taut and the material hauled in by means of the load cable to the discharge terminal. In order to serve a wide area, this type of equipment is frequently erected so that the one end of the track cable is anchored to a movable frame mounted on tracks. This permits a movement at right angles to the track cable line.

The cableway mentioned above depends upon gravity to carry the bucket along the track cable and in order to use a similar system over level areas it is necessary to install what is known as the horizontal endless rope cableway. Three illustrations of this type are shown in Figs. 17, 18, and 19. The first two show the equipment being used in an industrial plant for the handling of bulk material, and the third illustration, Fig. 19, shows an installation on the construction of a large concrete bridge.

The operation of this type of equipment is similar to the inclined or semi-gravity type, except that the endless rope is fastened to a double drum winch so as to permit a reversible travel with the bucket, or carrying medium, always under the control of the operator. The load carrying cable, or track cable, is suspended from towers, and is fixed. It does not necessarily have to be placed on the horizontal but can be placed on an incline. When placed on an incline, however, the operating machinery should be located on the higher elevation in order to secure the best results. The endless rope, or hauling cable, is supported from the track cable by rope trolleys. These trolleys are spaced at regular intervals by using chain or rope spacers. Fig. 18 shows how these spacers festoon when the bucket is hauled in to the driving end; and Fig. 17 shows how the cable trolleys support the endless rope when the bucket is well out on the track and ready to discharge. The pick-up and release of these trolleys is automatic and is accomplished by means of a horn arrangement attached to the cable carriage.

Many installations of this type are in operation in coal fields and cement plants. Frequently the span between head-towers will run well over 2,000 feet, although the average cableway spans, between head-towers, will run a distance of 1,000 feet or less. When crossing over railroad tracks or roadways, it is advisable to erect a

(*Continued on page 42*)

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THE CALCULAGRAPH
THE ELAPSED TIME RECORDER

(*Continued from page 40*)

safety net, or structure, so that in case of accident, the load or cables will not fall on passing trains or persons.

Cable tramways, or aerial tramways, are identical, although the two terms are used by different manufacturers. This equipment is also operated by means of cables but is entirely different in construction and operation than cableways. Tramways are supported not only by head-towers, but by intermediate supports, so that it is possible for this type of equipment to serve on long hauls. Installations have been made where the distance, or length of travel, is a matter of miles instead of feet. The installation shown in Fig. 23 is located in Pachuca, Mexico, and is four miles long. It is used to handle silver ore, at the rate of 100 tons per hour, over mountainous country. As is the case with other types of materials handling equipment, we find tramways divided into several classes, three of which are shown in the illustrations from Figs. 20 to 25.

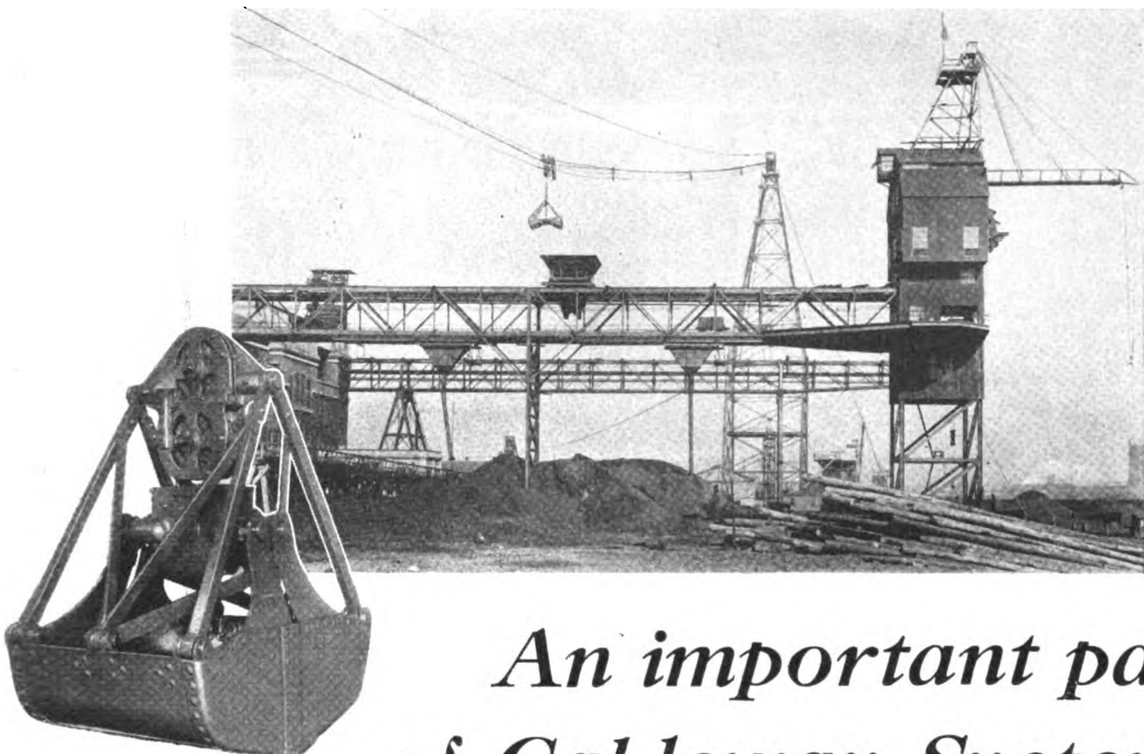
Fig. 20 shows one of the intermediate supports for an aerial tramway. It will be noted that the structure is very simple and inexpensive. The method of dumping the bucket on this tramway is shown in Fig. 21 and the caption explains the reason for using a front dump bucket under such conditions. This installation is operating at the Tierney Mining Company, Stone, Ky., and handles refuse from their coal mining operations. It was installed after they had carefully considered other equipment. This aerial tramway is known as a two-bucket system and is 1,320 feet long, with a capacity of 40 tons per hour, when dumping at a point 1,150 feet from the loading station. The two-bucket tramway system, as the name implies, consists of two buckets suspended on carriers, operating back and forth upon separate parallel stationary track cables. Buckets are spaced so that when one bucket is discharging the other is being loaded.

Two bucket systems of aerial tramways will be found operating in the transportation of ore, sand, gravel, clay and similar bulk material. As in the above installation they provide an economical method of disposing of waste rock and refuse from various industries, for the reason that the buckets are automatically dumped while in the air, and only one attendant is required for the operation of the entire tramway. The operator is located at the loading station and controls the filling of buckets as well as the power and speed of the endless traction rope or hauling line.

Aerial tramways, using continuous stationary load carrying or track cables and equipped with a number of buckets which are propelled by a continuous hauling cable, are laid out as shown in Fig. 22. It will be noted that the contour of the country is not of any consequence when this type of equipment is used for the handling of material. In operating this type, the hauling cable is kept continually running when loads are being handled. The buckets, or carriers, are suspended on trolleys from the track cable and attached to the hauling cable by friction grips. These carriers are distributed on the track cable at regular intervals according to the quantity of material being transported. Usually, they move in a circuit between the loading and discharge terminal stations. The loaded ones always traveling on one side of the line, while the empties return on the parallel cables, on the opposite sides. In some installations (Fig. 22) the

(*Continued on page 45*)

Hayward Buckets



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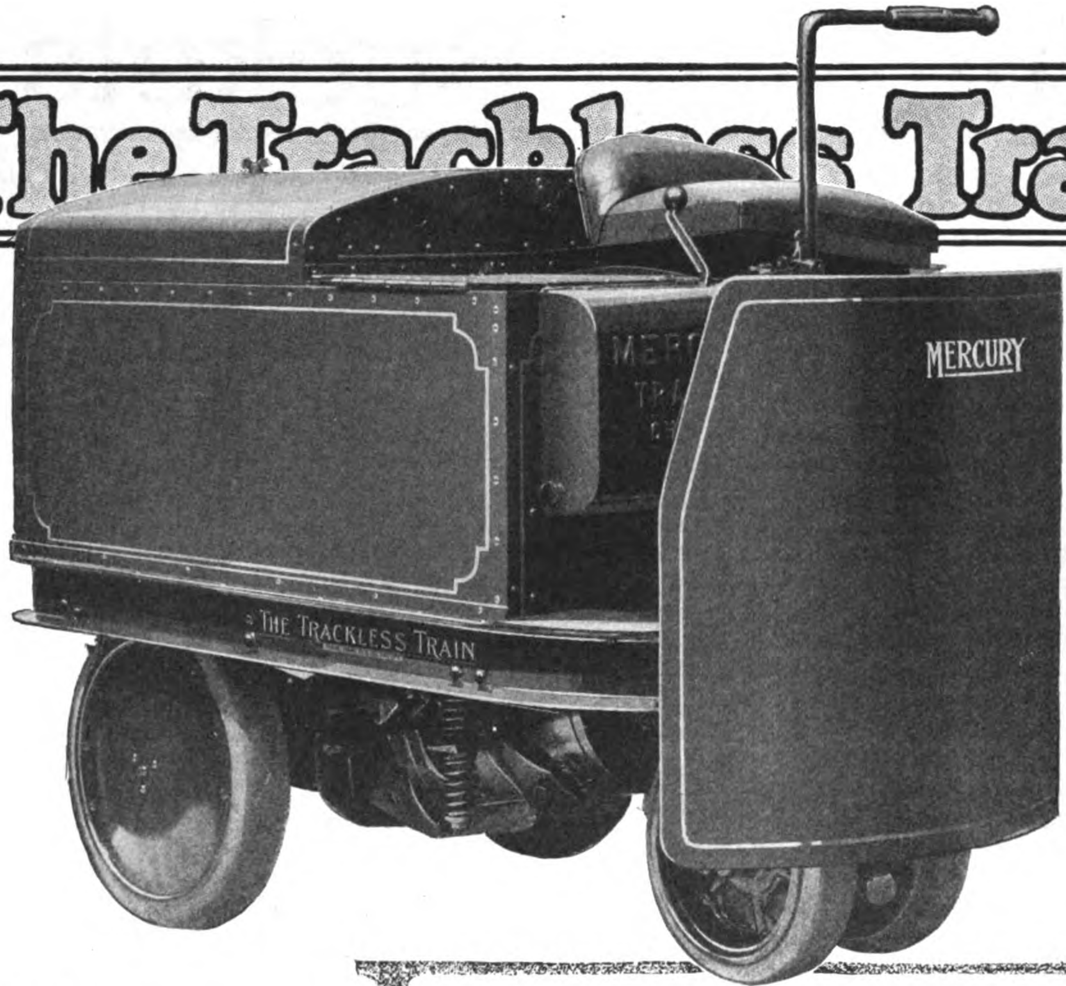

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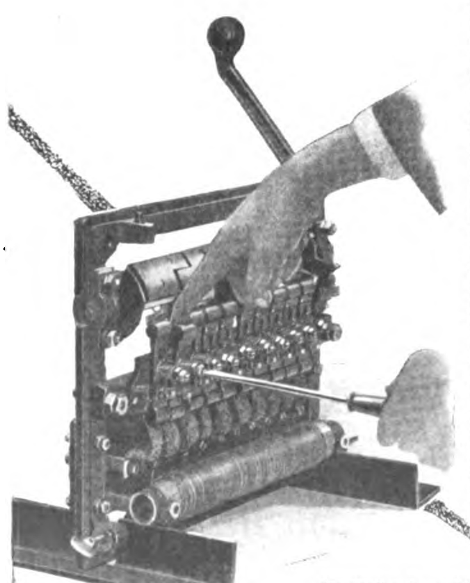


Controller Assembly with cover removed.

—and the controller is but one of nine outstanding features of The Mercury "Type-H." The others are fully covered in Bulletin No. 106. Request a copy now.

(*Continued from page* 42)

outgoing and incoming cables are widely separated, while on long hauls (Fig. 23) the cables are placed parallel, so as to reduce the cost of erecting track cable supporting towers. Aerial tramway installations of this class will be found operating in many industries, both in this country and in foreign lands. Installations having been made for the handling of sugar cane, silver and gold ore, bananas, oil and many other commodities. In order to handle various commodities, a number of devices, such as slings, grab hooks, tongs, and grapples, have been designed, so as to handle stone, logs, lumber, tanks of liquid, barrels and many other packages, and, in addition, various types of bucket carriers, self-dumping turnover type, front door discharge and grab buckets are used for the handling of bulk material.

Another class of aerial tramway uses two parallel track cables in place of one, and on these installations the supporting towers and cables are arranged as shown in Figs. 24 and 25. In this type, the load is carried in small four wheel cars, mounted on the track cables, and drawn by a traction cable, secured to the bottom of the car. These cars are loaded by passing under hoppers, filled with the materials to be transported and the loaded cars travel on the upper run. In this type of tramway, the discharge takes place at a terminal located at the end of the run, where the car passes around the large drum, discharging the material by gravity. The return trip to the loading point is made on the lower track with the car in an inverted position. The loading again takes place when the car returns to the upper run. When this type of aerial tramway is installed for the disposal of waste, or piling of material for storage, cars or carriers with bottom doors hinged at the end are installed instead of the type of car shown in Figs. 24 and 25. The entire operation is similar to that previously described except that a tripper is suspended from the cables in such a manner that the bottom doors of the car are automatically unlatched by the tripper; thus dumping the material at whatever point desired. The trippers are movable and can be arranged to discharge any, all, or no cars, as may be required. A positive and automatic closer is installed at the terminal so that all cars on the return run are in the proper condition to receive the next load when arriving at the feeding point.

The installation in Fig. 25 shows a good reason for installing an aerial tramway system and we believe the reader will agree that it is easier to span a body of water, with the cables as shown, than it would be to build a bridge for any other type of conveying equipment or industrial railway system. The cost of installing the cables would also be considerably less than if a bridge or structure were erected.

A number of industrial plants have installed cable hauls for moving railroad cars, both short and long distances. This type of equipment was described in the articles on the Ford Motor Company's plant at River Rouge, which appeared in the August issue and description was given of three or four installations in this one industrial plant. While these cable hauls are used for handling standard gage railroad cars, there are also a number of installations in such industries as quarries, sand pits, etc., where cables are used for pulling trains of industrial cars up steep inclines. A number of executives have overlooked the possibility of propelling industrial

(*Continued on page* 47)

(*Continued from page 45*)

railways by means of cables; not only on the incline but also on the horizontal run. This type of equipment has been used extensively in England, on the continent of Europe, in Cuba and other countries, and there is no reason why it should not be used more extensively in American industrial plants. An installation of this cable propelled industrial railway consists mainly of a regular industrial track system, fully equipped with cars, but instead of using locomotives for hauling the loads, cables are employed. In some cases, these cables are suspended overhead, but more frequently they operate in guides and around sheaves, which are located between the tracks.

The average industrial executive and plant engineer is well acquainted with the use of cables in connection with freight and passenger elevators, on various types of cranes, hoists, etc., but they never look to the possible substitution of cables for chains on other materials handling equipment. We believe that a more extensive study of the use of cables would not only benefit the cable manufacturers, but would also be of material assistance to the industrial executive. The equipment described in this article is only a small portion of that which is now successfully operating in various industries throughout the world.

OVER 260 exhibitors have been assigned space at the Third National Exposition of Power & Mechanical Engineering which will be held in the Grand Central Palace, New York City, from December 1 through December 6. As this number is more than two times greater than those who had engaged space on August first a year ago, the indications are that the coming event will be of tremendous interest and importance.

The 1923 Exposition drew an attendance of 62,079 engineers, executives, financiers, operating men, as well as large numbers of engineering students with their instructors. This is an increase of 15,000 over the number who attended the 1922 Exposition.

As the expressions of appreciation and interest in the 1923 exhibit were proof of the value of the Exposition and as the large attendance of vitally interested visitors was a great satisfaction to those exhibiting, it is safe to assume that the coming event will greatly surpass all of its predecessors. The constant growth of the Exposition is interesting proof that the industries related to power and mechanical engineering are in a state of rapid development, and need the inspiration and ideas started at the Exposition. The growth of the Exposition has also been an object lesson to these industries, for in addition to giving the engineering and general public an idea of the size and importance of the industries, it has dignified the industries in the eyes of those engaged in them and presented a perspective of functions and methods that nothing else could have provided.

The Exposition will, as usual, parallel the meetings of The American Society of Mechanical Engineers and the American Society of Refrigerating Engineers.

Individual or Group Drive?

By Robert W. Drake

THE choice between group and individual drive for most ordinary manufacturing plants cannot be intelligently made for the plant in toto. Some applications can certainly be most economically group driven. For some applications individual drive is unquestionably best. But the great majority of drives in most factories can be satisfactorily designed in either way. The decision as to the "best way" in these cases can only be made by balancing the very much larger first cost and maintenance of the individual plan against any increase in output which is likely to result. There are a half dozen other advantages and disadvantages of the two types of drive which have been used in arguments pro and con in the past; power saving, etc. It is shown below that several of these advantages are more fancied than real. There is some compensating disadvantage which just about balances the saving.

Whenever two such alternatives are under consideration one searches for a method to evaluate the relative advantage and disadvantage in dollars, to aid in a decision. The writer has made an effort to give data which will help in such a comparison in the absence of data derived from your particular industry or conditions.

Each type of drive has its place. In general there is a field where each is supreme and it is folly to attempt to apply the other. There is a large middle ground where either may be used and where each case must be decided upon its merits. This article aims to offer a number of suggestions to aid in such a decision.

First, let us briefly mention a few examples of applications in which individual drive shows undoubted superiority. These need little discussion and it is well to have them out of the way. Where traveling crane service is needed over an area, individual drive is the only reasonable solution in most cases. Overhead shafts and belts are out of the question.

On very large work where it is cheaper to move the machine tools to the work than to move the work to the machine, individual drive is, of course, indicated.

Any machine which takes twenty-five to fifty horsepower or more, and operates at a fairly uniform load not far from full load, particularly if the speed is high, should be considered for individual drive. In some special applications involving very frequent stops, starts, reversals, or speed variations, the controlling of which absorbs a considerable part of the operator's time, group drive is ruled out, due to the convenience of the electric control which makes possible a saving in time over mechanical control, and the fact that the clutches, brakes, etc., necessary to give a comparable operation would require more repair, or give decreased reliability.

In the great majority of applications either group or individual drive can be used. In the last analysis a decision should be based on a balancing of the advantages of group drive against those of individual drive.

The average load on an individual drive motor is only, say 30 per cent. capacity. This results in lower power factor. It is beyond the province of this article to enter into a technical discussion of power factor, suffice it to say that the ordinary squirrel cage or slip ring types of induction motors almost universally used because of their simplicity and reliability, take from the source of power two kinds of current simultaneously; power current, and idle or magnetising current. The latter requires no coal (no energy) to produce it, but the sizes of lines, switches, transformers, generators, etc., must be proportioned to carry it nevertheless, and the quantity of such current required is substantially independent of the load on the motors, provided only that the motors are running at all. Worse, small and slow speed motors require more of this idle current in proportion than do large and high speed motors, so the individual drive installation with its three to five times greater capacity of smaller motors installed, is at a great disadvantage in this respect, say in a ratio of 5 to 1 or worse. The cost of feeder mains, generators, switchboard, powerhouse buildings, etc., will be increased on this account. In case power is purchased the corresponding additional investment on the part of the supplier is very often taken care of by a power factor clause in the contract and a corresponding increased rate for power. There are various well recognized methods of combating this condition and improving the power factor, but all involve additional cost. They may thus reduce the above stated ratio somewhat but they cannot approach equality in costs.

Let us next consider the power consumed. In most discussions of this subject it is stated that the power consumed is much less with individual drive. In my experience the difference has been more fancied than real. It is true that in the old days when an entire group of buildings was driven from one large engine with belts in tunnels from basement to basement, massive main shafting, bevel gears, or large quarter turn belts to turn corners, and all the complication of old time millwrighting, losses in power transmissions were ordinarily 30% and sometimes with poorly planned installations reached 50%. With modern drives in groups of seven and one-half to fifty, and occasionally (in the case of heavy machines) 75 to 100 horsepower, a large number of tests made under the author's direction indicates an average loss including countershaft losses of 12½% as ordinarily tested, with a probable actual loss in operation of 15 or 16%. Of this loss only 1/6 was in the main line shafting. The remaining 5/6 was in the counter shafting. At first sight this appears impressive, but there are compensating extra losses in individual drives. Even in a completely individually driven shop, belts and countershafts can seldom be completely eliminated to advantage. Some of the above losses remain. Much more important, however, is the greater per cent. loss of power in the smaller motors of an individual drive, necessarily operating on the average at far below their rated load, as explained in a preceding paragraph. Small motors operting at 1/4 to 1/5 full load as compared with larger motors averaging 75% full load or so, have increased loss of 10% to 15%, the latter in case the small motors are also slow in speed as is frequently the case when they are geared to fluctuating loads. If, as is common, the electrical pressure or voltage on the motors near the power house is maintained, say 10% higher than the normal rating for the motors, in order to assure full normal pressure on the motors farther from the source of power, the losses of underloaded individual drive motors are further increased approximately 1%, while the losses of group drive motors operating near load are unaffected. Thus we see that there is little difference in power losses between individual and group drive installations. In fact, if equipment such as synchronous condensers must be operated in the case of individual drive, to avoid a penalty in increased rate for purchase power, or increased investment in generating equipment, including, as is logical, the losses in this corrective equipment in the comparison, may actually show a saving in power for group drive.

On the other hand, if there is much overtime work in the shop involving the operation of a very few machines in a room, for many hours per year, overtime; with a group drive, the corresponding line shaft losses from operating the group line shafting for a few machines may show a decided loss in power as compared with individual drive. Similarly in an industry which is highly but not completely seasonal, where through a part of the year only a few machines are operated, a similar condition arises. If such conditions can be forseen the overtime or off-season machines in a room may be arranged in a separate group, or if they cannot be located in a group together, may be individually driven, leaving the remainder of the machines in one or more groups.

Reliability. In a large highly organized shop where the inventory of work in progress is kept at a minimum to reduce investment in unfinished product, and where, therefore, a manufacturing delay of a few hours, or a day or two, in one part of the plant will throw many other departments out of step, reliability of motive power frequently outweighs considerations of first cost or power loss. In almost any plant this is true during periods of abnormal activity. There are many drives in most industrial plants which will cause loss out of all proportion to such costs if they are shut down for minutes or hours only. Examples of such drives are pumps supplying cooling water to parts which will be destroyed in a short time without it, especially if long expensive dismantling is required to make replacements. Such drives should be in duplicate, and when there is only one source of electric service available the spare should be steam, gasoline or Diesel Engine driven.

Primarily there are two phases to reliability from the executive's standpoint:

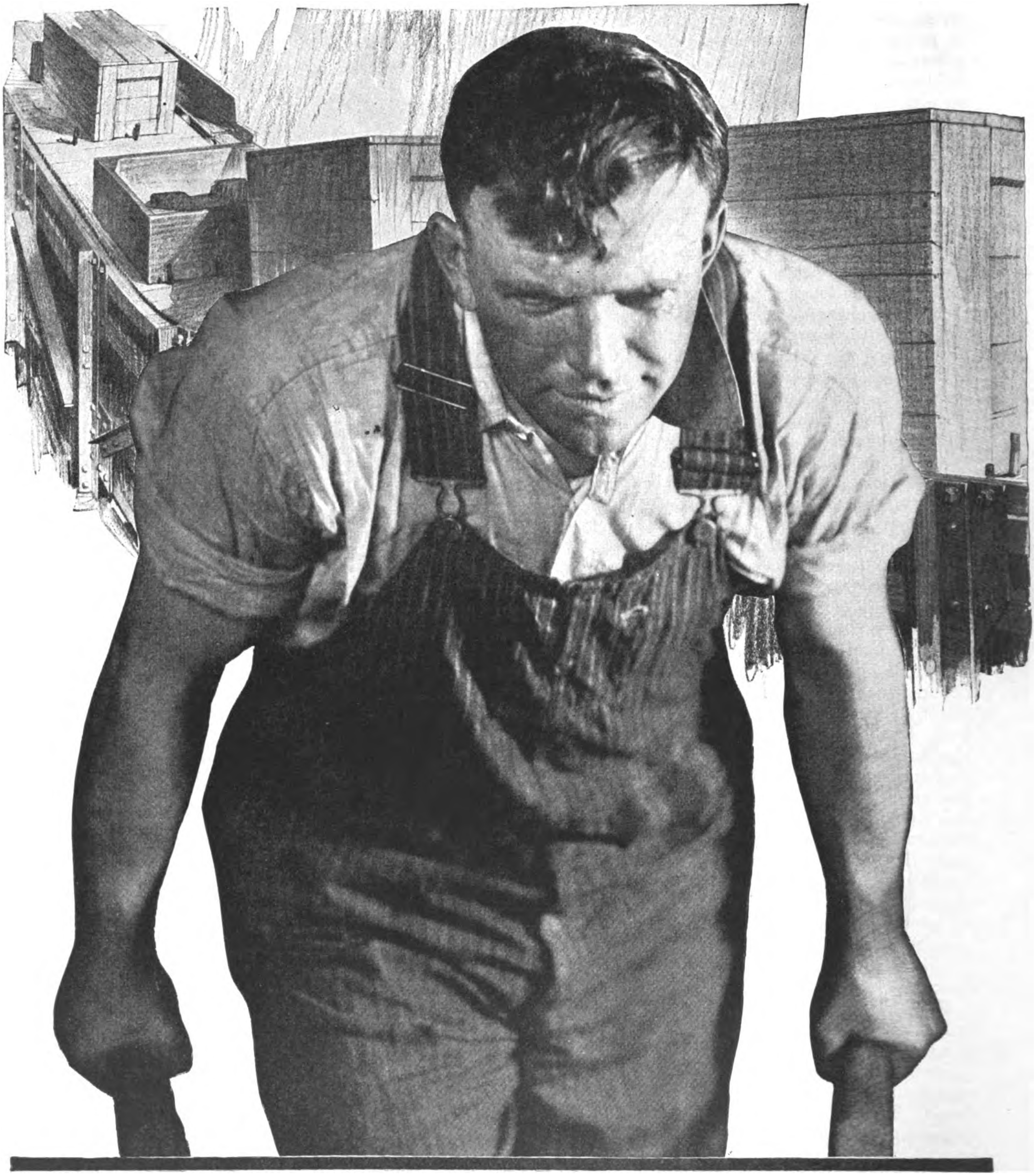
First, there is equipment which seldom breaks down, or in a comparison of reliability, equipment which breaks down less often.

Second, we must consider the expedients possible to assure substantially continuous service in spite of breakdown. This ordinarily means spare equipment with arrangements making possible quick interchange in case of breakdown.

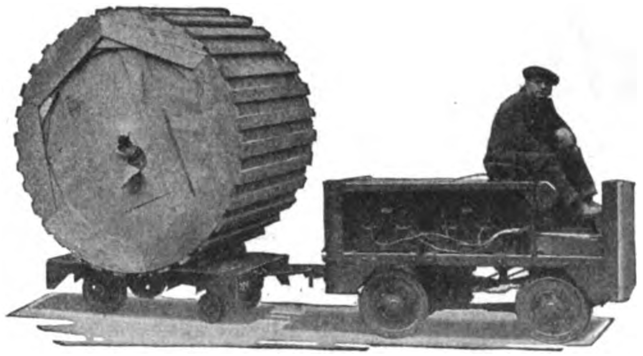
As to the first sort of reliability, with individual drive it is, of course, evident that the total number of motor breakdowns per year will be greater because there are so many more motors involved. It is less evident but none the less true that the total number of motor breakdowns per motor installed is always far greater with individual drives. Some of the reasons are as follows:

Small motors are less rugged. In A.C. motors most small motors are wound with "soft coils" and partially

(*Continued on page* 52)



JEFFREY



(Continued from page 49)

closed slots which leads to more frequent breakdowns to ground at the coil ends than is the case with larger motors having form wound coils. In D.C. motors the circumferential creepage distance on the mica ring at the end of the commutator is less, leading to more frequent trouble here. Many small motors have die cast bearings or other types of bearings inferior in life to the babbit lined iron or steel shells almost universally used on motors of larger sizes.

If an individually driven machine is overhauled and the bearings adjusted too tight, if a heavier job is put in the machine than it was motored for, due to some new development in tool equipment, the motor is seriously overloaded and not infrequently burns out. In the case of a group drive, such occurrences never happen on a large proportion of the machines in the group at once, and an abnormal load on one machine results in a small relative increase in load on the driving motor.

Individual drive motors are ordinarily located on the driven machine, frequently on the floor nearby. Group drive motors are most often on the ceiling. Thus, one of the most common causes of breakdown in motors, viz., foreign body entering the motor, is far less frequent with group drives. Steel chips, cutting compound, broken glass from lamps, etc., seldom reach the ceiling.

Many individual drive motors are necessarily geared, which wears out bearings more rapidly than does belt drive. A fair average life for a pair of bearings on a 50 hp. motor driving a group is five to ten years. For a geared 5 hp. motor twice as many months, while in exceptional cases the life of bearings on gear drives is measured in weeks only. Even with average to better routine inspection, a bearing failure occasionally causes a rotor to rub and causes a breakdown.

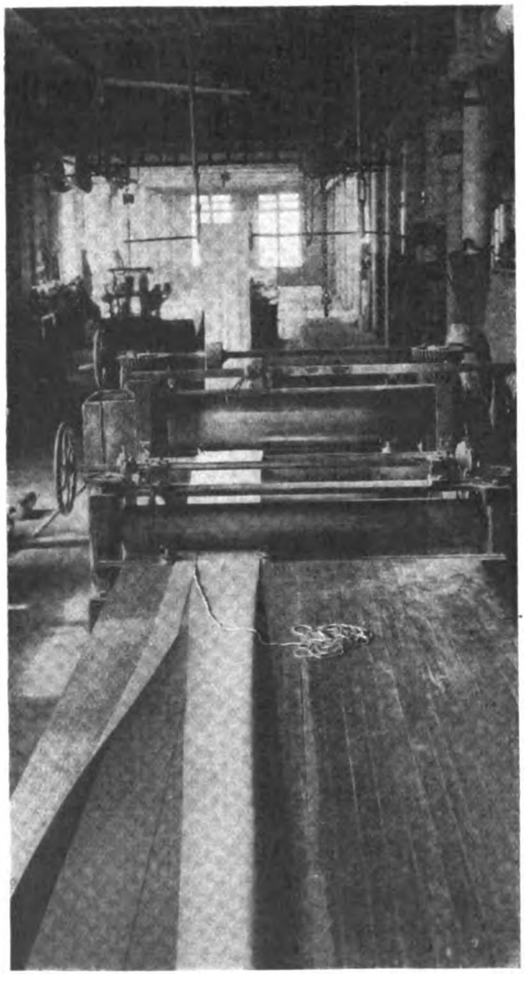
Judging from two similar plants studied by the author the ratio of breakdowns per motor installed favors group drive approximately 4 to 1. Nor is this all, for in an individually driven plant the number of motors installed is far greater than where one motor drives a group of machines. Thus, not only are motor breakdowns (in an individually driven shop) more numerous in a 4 to 1 ratio, per motor installed, but there are several times as many motors installed. Depending on the class of work, and consequently on the number of machines which can be grouped together to advantage, we have a relative number of motor breakdowns to be expected of from 20 to 1 to 100 to 1 or more, in favor of group drive. Of course, we must balance against this the delays from failure in the group line shafting, belting, and the fact that, ordinarily, breakdowns on individual machines disturb the production schedule, less than do breakdowns affecting a group of machines. Delays due to line shafting, bearings, etc., when properly designed and reasonably maintained are almost unheard of. Delays due to failure of the individual drive belts to machines are quite common, but of only a few minutes duration in a well organized shop.

From the standpoint of delays let us consider a factory using say 7,500 electric horsepower mostly in group drives, conditions of the industry not particularly severe on motors as to fumes, steamy atmosphere, dripping water or hot surroundings. With an excellent electrical maintenance force well trained and ably led by experienced foremen located where they can quickly

(Continued on page 55)

BRIEF TALKS ON RUBBER BELTING

A BELT must be chosen for the work it has to do



A Bull Dog Belt receiving its outer covering. Note the cord of high grade rubber which after vulcanizing binds the edges of the outer ply together

BELTING which keeps a plant in continuous operation at full power is an investment of the first order. To do this a belt must not only be intrinsically good but it must be closely adapted to the conditions under which it is to work. A belt for heavy drive work differs not only in weight but in construction from a belt for a light, intermittent pull. For each kind of drive there is One Best Belt, correct in structure, fabric, size and in the composition of the "friction" or rubber compound with which the fabric is impregnated.

We make rubber belts for heavy and light transmission, also for conveyor and elevator work. We have the largest factory in the world devoted exclusively to the manufacture of mechanical rubber goods. We are anxious to be helpful in enabling each industry to secure the *best possible belt for the work in hand,* whether it be our Extra Heavy Bull Dog for extra heavy work or the springy, flexible Perfection for the high speed and small pulleys. Our engineering department is as ready to supply *information* as our manufacturing department is to supply belts. Don't hesitate to write us if you have a type of service for which you have not found a satisfactory belt.

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(*Continued from page* 52)

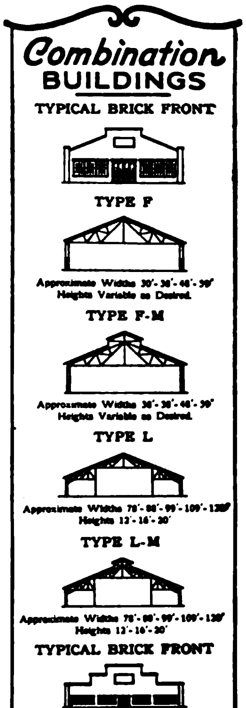
reach the "territory" under their charge, it should be possible to operate on the average, with only two to ten delays per year of more than one hour duration caused by motor or control breakdown.

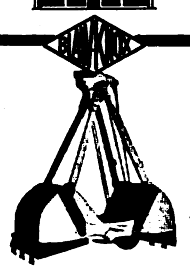
The number and to a still greater extent, the duration of these delays will depend entirely upon the policy of the management as to spare equipment. If through the years there has been a close adherence to standardization in the purchase of motors and control equipment; if spare motor of the same size and speed has been purchased with the first motor of a new type; delays will be few and short, seldom exceeding one hour, and never exceeding a day. With an "economical" administration and no spare equipment, delays will frequently last until material can be obtained and a motor rewound, two days to a month. This latter figure really need never be approached if a stock of repair coils is maintained, but an organization which cannot see the advantage of stocking spare motors for breakdown service, can seldom see a sufficient return to make it worth while to stock spare coils. With this same hypothetical factory individually driven, there would be in the order of one delay, exceeding one hour every day, caused by motor or controller trouble. The duration of these delays can be limited by an adequate stock of spare motors to an even greater extent than is possible with group drives. The individual drive motors are small, light and easily handled in general, and they are generally located where they can be conveniently changed. If the electrical department is properly organized for it, the majority of such changes can be made in one hour. For an individually driven plant to carry a complete stock of spares covering every drive, or substantially every drive, in service is a very much greater burden than a similar stock for a group driven plant. The individual drive plant frequently purchases its machines complete with motor. Thus, they accumulate a heterogeneous assortment of motors of every conceivable make, speed, size and type, very few of a kind. Thus, the number of spares which must be purchased to assure substantial continuity of service is very large, so large as to be considered a financial burden. If the purchaser attempts to specify the type and speed of motor to be furnished with his individually driven equipment, in order to make possible an attempt at standardization, he meets the universal answer of deferred delivery. The best way to cope with this situation is to stock several spare motors of the present shop standard types, sizes, and speeds, in addition to the regular breakdown spare, and purchase new machinery, less motor, motor to be shipped by the purchaser to the machine builder's shop and installed by him. In more than half the cases this solves the problem.

Location of machines to suit the continuity of manufacturing operations without regard to the location of lineshafting. In almost any shop there are instances where it is desired to place one machine at a considerable distance from any other machinery, e. g., in a storage room, etc. Then individual drive is indicated, of course. As for the general run of machines through the shop, no great difficulty is experienced by a resourceful designer in putting the great majority of them on reasonably planned groups. An occasional heavy machine which can be best located at right angles to the room or some such special case can often be individually driven to advantage.

Closer speed adjustment of machine to the work with individual drive. This is a real advantage and may well be the determining feature on certain drives. Where a speed adjustment practically without stops and through a considerable range is of sufficient advantage to warrant the additional expenditure, we have a clear case for individual drive. Since the economic superiority of A. C. for general factory use became so pronounced with the increasing use of purchased power during and since the war, the manufacturers of machine tools have brought out many types having as many as six and eight speeds available with self-contained gears. With an ordinary two-speed countershaft, this gives 12 and 16 speeds, which is ample for most machine tool applications. There are many applications other than machine tools where a considerable saving in power, or a worthwhile increase in output can be had through exact speed regulation with or without the corresponding possibility of automatic control of speed, pressure, or what not, through the use of individual drive. Such applications should be individually driven even in an otherwise group drive shop.

Additional output from individual drive through positive maintenance of the desired speed through the elimination of belt slip, etc. This is a very positive advantage in certain instances, especially in machine tools. The conservative and rule of thumb attitude of some tool builders has led to the marketing of machine tools with belt drives which would have been more than adequate for the maximum possible output of the machine in the days of carbon steel tools, but with high speed steels or stellite it is impossible to avoid excessive belt slip and a consequently reduced output. A geared drive, or a silent chain drive eliminates these slips and maintains constant speed and full output. In the case of most lines of machines, equipment suitable for group drive is available with pulley sizes adequate to do any work of which the machine is capable without overstressing belting to the point where frequent takeup is necessary. Where such is not the case gear drive may offer possibilities of increased output which will amply warrant the increased cost and maintenance of the individual drive plan. There is another side to this question of gear drives versus belt drives. Where through carelessness or accident something "catches" "jams" "blocks" or "strikes," in the case of a gear driven machine tool, something breaks. Generally, there is a considerable delay for repairs and considerable expense. Where a belt drive is used, ordinarily the belt comes off on such occasions and no great damage results. The most common exception to the latter statement occurs in presses and such machines as have a fly wheel built into the machine. In such cases the stored energy in the flywheel is sufficient to break the frame of the press. So common are these accidents that several plant engineers make a practice of using one belt drive somewhere between the motor and the load on each individually driven machine where this is possible. This is a practice to be much recommended in the case of a single machine, the only one in the shop capable at making some necessary item of output. A breakdown on such a machine, especially a broken frame, is serious indeed. In the case of a number of similar individually driven machines the breakdown of one is less of a catastrophe.





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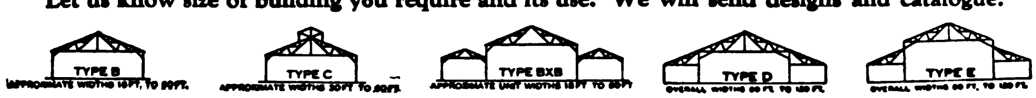

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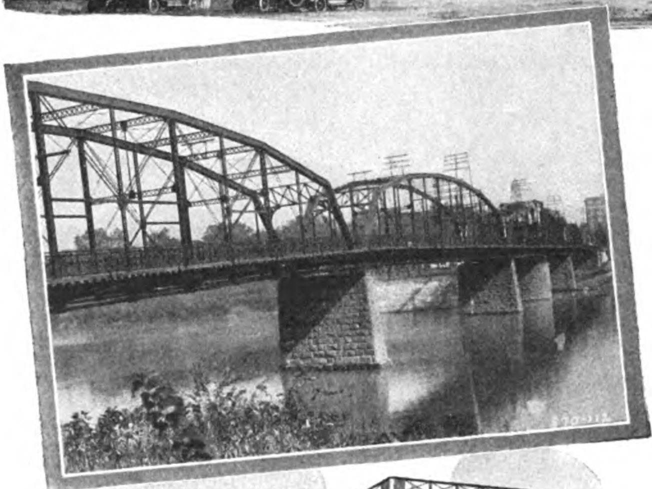

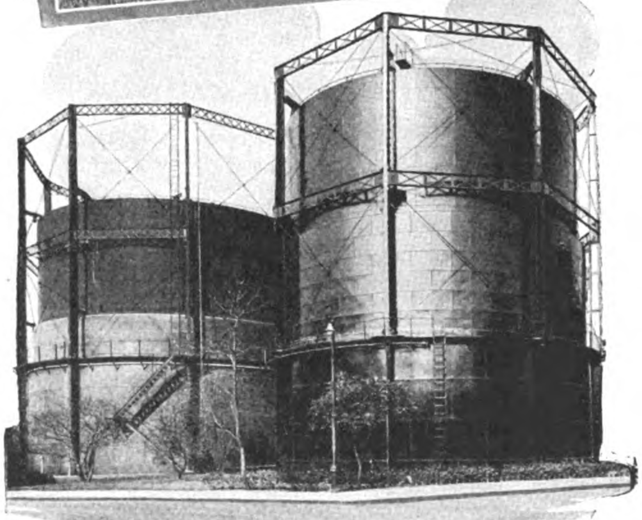

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(*Continued from page 21*)

drain upon the diminishing supply of raw materials so necessary to human progress.

If plant managers and superintendents more fully understood the basic methods to follow to offset rust and decay, there would undoubtedly be a great deal less of it. Protective coatings as made today by up-to-date manufacturers are wonderfully efficient and are responsible for the preservation of millions of dollars' worth of metal surfaces throughout American industry. Constant experimentation, research and development in the laboratories of paint makers are responsible for the production of paints and varnishes that are used in enormous quantities in industrial plants. Frequently, after months of patient work, a finish is developed that successfully meets some particular requirement,—another step forward in the great struggle between the preservation and destruction of metal surfaces. If a protective coating could be applied that would keep out water in every form, and if means could be devised to make the metal resistant to the flow of surface electric currents, there would be no corrosion. There are three sources from which water may come: first, from rainfall; second, from condensation of moisture from the atmosphere; third, from direct contact with water in manufacturing processes. Water may also be present in the oil in the paint coating or absorbed by it in sufficient quantity to stimulate corrosion.

It has further been shown, through many actual tests, that there are certain pigments, which, if allowed to come in contact with iron and steel, have the property of stimulating corrosion, while still others exhibit the tendency to prevent it. When iron is painted with a stimulator of corrosion, such as graphite, if for any reason water finds its way into the paint film, corrosion is bound to take place to a very advanced degree. Graphite paints, however, are very efficient in many cases as finishing coats, but should not be used as first coats directly upon the metal for the reason mentioned. Should a paint be applied to metal that is chemically active in its pigment content in such a way as to convey oxygen to the metal beneath, it will surely stimulate corrosion instead of preventing it. Fig. 5-A shows what happens on a steel panel when painted with a rust-stimulating pigment. In this case the rust has proceeded beneath the paint, outcropping in spots which closely resemble the contour of a miniature volcano. Here is an instance where the coat of paint is practically useless,—in fact the metal might just as well not have been painted.

The most important thing for the plant superintendent to do is to use the proper material and to paint all metal surfaces in and about the plant with sufficient frequency to prevent corrosion. If surface conditions are right and the material used according to directions, rust and decay will be retarded.

In many industrial plants conditions exist which are very difficult to meet with any degree of efficiency. In fact many cases exist where it is impossible to make any recommendations for the preservation of these surfaces. Contact with acid or gaseous fumes frequently causes advanced corrosion. There are paints that will resist such severe conditions for a considerable length of time, and while not affording indefinite protection, their use at regular intervals would be a distinct economy.

Serious difficulty is experienced in preventing rust and corrosion on piping and other surfaces subject to constant contact with moisture or dampness, where water is sprayed, or where it leaks or drips on such surfaces intermittently. Alternate wetting and drying of metal surfaces is particularly severe on paint coats. Piping and other metal surfaces that come in contact with steam and vapor rising from vats or other moisture-creating conditions may be preserved from corrosion, provided the paint is allowed to become thoroughly hard and dry before exposure. In this way the protecting film will present a strong defense to these destructive influences. Any industry which has conditions of this kind to meet, and where production does not permit of shutting down processes long enough to allow thorough drying out of the surface to be painted, should not attempt to paint at all. For it is worse than a waste of time and money to apply paint on a surface that is damp or moist, or in any other sense not in proper condition for painting.

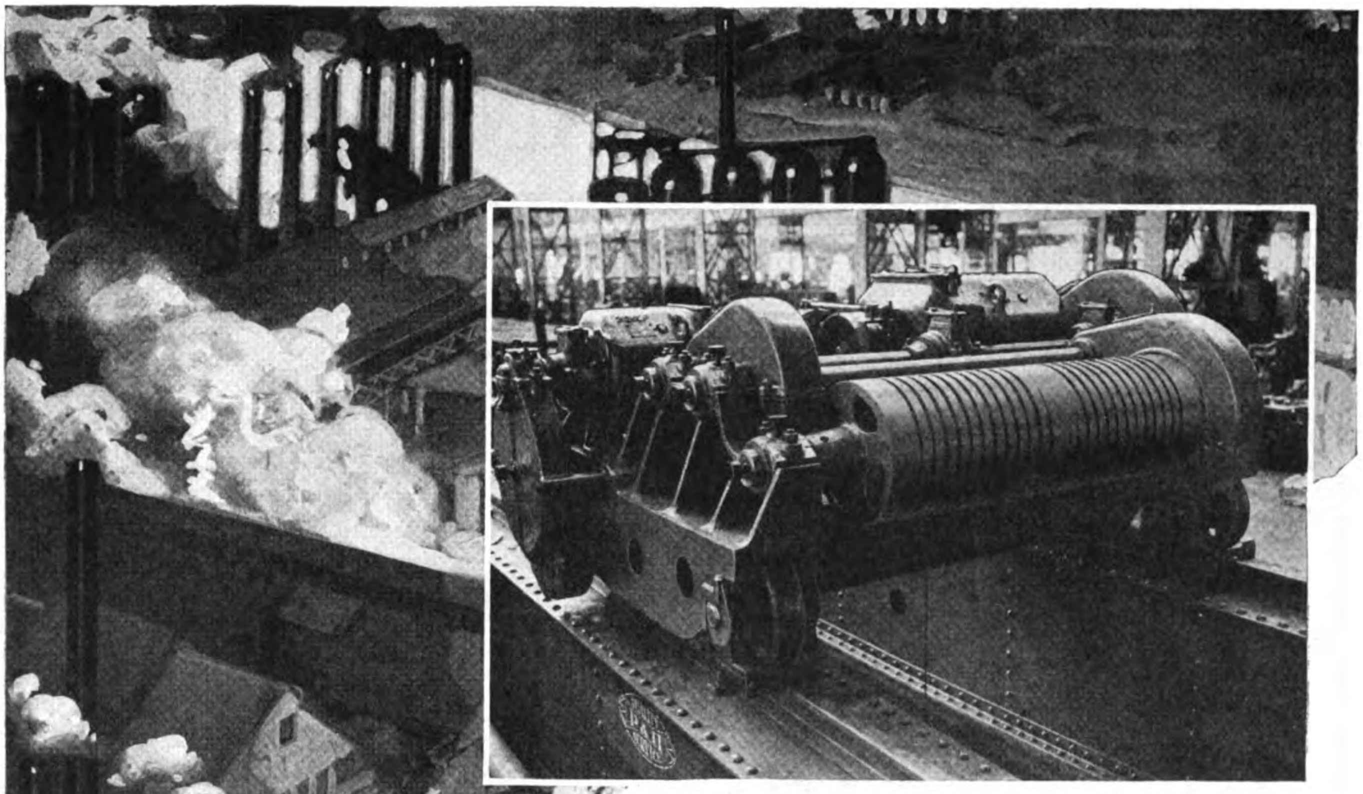
A paint to successfully protect metal surfaces from corrosion should be composed of suitable pigments combined with the proper type of vehicle (liquid portion of a paint), the resultant product possessing the following qualifications:

- Chemically permanent;
- Chemically inert toward iron;
- Resistant to physical damage;
- Impervious to air and moisture;
- Sufficiently elastic to expand and contract without damage to the film;
- Rust-inhibitive (resistant to corrosion)

There must be an affinity between the pigment matter and the oil or vehicle, and the pigment must be exceedingly fine for the most satisfactory results. This is extremely important. For instance, in red lead of the best quality, the particles have a strong attraction for oil, which tends to hold the film together and to make it tough, so that it will not open out into pores. When such a paint is applied it does not break, but makes a continuous film. If this attraction of pigment for vehicle does not exist, the paint may apparently brush out satisfactorily, but be full of breaks and imperfections invisible to the eye, giving poor protection to the metal underneath. Too rapid drying is evidence of unstable chemical condition. Drying is a chemical change and should proceed gradually. In most ready-mixed paints the manufacturer has included sufficient dryer in the product to make it dry satisfactorily under normal conditions. It must be remembered that for every hour subtracted from the drying time, the life of the paint film suffers tremendously. So beware of adding extra dryer to any paint product on your own initiative. Such a procedure has caused endless complaint with the wearing qualities of paint coats.

A paint for use on metal surfaces should be a "non-conductor" of electricity. With the exception of graphite, most pigments are non-conductors. As stated previously, graphite paints may be used as finishing coats on metal surfaces, but should never be applied to the bare metal. Electrolysis begins almost at once, and unless checked it may in time completely destroy the metal. Fig. 5-B shows a close-up of a panel on which graphite has been applied direct to the metal. This photograph was taken after an exposure of eight years. While it is not to be expected that a metal surface will still be in perfect con-

(Continued on page 63)



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(*Continued from page 60*)

dition at the end of eight years, even though painted with a rust-inhibitive paint in the beginning, nevertheless, the inherent strength of the metal should still be intact. In this case, however, the destruction is practically complete.

In Fig. 5-C and 5-D you will note two panels, the left-hand portion of each showing considerable rusting. In fact the protective value of the paints applied on this portion of each is practically nil. The right hand side of each is still in perfect condition. In both cases the right-hand section of each panel has received a first coat of the best rust-inhibitive paint known to paint-making science. This priming coat is composed mainly of a pigment called "basic lead chromate" or "American Vermilion." Tests carried on at Atlantic City by the American Society for Testing Materials showed that at the end of five years, panels painted with this product showed the least evidence of rust. A table further on in the article gives the comparative ratings of these various paints. The panels in this picture were exposed nearly two years,—long enough to demonstrate conclusively the value of a rust-inhibitive paint for use next to the metal surface. Panel (C) was painted with an ordinary linseed-oil paint; panel (D) with a varnish-vehicle paint. While the latter panel is in better shape than the other, it still shows the weakness of a paint of either character when applied to a metal surface, especially when neither is particularly rust-inhibitive.

It is obvious that a paint which dries to a brittle, easily-abrased surface is of little value on metal work. The character of the vehicle in the material has a most important bearing on its toughness. Brittle films soon crack and scale off. These cracks are of two kinds: those which penetrate through to the iron and are caused by lack of strength and toughness in the film, and those which appear only on the outer surface, and are due to too soft and elastic an undercoat. To prevent the latter the priming coat must be hard and firm. Sufficient time must elapse between coats to permit of thorough drying of the first coat. It must contain plenty of pigment and at the same time a considerable degree of hardness, so that it does not involve loss of toughness. This has an extremely important bearing on the wearing and resistant qualities of subsequent coats, permitting them to oppose the action of the elements and the abrasive influences of contact with other surfaces. Numberless cases are found where due to the use of the wrong type of paint, many surfaces fail to be adequately protected from the conditions to be met; whereas, at no greater expense, the right material would have given excellent protection and preservation.

A paint that has an open or porous structure is of little value in the protection of metal surfaces. Many such paints exist and perform well on the surface for which they are intended. But for exterior exposure especially, the paint should dry with a smooth, firm film. The film should prevent the absorption of moisture and be unaffected by atmospheric conditions. When it is remembered that the average paint coat is from 1/500th to 1/1000th of an inch in thickness, the importance of this fact can be more readily understood.

This is one of its most important characteristics. No matter how impervious to air and moisture the film may be, nor how closely it adheres to the surface, if, when dry, it does not expand and contract along with the metal without being affected thereby, it fails in its protective function. In many industrial plants there are extremes of contraction and expansion of metal surfaces which no paint can successfully withstand. But the average or normal expansion or contraction of the metal should exercise no harmful effects upon the paint coat.

A paint film that successfully meets all other qualifications, yet is composed of pigments which stimulate rust and corrosion,—such a paint is worse than none at all. Paint pigments are of three kinds: those that excite rust or corrosion; those that are neutral or which neither assist nor prevent decay; and finally, those which actually possess qualities within themselves which work against corrosive influences. The following table shows the results of a five-year test conducted by Sub-Committee IV of Committee XXX D-1 of the American Society for Testing Materials at Atlantic City, N. J.

AVERAGE RATINGS OF PIGMENTS

The rating of 10 indicates maximum value as a rust-inhibitor.

No.	Pigment	1910	1911	1912	1913	1914
4	Sublimed White Lead	9.5	9.0	8.1	5.9	3.5
5	Sublimed Blue Lead	9.6	8.8	9.0	7.2	6.0
9	Orange Mineral	9.0	8.3	6.9	4.0	3.0
10	Red Lead	8.7	8.3	8.1	6.3	4.0
12	Bright Red Oxide	9.3	8.1	6.7	4.5	2.5
14	Venetian Red	7.2	8.0	6.4	5.1	1.5
15	Metallic Brown	6.3	6.3	6.2	6.1	3.0
16	Natural Graphite	9.1	6.8	6.6	6.2	4.0
17	Artificial Graphite	7.1	5.9	4.4	2.6	0.0
19	Lampblack	7.1	6.3	5.5	4.2	0.0
20	Willow Charcoal	8.8	8.8	8.6	7.9	4.5
21	Carbon Black	8.3	7.2	7.0	6.8	5.0
24	Yellow Ochre	5.8	5.5	5.8	5.2	1.5
34	*American Vermilion*	*9.1*	*10.0*	*9.9*	*9.8*	*7.5*
36	Medium Chrome Yellow	7.0	7.7	6.0	5.2	3.5
39	Zinc Chromate	9.4	9.5	8.8	8.0	4.0
40	Zinc-and-Barium Chromate	9.7	9.5	8.5	7.8	2.5
41	Chrome Green	9.8	9.8	8.6	7.6	5.0
44	Prussian Blue (water stimulative)	9.2	9.0	7.8	6.7	3.5
49	Zinc-and-Lead Chromate	9.5	9.7	9.2	8.3	4.0
51	Magnetic Black Oxide	9.5	9.5	8.6	7.8	4.0

NOTE: No. 34, American Vermilion (Basic Lead Chromate), is given the highest rating as a rust inhibitor.

You will note that the rating average runs generally uniform until the fifth year, when the rating drops rapidly. This would seem to indicate that the proper time for repainting is not later than four years.

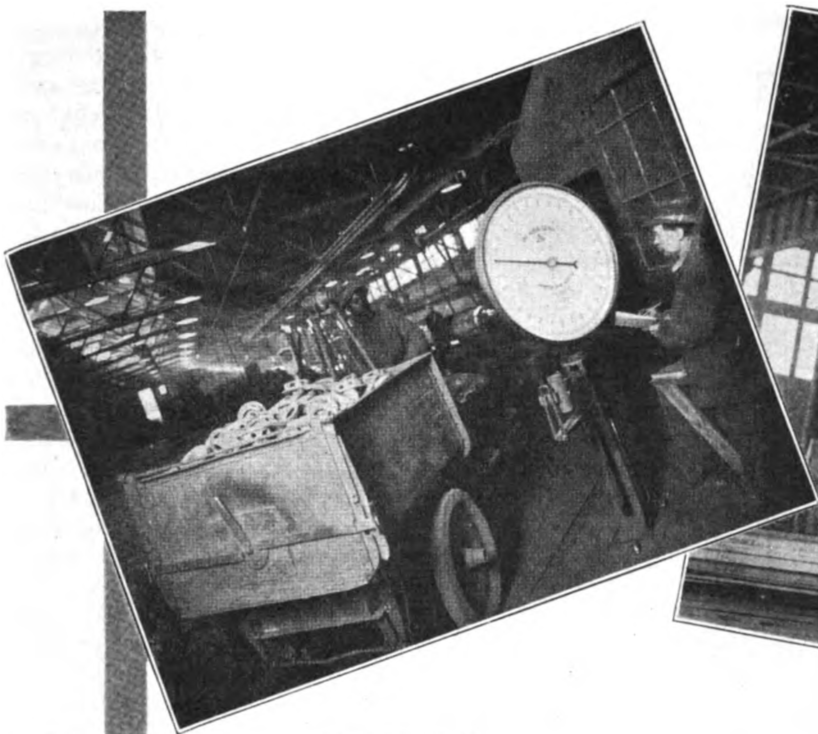
This and other tests conducted by the Society mentioned have proved that basic pigments and chromic compounds make the most efficient paints for application next to the metal surface; that they should be followed with finishing coats of iron oxide, carbon or graphite paints. Such a treatment will give maximum efficiency under most conditions of exposure.

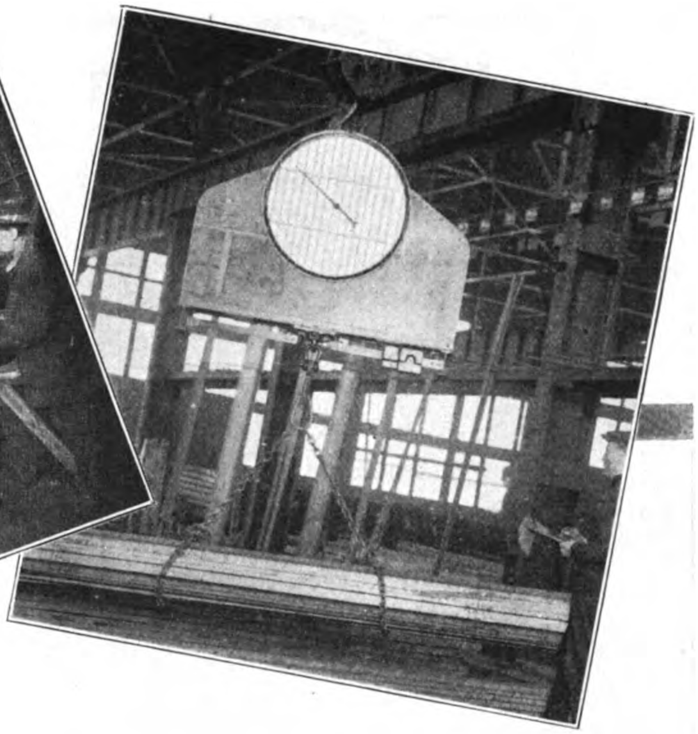
The nature of the vehicle used in metal paints is equally important. Linseed oil, when used without the addition of pigments, is often the direct cause of peeling or blistering of the finishing coats. The oil is seldom dry enough to insure close adherence to the metal surface before the other paints are spread over it. When subsequently painted, the underlying coat of oil is softened, and the moderate heat of the sun is sufficient to cause the entire film to draw up, blister and finally peel off. Too much oil in the paint coat, particularly in or next to the priming coat, will generally cause the same result. If the painting is not finished on an oil-coated structure within a reasonable length of time, the film of oil will have practically perished, the surface will be dead and will not have stability enough to carry the subsequent coat successfully.

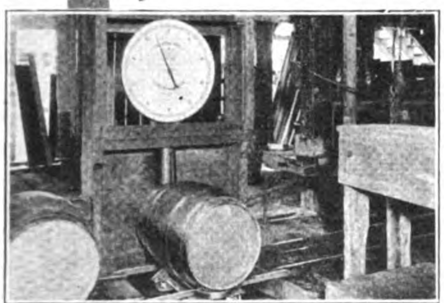
The vehicle of the most successful rust-inhibitive paints is largely composed of high-grade gums and treated oils, which may be combined with linseed oil and drier for proper oxidation. Paints containing tar or those with a tar base should not be used on steel structures exposed to the weather, as tar-paint films rapidly check, crack and alligator.

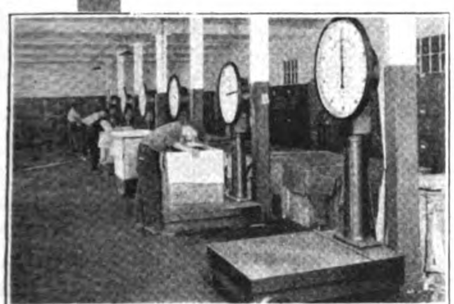
Too much emphasis cannot be laid upon this extremely

(*Continued on page 66*)









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KRON SCALES

(*Continued from page 64*)

important point. Much good paint is spoiled through failure to take sensible precautions to see that the surface is in proper condition for painting. It is obvious that paint cannot be expected to prevent rust and corrosion, if it is applied directly upon a metal surface in an advanced state of corrosion, without first removing the rust already existing.

Should paint be applied over such a surface, it will be found that the rust already present will extend itself underneath the new paint coat and attack the otherwise sound portions of the surface. In time the probabilities are that the strength of the metal will be entirely destroyed, even though from the outside it may look to be in a fair state of preservation. It is of the greatest importance to wirebrush the surface thoroughly, removing the rust and cleaning out the corrosion spots down to the bare metal. Then dust the surface thoroughly and see that it is clean and dry. All grease or oil should be removed by washing with benzine or gasoline. All peeling or scaling paint should be wirebrushed. In some cases it may be advisable to use the sand blast or steel scrapers, removing all mill scale from new surfaces, as well. Where metal has been cleaned by sand blast and the painting done promptly, there will be little danger of corrosion gaining a foothold. The wire brush is an efficient means of getting rid of loose scale or dirt; but it is practically worthless for removing heavy rust or anything which adheres closely to the surface. Such material may be removed with steel scrapers; but deeply corroded spots should be thoroughly cleaned with a chisel, then well brushed out. Where surfaces have been previously painted, and it presents a glossy appearance, it is best to sandpaper or wirebrush the surface sufficiently to remove a portion of the gloss, then dust carefully before applying the new coat.

There is no secret or mystery in the successful painting of new galvanized iron surfaces. Siding and roofs of buildings, cornice work, gutters, drain pipes, etc., are often permitted to remain unpainted, under the mistaken impression that since the metal is galvanized, it will last indefinitely without painting. This, however, is a serious mistake, as has been found by those who have neglected to protect them. It is true that a galvanized iron surface will remain in good condition for a time and apparently show no signs of decay; but when the thin protection afforded the metal by the galvanizing process has disappeared through the action of the elements, there is nothing to prevent corrosion, which usually proceeds at an astonishing rate. Before one knows it the rust has penetrated the metal to such an extent that the application of paint to the surface is of little benefit. These surfaces should be painted promptly when new.

You may say that one can not paint galvanized iron successfully, and that there is no assurance that the paint will adhere to the surface when dry. This, however, need not be true. The surface may be painted with absolute assurance of successful and permanent results, provided the proper method is followed. In the galvanizing process, a thin, almost invisible film of a non-drying oil is left on the surface; and it is this that causes the trouble mentioned regarding the failure of paint to adhere properly to the surface. This must first be removed by either one of the following two processes. The surface may be allowed to "weather" for a period

(*Continued on page 69*)

PHOTOGRAPH *shows Cowan Lift Truck in use at the plant of the Beech-Nut Packing Company, Canajoharie, New York.*

$4,800 more net profit

From a source overlooked by most manufacturers

IN THE plant of the Beech-Nut Packing Company, Canajoharie, New York, the Cowan System of reducing handling costs is saving $4,800 a year in wages alone.

Reducing the cost of handling is a source of profit that is open to all manufacturers. The figure given above is typical of actual saving. Expressed in percent, 40 to 60 percent of handling costs can be saved and added to net profits.

Strangely enough, the importance of this source of profit is being overlooked by most manufacturers. In the few plants where handling costs are known, it is surprising to see how many thousands of dollars they amount to in a year. They amount to a far greater sum than is generally supposed. 40 to 60 percent of them is an amount well worth seeing on the profit side of the ledger.

Would you like to find out whether such a profit is possible for you? Have you any definite data on what your material-handling costs you? At no cost to you, and without obligating yourself in any way, we will, at your request, make a survey of your present handling methods.

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Gentlemen: Please send full information about the Cowan System of Reducing Handling Costs to:

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Name of Company..................................

Street..................................

City...................... *State*....................

(*Continued from page 66*)

of three or four months, no longer. By so doing, the oily surface will have disappeared and the paint applied successfully. The other and safer method is to wash the surface with a solution made by dissolving eight ounces of Copper Acetate or Copper Sulphate in one gallon of warm water. After this solution has been allowed to dry on the surface, the paint may be applied without any fear of its failure to adhere to the surface.

Of all the causes for complaint with the wearing qualities of paint coats, the most prolific is that of faulty application of the material. No matter how good the paint may be, nor how carefully the surface may have been prepared for painting, unless intelligence is used in the use of the material, one cannot hope for satisfactory results.

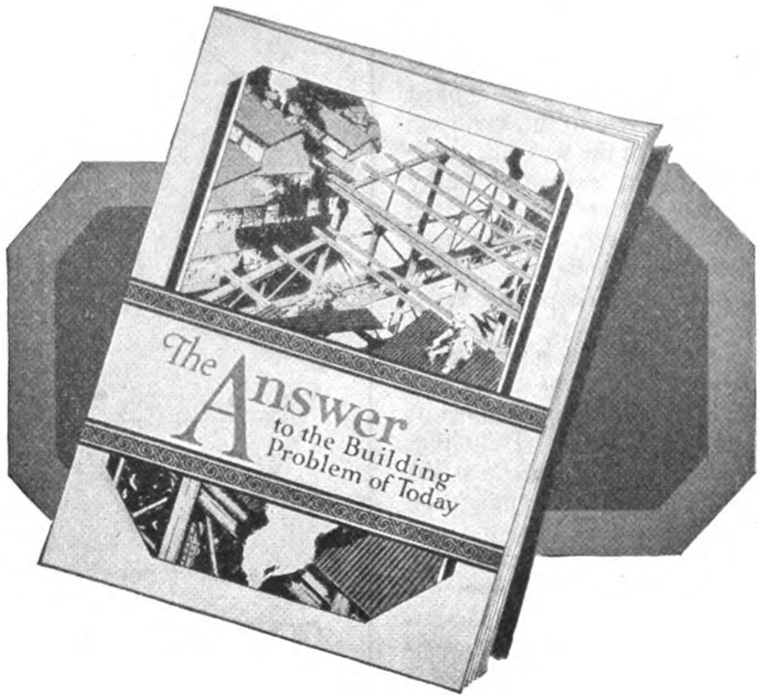
The first necessity is the thorough incorporation of the pigment and vehicle. It is surprising to know how often the individuals responsible for the application of the paint fall down in this important detail. Paint that is not thoroughly stirred cannot possibly produce the proper finish for the reason that when the application is begun, the paint will be too thin, will run, and will fail to hide as it should. In ordering paints containing a pigment, very often request is made that the material be shipped in an iron drum. This package is satisfactory for an oil or a varnish; but it is utterly impractical for a pigment paint. The orifice of such a package is about 2" in diameter. And while it is possible to fill such a container at the paint factory with any sort of a liquid mixture, the main difficulty is encountered by the user. During shipment and on standing in a warehouse, the pigment is bound to settle out and drop gradually to the bottom of the package. Imagine the difficulty, if you will, of incorporating again the pigment with the vehicle in this kind of container. *It simply can't be done!!!* Furthermore, it is not sufficient to simply stir the contents of the package two or three times with any tool that is handy and think you have the contents in shape for application. There are certain methods to be followed, which will insure thorough and complete preparation of the material.

The following should be carefully observed: If received in a barrel, half-barrel or five gallon package, remove the head or top completely; if a gallon or half-gallon can, cut out the top entirely. Have another empty and perfectly clean package, large enough to hold at least half the contents of the original container. If an attempt is made to stir the contents of a full package, much of the liquid may be splashed about, and a much longer time be necessary to make the contents ready for use. Pour off most of the liquid portion, *without stirring,* into the empty receptacle. Use a broad, flat, clean paddle and thoroughly stir the remaining contents until a uniform consistency is secured. See that all pigment is loosened up from the bottom and sides of the package. Then pour back the liquid portion from the other container, a little at a time, thoroughly stirring all the while. Stir each lot into the pigment completely before adding more. Finally all the liquid will be back in the original container, and the contents will be in ideal shape for use.

As a general thing it will be found that where large quantities are involved the purchase of the paint in the five-gallon package will be the most satisfactory and

(*Continued on page 71*)

Every Building Owner



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(*Continued from page 69*)

economical procedure. Barrels are heavy and hard to transport from place to place. A great amount of waste is entailed through skinning over of the contents of the package, after the head has been removed. Even though the barrel be equipped with an agitator, it will be found that a considerable portion of the pigment has adhered to the sides of the package, which is extremely difficult to dislodge and work up.

Faulty application has been mentioned as the foremost contributing cause to unsatisfactory results in painting metal surfaces. In addition, the following should be carefully noted:

1. **Moisture**—Paint will blister and peel, if the surface to be painted is damp or wet. For this reason, exterior painting should never be done in wet or freezing weather. Interior painting should not be done in a moist atmosphere.

2. **Thickness of Coat**—Paint will blister and peel if applied too heavily. *Brush out well.* Three thin coats will give much better service than two thick coats. Use a good brush, one that is suitable for the work to be done.

3. **Wrong or Poor Primer**—No matter how good or how well suited for the work the finishing coat may be, it will fail to perform satisfactorily if the primer is not right. *Make sure of the primer.* This is of utmost importance. A different shade from the finishing coat is advised, for checking purposes.

4. **Time for Hardening**—Allow plenty of time for drying before applying succeeding coat. Finishing coats will not adhere properly if previous coats are not thoroughly dry.

5. **Use of Thinners**—Follow the manufacturer's recommendations as to the material to use, if thinning is required. Make sure of the quality and quantity of the thinners used. Guard against cheap and worthless oils, japans, etc. Be equally careful not to "cut" the paint too much, for, once added, it is impossible to get them back.

6. **Thorough Stirring**—See that the pigment is thoroughly incorporated with the vehicle. Follow carefully the directions for the preparation of the material for use.

7. **Keep Packages Closed**—Cans that have been opened and part of the contents used should be treated so as to preserve the remaining material for future use. If this is not done, the volatile material will evaporate, leaving a heavy mass of pigment, which must be thinned and worked over again for application. If a large package and the lid has been retained, it should be sealed up again as tightly as possible. If a gallon or smaller can, and the lid has been cut out, a piece of heavy paper should be tied over the top. In any event the material should be covered, if for no other reason than to keep out dust, dirt and other foreign material. If on reopening, the contents have skinned over, carefully remove the skin. *Do not stir into the paint under any circumstances.*

Why Industries Leave Big Cities

(*Continued from page* 18)

land to Pennsylvania, low living costs due to adequate housing and an agricultural back-country, and proximity to New York and other industrial centers, make it a logical seat for manufacturing. When the industrial disadvantages of large cities to many lines of business began to become evident, and various manufacturers recognized the importance of proper location, Poughkeepsie began to grow, and in recent years has added many firms from New York and other cities, including automobile parts, electric appliances, clothing, tobacco, cigars, pianos and other diversified products.

The heavy immigration of the past thirty years poured cheap labor into our large cities and to the one-industry towns, where their respective languages were already spoken. With the restriction policy now in force, which bids fair to continue for a long time, this differential in favor of size is passing, and the immigrants now here, as they become more familiar with the country, will spread out to other and smaller towns as opportunity beckons.

Poughkeepsie is but one of many cities in the 25-100,000 population class which census reports show are increasing industrially faster than the big cities. New Brunswick, N. J., thirty miles from New York, is another example.

Richmond, Va., Middletown, O., and Springfield, Mass., are examples of medium sized cities that are growing industrially and attracting plants.

All these towns have diversified industries, good housing, and an industrial civilization of live and let live, where labor and labor's children can live a normal healthy life and save for old age under the existing wage scales, and where it is putting in a day's work. More universally available rail or water facilities, stable labor, room for expansion, greater interest by banks and investors in local industries, and a steady supply of cheaper fuel or power sum up the advantages of our smaller industrial units now taking the lead in industrial development over the big cities.

The latter are not asleep. The Plan of New York movement is but one of a number of surveys being undertaken by large cities officially or unofficially to consider the problems of congestion and the future course of industry and population over areas which, in the case of New York, extends over fifty miles in each direction, and takes in the complex activities of nine millions of people.

Every manufacturer owes it to himself to look into the future also, and determine where he ought to be five or ten years from now, whether in his present location or elsewhere, and make his plans accordingly. He may find many of his present problems due to an unscientific location, a factor which perforce influences all the others. He may find the present expense of relocation a worthwhile investment.

CUTLER-HAMMER

Clean Oil—the Secret of Effective Lubrication

(*Continued from page* 25)

The modern oil house or oil room should, wherever possible, be of fireproof construction throughout, with concrete or brick walls and floor. It should be equipped with a tile, sheet metal or slate roof, or at least a ceiling of some fireproof material set on steel roof beams or rafters. The danger of fire in an up-to-date oil storage house will, in general, be relatively negligible, yet, constructional features of fireproof nature are the best sort of insurance. Therefore, first cost, unless it is prohibitive, should never be dickered over. An additional feature which such construction involves is that cleanliness will be far easier maintained, than in a building or room where considerable wood work is present. The latter, if splashed with oil, soon becomes soaked or sodden, is difficult to clean and is an ever present fire hazard.

Doors and windows are other factors which must also be considered in planning on oil room storage. It is generally the best practice to use as few of these as possible, within the limitations of light and ventilation requirements, and those that are installed should be of the steel frame or roller type, fitted with wire glass, and with automatic closing devices. In addition to these precautionary measures it is also always advisable to furnish the oil room or oil house with adequate fire extinguishing apparatus.

The location of the oil house is the next important factor which should be considered. In general an oil house is subject to considerably more latitude from the viewpoint of its location than an oil room. Usually the latter must be part of a storehouse or shop, whereas an oil house is frequently built especially for the purpose. Therefore, wherever possible, in order to avoid unnecessary and laborious handling of the shipments received, the oil house should be located as close to a railroad siding as possible. Filled oil containers are bulky and heavy, therefore an adequate loading platform of suitably heavy construction should be built on a level with the floors of the cars. The oil house unloading floor should be on this same level. Thus barrels and drums can be rolled directly from the cars, or in some cases the auto trucks, to the storage racks in the house with little or no lifting. This not only promotes speed in handling, but is a protection to the containers not to mention the employees. This same principle holds true not only for the smaller plant where automobile delivery is prevalent, but also for the plant located adjacent to some waterway where boat delivery is possible. In other words, plan to roll your cans, drums or barrels instead of lifting them.

Lubricating oil containers are heavily built, yet they are oftentimes relatively fragile. Therefore, regardless of their nature, they should receive careful handling and as little manual labor as possible should be used. Every care should be observed, especially where wood barrels are to be handled, to guard against unnecessary dropping, inasmuch as this will tend to promote leakage at the seams by opening the head or staves. As a result it is good practice wherever possible to use some form of a portable elevator on which the containers may be rolled and then raised to the desired height; as a rule this will

(*Continued on page* 77)

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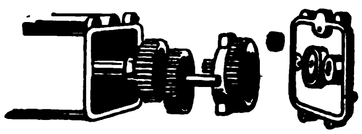
CRANES HOISTS
"RAISE PROFITS"

—"Not a Dollar Lost in 7 Years"

EUCLID for PERMANENT PERFORMANCE

SIMPLE



3 Big Spur Gears.
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Skilled mechanic not required.
Disassembled without removing hoist.

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Frame one piece—accurate alignment.
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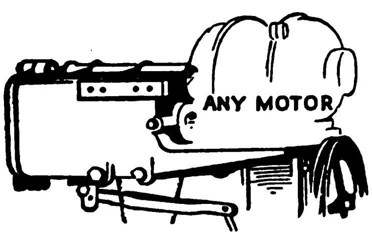
Unfailing brakes and limit switches.



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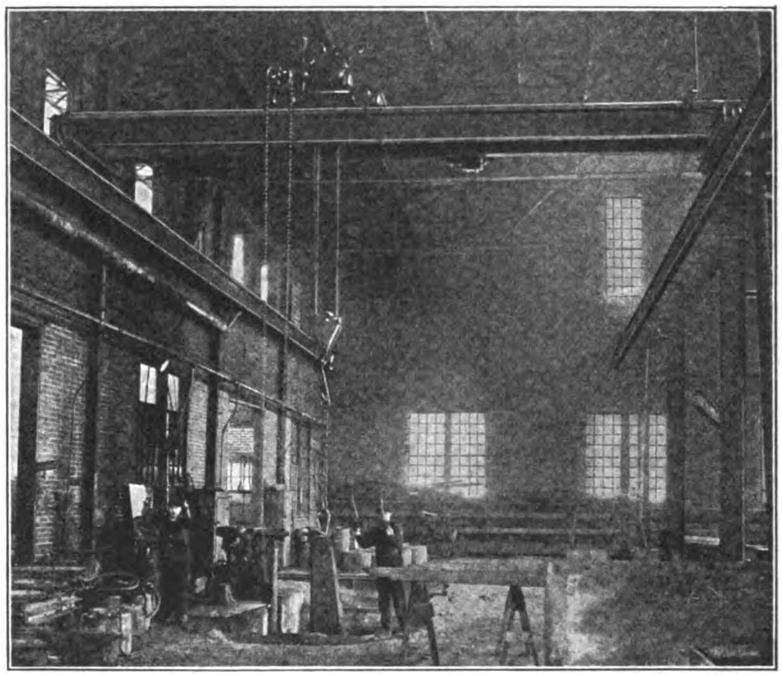

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Your satisfaction will be just as complete when you intrust your lifting problems to Euclid.

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(*Continued from page 75*)

be the level of a permanent storage rack or the top of the main storage tank into which the contents of the shipping container is to be emptied.

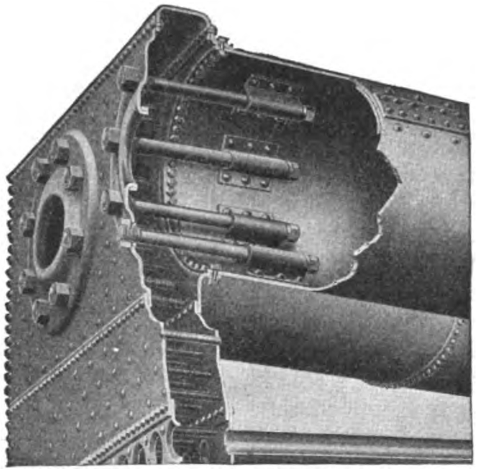
Storage racks, if such are to be used in preference to central storage tanks, should be built of steel wherever possible and in such a manner that individual barrels can be removed independently and without disturbing the others. In storage, these containers should be laid on the side or bilge with the bung down. It is generally inadvisable, however, to use wood barrels for any lengthy storage of lubricating oils, owing to the danger of loss from leakage or evaporation. Wood barrels are the most perishable type of oil container in use today and their damage, through improper handling, may result in serious contamination of the oils therein if the constituents of the glue lining should come in contact with any moisture. For this reason, such containers should never be allowed to stand on end for any length of time or exposed to rain or excessive dampness, inasmuch as the latter will almost surely penetrate the seams, affect the glue, and ultimately the oil.

In handling lubricating oil out of wood barrels, it must be remembered that these latter have quite an appreciable salvage value, and in good condition they are in demand, not only by cooperage concerns, but also are returnable to the oil companies. Therefore, every care should be taken to prevent their damage under transit and also in the hands of the consumer. They should never have holes bored in the ends for outlet of oil or inlet of air; instead, it is advisable to draw off the oil from the barrel while it is on its side from a suitable valve inserted in the hole for the same, in the head. Air, meanwhile, may be admitted by loosening the bung which should be upward. Where a barrel is to be completely emptied into a central oil storage tank, it can be rolled over the filling hatch of the latter, the bung taken out and the contents allowed to drain right into the tank. A bung hole should never be reamed out, since this will necessitate the use of an odd size bung on the next shipment, and therefore lessen the value of the empty barrel. Likewise, a bung should never be driven entirely into a barrel, since it may cause the bung stave to split and may entail the possibility of glue or wood chips being jarred into the oil to contaminate it and perhaps cause serious trouble in subsequent lubrication. The greatest care in thus handling wood barrels will not only result in the highest value from a resale point of view, but will also insure that the lubricating oils will be in fit condition to meet the machine requirements of the plant. It is considered best practice to remove bungs by means of a chisel or bung pick, after tapping the bung stave lightly with a hammer or bung starter.

Empty barrels should be given practically the same consideration as filled barrels, in order to prevent damage and to insure the receipt of the highest price when disposed of. This applies in particular to wood barrels when empty, as they will always be more or less subject to warping of the staves and heads, if they are stored on end or in any locality exposed to the weather, so that water may have an opportunity to collect on the heads and remain thereupon for any length of time. Warping will be especially liable to occur where barrels are exposed alternately to the effects of the sun and to excessive dampness. The heads, or even the staves

(*Continued on page 79*)

Economy Advantages of THE EDGE MOOR BOILER



IV. The Method of Staying

STAYBOLT holes in the Edge Moor Boiler are drilled in both tube plate and hand-hole plate on special machines, simultaneously with drilling of tube holes and facing of hand-holes, so that there is no possibility of misalignment and the corresponding holes in both plates are certain to match perfectly. After the staybolt holes are drilled and the header plates are riveted together, the headers are set on edge. Then opposite staybolt holes in both plates are first reamed and then tapped by the continuous travel of a special combined reamer and long tap, which passes through the staybolt holes in both plates.

Thus the opposite plates are threaded as if they were in one piece of metal, making it possible to screw in the staybolts without forcing. Staybolts cut to size and threaded are then screwed in place, and the projecting ends are riveted over to make the joints tight. The ends of the staybolts are drilled with $\frac{5}{16}$" center holes, as required by the A. S. M. E. Code.

The bulges opposite the drums are stayed by eight steel bolts anchored through U-shaped steel plates riveted to the inside of the drum. The joint in the header plate is made permanently tight by the use of an annealed copper cone nut which is drawn into the conical hole in the plate by screwing up on the outside nut before the staybolt is anchored.

Just as a cable built up of strands of small wire is superior to a solid wire of the same diameter, so are built-up boiler headers far stronger and more reliable than those cast or forged in a single piece. All headers used in Edge Moor Boilers are of built-up construction.

Details of other features of Edge Moor design and construction contributing to greater economy and improved efficiency are described in Catalog No. 63. Your request will bring a copy promptly.

EDGE MOOR IRON COMPANY

Established 1868

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New York Chicago St. Paul Boston Pittsburgh Charlotte Los Angeles

EDGE MOOR BOILERS EDGE MOOR, DEL. U.S.A.

EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

(*Continued from page 77*)

of a wood barrel will warp and split readily in such cases, causing the glue to become loosened and necessitating not only re-gluing but also practically re-cooperage, before it can be again used with any dependability.

In the larger type of oil house it is generally best to plan for bulk storage tanks, installing as many in number as the grades of oil involve. All permanent storage tanks should have filling lines so laid out that the oil can be piped directly from tank cars where deliveries are made in bulk. Otherwise tanks should be so installed that barrels or drums can be rolled to a point above the filling hatch or pipe, and the bung removed to allow the oil to flow directly into the tank as rapidly and with as little waste as possible. Therefore, it is best to plan to locate such storage tanks in the basement of the oil house or oil room if possible, to make use of gravity in filling, and to insure the least temperature fluctuation.

Where heavy, viscous oils such as valve and cylinder oils, greases or semi-fluid compounds, are to be stored, the oil house should be fitted with steam heating coils. Many oil storage tanks are built similarly to fuel oil tanks, with heating coils within the tanks. For the storage of lubricating oils this practice is not recommended owing to the danger of damage to the oils through water leakage, excessive heating, or boiler compounds contaminating the oils via leaked steam or condensate. By the use of adequate external steam heating coils, the temperature within the oil house can be regulated as desired, overheating will not be so apt to occur and exhaust steam can be used economically in practically all cases.

Lubricating oil storage tanks should be located horizontally wherever possible, in order to obtain the best distribution of load on the foundations, by reducing the load per unit of area to a minimum. Tanks should be securely anchored to the foundations in order to prevent shifting or breaking of pipe connections in event of occurrence of floods or explosions which might subject the tanks to severe strain.

THE present prospects are that advancing security prices, rising commodity prices, increasing employment, and more active industry, will characterize business during the remaining months of this year. Recent price advances have greatly bettered the financial outlook of the farmers. This important fact, together with the general optimism which always accompanies advancing security markets, and the speculative opportunities made possible in many lines of business by the present low interest rates, as well as the constructive developments in Europe, will probably start the upward tide of business flowing.

Although the symptoms of better business are visible on every side, the actual turn will probably come rather gradually. Industrial employment and production will improve in some lines when orders in volume begin to appear, but in others there are still considerable stocks of goods on hand to be worked off. The business improvement which appears to be getting under way will have the advantage of the normal autumn increases working with it, but it does not seem likely that the combined effect of these factors will be sufficient to stiffen interest rates in any notable degree in the near future.

The Maintenance of the Power Plant

(*Continued from page* 36)

foundation cracks a cement grout should be poured in. If there is not sufficient clearance around steelwork there are apt to be cracks at these places. The outside of the brickwork is often covered with a plastic covering when it has become badly cracked and the infiltration of air from many small leaks is giving trouble. The method of supporting drums and headers is often responsible for trouble in brickwork after a few years. When the support is not sufficient it should be reinforced. The life of the furnace lining is largely dependent on the materials used and on the temperature of the fire. The high temperatures developed in stoker or pulverized coal or oil fired furnaces require that high fusion point materials be used. It is wasteful to use high grade fire brick laid up with anything but high temperature cement for this severe service. Several forms of plastic linings are available for patching broken or burnt-out linings, or for lining the entire furnace. These are molded into place and have no joints. The joint material used is especially important when large blocks of special shape made of high grade refractory material are used over arches and directly above the grates. These blocks will last a long time if properly laid up. The cement joint should overlap on the edges of the brick so that it will have the tendency of protecting the corners of the brick. As soon as the joints are open the corners of the bricks spall off. The care of the brickwork extends up through the flues to the chimney. The lining should be carefully maintained. Points where two flues join should be watched for cracks. The parts enclosing the economizer should be kept in good order, as the weight of the economizer may cause settling cracks. It is best to have a layer of heat-insulating brick between the refractory brick and the common brick. These are not good for refractory service so must be well protected. The heat waste without proper heat insulation is often very great and is often overlooked. The arches are points that should be carefully inspected and well taken care of. When not properly maintained they are dangerous.

The amount of saving in fuel with economizers is dependent on their proper maintenance. They should be thoroughly examined and cleaned as often as necessary. Tubes should be cleaned with tube cleaners and kept in good condition to avoid corrosion. With the tendency to higher superheat temperatures the maintenance of the superheaters is becoming more important. Joints must be kept tight and tubes kept clean and free from corrosion. Pumps require constant care to keep them in good condition. The correct type of packing for each kind of service will go a long way toward cutting down the renewals of packing. Scoring of rods is very troublesome and is often due to wrong packing having been used. The valves and valve gear must be correctly set and well fitted to give good service. Most of this work must be done overtime, but this is usual in power plant maintenance work. Centrifugal pumps should have their bearings carefully lubricated. Blades on turbines may become scored and in some cases need renewals. Small steam engine drives on power plant apparatus are easily taken care of. These are now being

(*Continued on page* 82)

(*Continued from page* 80)

replaced by motor drives in many of the later power plants, but this question is far from settled.

Feed water heaters are of two distinct types, open and closed. The open type heaters make provision for separating the oil that comes back in the returns so that only clean water is returned to the boilers. These open heaters require little maintenance. Closed type heaters should have the tubes cleaned periodically in order to keep their efficiency up to standard. The corrosive action of air or oxygen in the feed water makes it necessary to use a heater that will remove all air and oxygen. When the make-up water contains chlorides or sulphates it is usually necessary to soften it by chemical treatment. Various methods of treatment are used, all of them requiring a special kind of maintenance to fit their requirements.

Condensers are of two main groups, jet and surface. Jet condensers are of parallel or counter current, the parallel current condensers being subdivided into three groups, low vacuum, siphon and ejector, and the counter current condensers into barometric and high vacuum. Surface condensers are of three groups, water cooled, air cooled, and evaporative. Water cooled surface condensers are more largely used than any of the others. The tubes in these condensers should be kept clean in order to keep the condenser working efficiently. With double flow surface condensers the tendency for unequal expansion of shell and tubes is largely overcome because the steam hits the warmer portions of the condenser first. Tube cleaners similar to those used on the boiler tubes are used for cleaning these water cooled condenser tubes, and cleaning should be done as often as necessary to keep the equipment working efficiently.

The maintenance of the piping in the power plant is a very important job. Large pipes are especially important. These should be kept well lined up and not allowed to sag. This may be done by adjusting the adjustable supports that are usually used with large pipes. Flanged joints are places that require watching, but by using the correct packing for each service the length of time between renewals of packing may be materially lengthened. The practice of pulling up joints to stop leaks is often carried too far and results in stripping the threads on the bolts. This is very dangerous and when new packing is required it should be put in. Emergency repairs often have to be made on piping, but if the line is an important one a permanent repair should be made at the first opportunity. The practice of allowing slipshod emergency repairs to stay for a long while and putting off permanent repairs should not be allowed. Piping like everything else has a rather short life under severe conditions. Corrosion by some kinds of water is very rapid and piping should be carefully watched for signs of serious corrosion. It is expected that water of this kind will be treated before being used in the boilers. Large valves are usually of the gate type and when necessary to grind them a special tool is necessary. This work may be done with the valve in place by using portable tools and this is usually done. Globe valves are made with renewable disks, so are very easily repaired. With high pressures and high temperatures of steam valves of steel or special alloys are necessary. However, the average industrial plants working on medium pressures use regular valves. Steam traps are of many dif-

(*Continued on page* 85)

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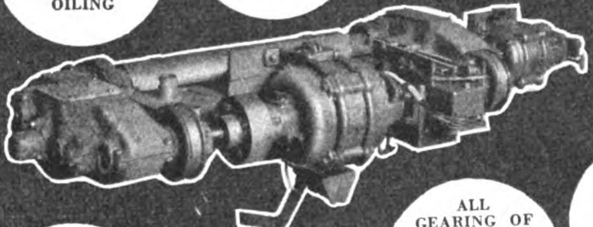

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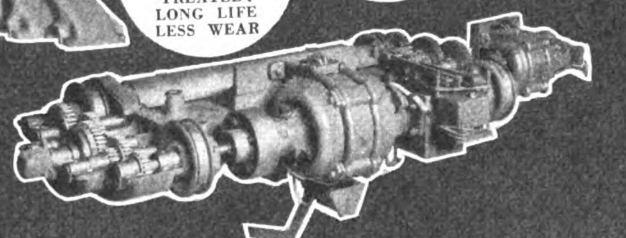

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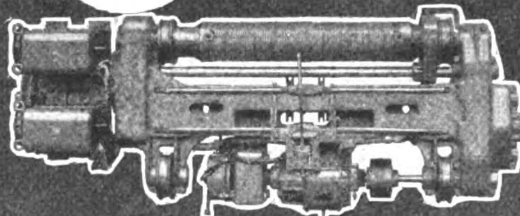

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SHORT SHAFTS INSURE PERFECT ALIGNMENT OF GEARS

BEARINGS AND SHAFTS ALL IN LINE; GREATER ACCESSIBILITY

STAFF

(Continued from page 82)

ferent types. The function of a steam trap is to get rid of condensation without wasting steam. With the ball float type the valve is always under water and therefore not subject to wire drawing, which is a serious trouble. For returning condensation direct to the boiler a direct return trap must be used. This type uses steam to drive the water back, but this steam is doing work and must not be considered as being wasted.

Pipe covering on steam and hot water pipes should be kept in good condition. The losses in radiation, due to neglected covering, are very large and a small amount spent for maintenance will repay the investment very quickly. Breaks in magnesia covering are easily patched. Old covering may be broken up and mixed into a paste by adding water. This may be easily troweled into cracks or breaks. Air cell coverings are not so easily mended but they are usually not used on important steam lines. The flanged joints at fittings are sometimes left uncovered if they are removed frequently. However, on permanent installations it is best to cover all surfaces.

The cost of handling coal and ashes has made handling apparatus necessary in most medium and large sized plants. The coal dust gets into bearings and makes the maintenance of coal handling apparatus an important job. The location of the plant and the physical conditions determine the kind of handling equipment but the moving parts of all handling systems require care. It is best to have spare parts for important units such as crushers, elevators and conveyors so that repairs may be made quickly. Motors for driving this equipment should either be of the totally enclosed type or else be located away from the dust. Overhead coal bunkers are usually made of steel plates lined with concrete or from reinforced concrete. If the coal is wet it will attack steel due to the sulphuric acid developed by sulphur in the coal mixing with water. Cast iron and concrete are less liable to corrosion. Bucket conveyors of various types are generally used for elevating coal. The chains and sprockets are bound to wear out and spare parts are necessary. For horizontal runs belt conveyors are also largely used. The bearings on these must also be well oiled or greased. Trippers for distributing the coal into the bunkers are usually set by hand in the average industrial plant although in the larger plants they are automatic. Distribution by cars is usual in large plants but not required in small ones. Where overhead bunkers are not used the traveling coal larry is used to distribute coal to each boiler. This is only a special crane and requires the regular crane maintenance with special attention to the electric controllers. Some installations use grab buckets mounted on locomotive or other cranes delivering to coal towers. The problems of maintenance though similar are special for each individual installation and the management should see to it that proper care is given to this equipment to forestall a breakdown. The ash handling equipment in many cases is similar to the coal handling equipment. Bucket and belt conveyors are often located under the ash hoppers. These conveyors usually handle wet ashes in order to eliminate the dust. They may lead to large bins or hoppers from which the ashes may be removed by the most convenient method. The same care should be given these ash conveyors as is given to the coal conveyors. Steam jet ash conveyors require very little maintenance. The elbows in pipes are subject to severe erosion but these usually are, made with replaceable liners. The ashes are usually fed from the ashpit directly into the intake which is conveniently located in front of the ashpit. In the largest plants hydraulic sluicing is being used but for industrial plants the other methods are usually used. Oil burning systems use two methods of atomization of the oil, one mechanical and the other steam. These systems are quite easy to maintain compared with coal and ash handling systems, as only pumps and burners need attention. Spare parts should be kept on hand for the burners so that repairs can be made quickly or else complete new burners may be put in and the other repaired at leisure.

Pumps such as fire pumps are rarely used but should be tried out occasionally to keep them in good working order. Many of the newer fire pumps are centrifugal and some have two sources of power. Outside of attention to valves and glands the many pumps around a power plant do not require much attention especially if they are working at fair speeds. Air compressors must have valves kept in perfect working order to render good service. Many of these are belt driven either from a steam engine or motor and belts should be kept in good condition. Cemented joints should be watched to see that they do not open up. In places where there is any dampness, waterproof leather or rubber belts should be used.

With the proper attention to lubrication and cleaning, turbo generators and engine driven generators units should operate steadily for long periods. However, if reserve units are available a thorough inspection should be made at intervals. It is to be desired that a crane is installed above all such important units so that the upper halves can be lifted off and replaced without danger. When the turbo generators are large or important units, air filters should be installed to insure clean air for cooling the generator. Small filter units are easily removed from the air intake pipe for cleaning when they get clogged up.

The quality of the oils used has a very important influence on the maintenance of the power plant. Cylinder oils should form an oil film between surfaces and prevent leakage of steam past pistons and gland packings. Lubricating oil is also a very important item in the amount of maintenance work to be done, because if the oil has enough body to prevent the surfaces from coming into contact there will be less wear on the bearings. The loss of power due to incorrect lubrication is also very great and the use of a correct lubricant will result in an increase in the economy of operation. Mineral oils are not oxidized so easily as the vegetable and animal oils and are therefore better for this purpose. In order to keep lubricating oil in perfect condition it should be purified or filtered continuously on large units. Any solid matter or dirt will be removed in this way and clean oil only will be pumped to the bearings. Although these purifiers and filters save oil, the main point to be taken care of is the generator which is usually a large expensive unit. It would be poor economy to allow the bearings on a large unit to become scored or worn due to dirty oil. The correct kind of grease is just as important as oil. With high pressure lubricating systems it is possible to grease bearings high up in out of the way places by turning the handle on the pressure cylinder.

(*Continued on page 88*)

(*Continued from page 86*)

Recording instruments are an absolute necessity in power plant operation. With a reasonable amount of care they will give the reliable records which are necessary for controlling the plant. Accuracy is of extreme importance and all instruments should be checked at intervals. It is best to have one man or the test department responsible for all instruments and meters, the test department checking them and having charge of replacing the charts each day. In this way only an authorized man can touch the charts and they will be dependable. Oil or gas fired boilers may be easily controlled by the steam pressure on controllers mounted on the gas or oil burners. Coal fired boilers may be similarly controlled if they are stoker-fired. The temperature of the feed water is very important and should be recorded. A duplex recorder with two pens to record the in and out temperatures of the water at the economizers is a great help in getting efficient control. A duplex recorder should also be installed at the condenser in order to control its efficiency by controlling the incoming and discharge temperatures. The temperature of the flue gas is a check on the efficiency of the boiler and an indicating or recording thermometer should be installed on the flue. The draft is important for economical combustion and indicating or recording draft gages are a necessity. The vacuum on condensers should be known at all times. This is shown by a mercury column vacuum gage which is simple and cannot get out of order. With flow meters on the steam lines the load carried by each boiler is shown. Several types are in use that indicate and record at the same time. CO_2 Recorders are an important check on the firing. These should have the attention of a competent man to see that they are working correctly. Recording meters are used on gas, oil, water, and air lines where a record is necessary and regular indicating meters where no daily record is needed. Indicating gages are necessary on all boilers but recording gages give a record which is often necessary. The various electric ammeters, voltmeters and wattmeters are usually mounted on the gage board and should require only occasional testing.

The maintenance of the power plant building itself is quite important as the steel work is apt to rust and paint does not last long under the severe conditions. All interior steel work should be painted at least every two years. The steel sash and sash-operating apparatus should be painted at the same time. The interior brickwork is usually painted white and about every two or three years should have an additional coat. The hot surfaces on boilers should be painted with a heat-resisting paint. Pipes should be painted every two years; and on account of the number of different pipes in the basement of a boiler room it is well to use a distinguishing color on each service. It is assumed that all steam, hot water and refrigerating lines will be covered and in this case colored bands may be painted at intervals or fittings may be colored. Windows are subject to steam dust and soot and should be cleaned often.

The exterior of coal and ash handling equipment as well as the outside of steel sash should be painted every two years in order to keep the plant in good condition. The power plant is often the most important unit in the whole plant and proper maintenance to keep it functioning perfectly at all times is money well spent.

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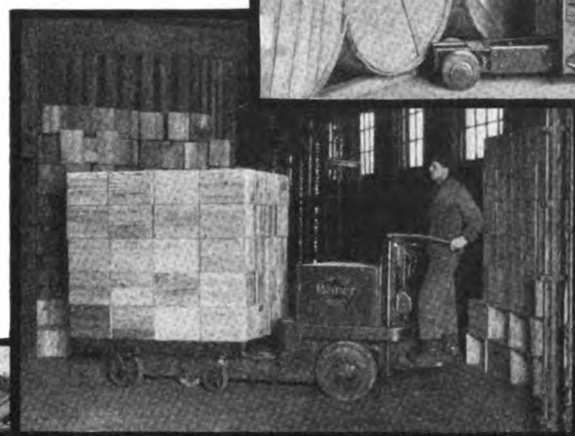

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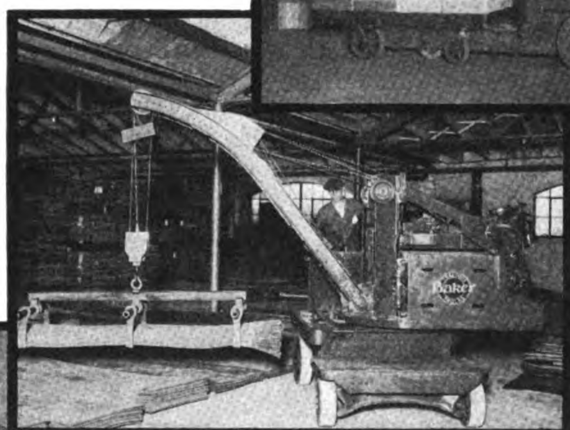

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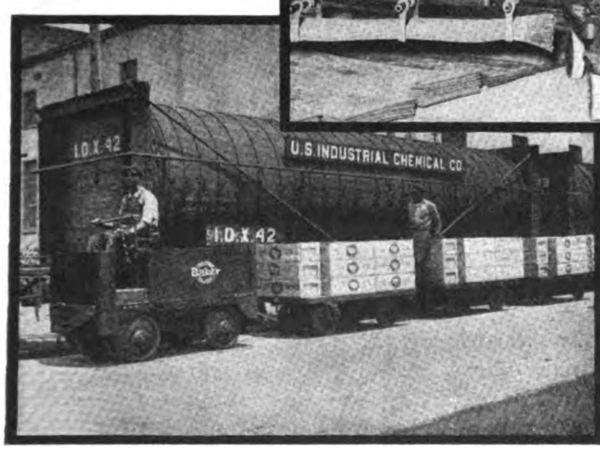

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ELECTRIC TRACTORS AND TRUCKS

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Baker

Establishing Industries in Australia

(*Continued from page* 31)

found on the Eastern Coast in the States of New South Wales and Victoria. This naturally forms a big item when a new industry is being founded, as here we have the market. Due to the diversity in the railway gauge, as it exists at present, bulky interstate shipments should be restricted as much as possible and the slower method by water resorted to.

Melbourne is the largest city in Victoria, and Sydney in New South Wales. It is very likely that one of these would be the location of the new industry. This of course is supposing that being close to the market is the most important item; should, however, large quantities of coal enter into the problem of manufacturing, then it would be found advisable to locate in or around the Newcastle or Lithgow district of New South Wales, where the coal mines are situated.

Considering that either Melbourne or Sydney will be chosen as the manufacturing center, let us study some of the questions that are likely to help us decide on one of these two cities. Taking one of the items in our cost of production, labor, we find the forty-eight hours a week being worked by slightly more trades in Melbourne than in Sydney and wages slightly lower in Victoria.

The other questions that one must answer—depending upon the size and nature of the work—would be these:

Access of raw material if imported, do ships call at given port, restrictions of trade, if any, comparison of labor disputes, initial cost of starting the enterprise, disposition of finished product, climate conditions, state taxation, cost of public utilities such as gas, power, etc. The weight that each of these items shall have on any decision naturally depends upon the extent to which they bear, in relation to each industry.

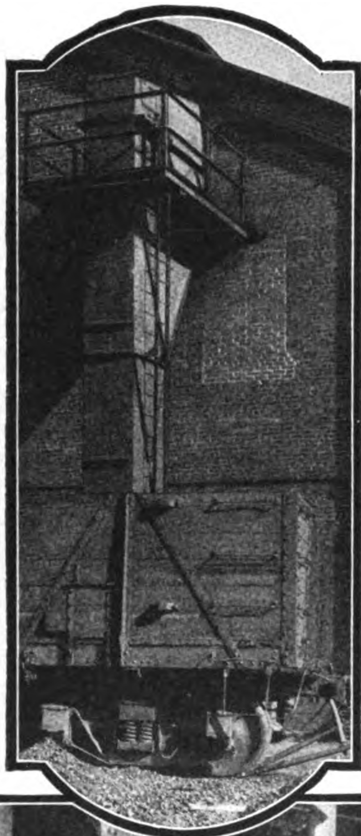
It is, of course, impossible to deal separately with each of these items, we can, though, take one of them and discuss it more fully. That of initial expense must naturally interest all persons contemplating the establishing of new industries.

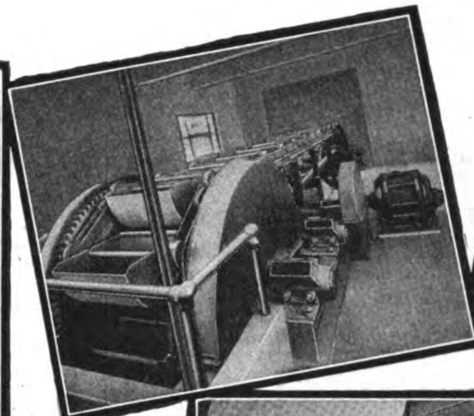
The costs pertaining to registration, ordinary fees, stamp duty fees, etc., can be best explained by quoting a newspaper article whose figures were verified by the American Consulate of Sydney.

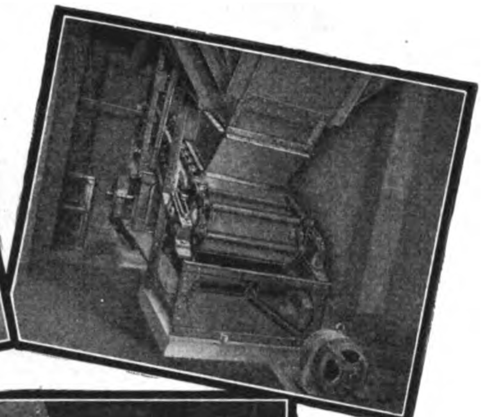
"Taking the concrete instance of a company with a nominal capital of £50,000. 0. 0. and acquiring book debts and good will of say £30,000. 0. 0., the cost of registration in New South Wales amounts to £312. 0. 0. As the cost in Victoria of registering the same company would be only £17. 0. 0. a saving of £295. 0. 0. would be effected by registering in the Southern State. In case of a company registered in Victoria, but doing business in New South Wales, it would, however, be necessary to register in the latter State as a foreign company which would cost about £30. 0. 0. Nevertheless, there would still be a substantial saving of over £250. 0. 0. in the example quoted."

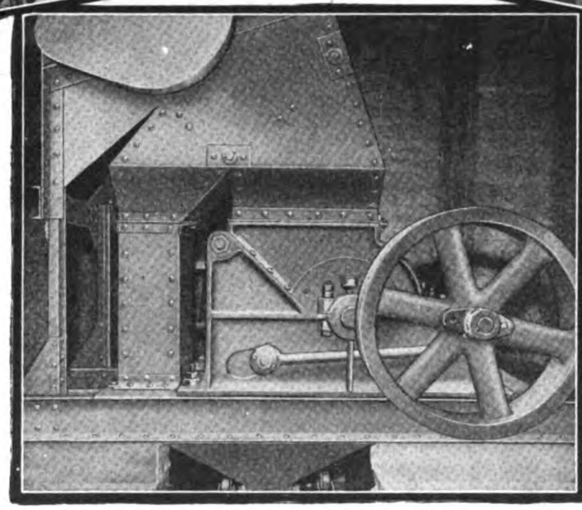
The following letter is of interest; being a reply to a protest:

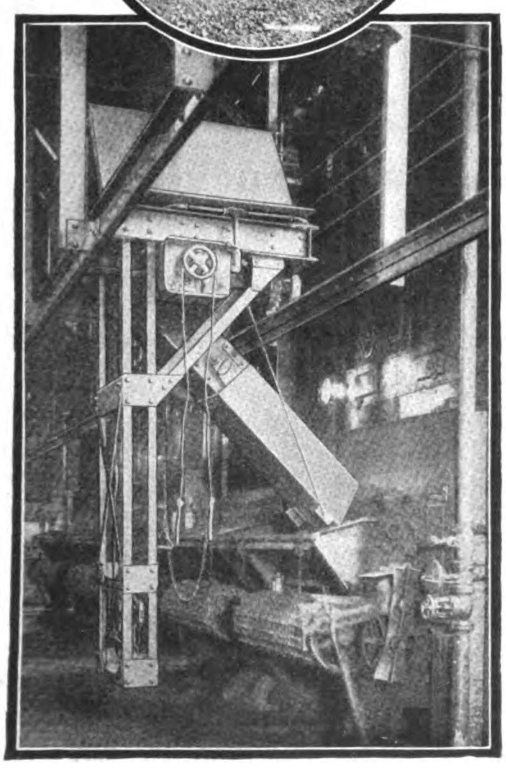
(*Continued on page* 93)











Meeting the Needs for Suitable Equipment for Power Plants

WEBSTER equipment fulfills the requirements of every power plant operator and owner who appreciates the best methods as expressed in coal and ashes handling machinery. The big reason for the 100% service which it gives is because each installation is exactly fitted to the work required.

Webster equipment for large or small power plants is the culmination of years of experience in building and designing machinery for this work. During this time Webster engineers have thoroughly studied the correct handling of coal and ashes in power plants, and can ably assist in specifying suitable equipment to meet all needs. Check up on your coal and ashes handling equipment with a Webster engineer!

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

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BUFFALO.................572 Ellicott Square
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Pittsburgh, Pa...Dempcy-Degener Co., 708 Penn Ave.
Salt Lake City, Utah, L. W. Mendenhall, 517 McIntyre Building.
Salt Lake City, Utah........Galigher Machinery Co.
Seattle, Wash., The Brinkley Company, 651 Alaska St.
Vancouver, B. C...B. C. Equipment Company, Ltd., 613 Bank of Nova Scotia Bldg.

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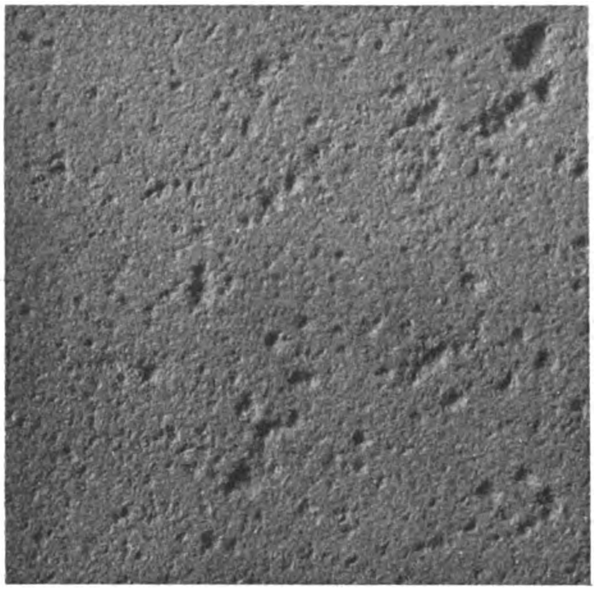
When writing advertisers please mention Industry Illustrated

NORTON FLOORS



Plain concrete floor

Concrete floor with Alundum Aggregates imbedded in surface

(Two inches in pictures equals three inches on floors)

An Interesting Comparison

of two factory floors subjected to heavy trucking

The two floor pictures are from locations in a factory where heavy trucking has caused a serious flooring problem. The illustration on the left is a typical section of plain concrete; the other is concrete with Alundum Aggregates imbedded in the surface.

The two floors have been subjected to approximately equal wear. With the plain concrete pitting is quite pronounced and the floor is wearing away rapidly. The floor of Alundum Aggregates is still in excellent condition and good for many more years of hard service.

The addition of Alundum Aggregates to concrete results in a floor that is well adapted to rough and heavy industrial service. Actual measurements in the case above have shown the wear per year of this floor to be but one quarter that of the plain concrete.

There are other types of Norton Floors suited for industrial needs. There are Alundum Floor and Stair Tile for floors, ramps, platforms and stairs, Alundum Ceramic Mosaic Tile for lunchrooms, washrooms and lavatories, and Alundum Aggregate Tile and Treads for entrances, lobbies and stairways of administration and similar buildings where attractiveness or color harmony is desirable. All are made durable and slip-proof by the same Alundum Abrasive used in the well-known Norton Grinding Wheels.

NORTON COMPANY - - Worcester, Mass.

New York Chicago Detroit Philadelphia
Hamilton, Ontario

T-111

(*Continued from page 90*)

Commonwealth of Australia,
Department of the Treasury,
Melbourne, 31st March, 1921.

Dear Sirs:

"I am in receipt of your letter of 22nd March regarding the consent dated 11th March issued for the registration of the above company as a foreign company in N. S. W. In connection with the objections raised to the terms of the consent attention is invited to the following:

2. Similar conditions have been embodied in the permits issued by the Treasury for the registration of certain American Companies which propose to carry on manufacturing businesses in Australia and have been accepted without question.

3. Regarding Condition (a) whereby the Company is required to have fixed assets in Australia (including uncalled capital in the hands of natural born British Subjects in Australia) sufficient to secure its Australian Creditors, a misapprehension appears to exist. If the Company will have no unsecured creditors in the Commonwealth the condition will not apply. Neither is it necessary on the part of the Company to issue contributing shares to any person in Australia to secure its Bank overdraft, or for any other purpose whatsoever. The intention underlying the condition is that, should he deem it necessary, the Treasurer may at any time require the Company to have such fixed Assets in Australia as are sufficient to secure its Australian Creditors. Uncalled capital will not be regarded as part of such fixed Assets except when it is in the hands of natural born British subjects in Australia.

4. Condition (b), which enjoins that the Company shall not issue share warrants to bearer cannot be waived as it is essential that the Commonwealth shall be in a position to ascertain from foreign companies registered and operating in Australia the names and addresses of all their shareholders. It is quite unusual to find in the constitution of an American Company, whether the Company be a public or a private one, any provision authorizing the issue of share warrants to bearer. The practice of issuing bearer shares appears to prevail extensively in connection with companies registered in Europe.

5. In Condition (c) (2) it is merely stipulated that the written consent of the Treasurer must be obtained before the Company acquired the freehold or perpetual leasehold or a leasehold for more than ten years of any land in the Commonwealth. It is not intended to require the Company to erect a Factory in Australia on leasehold land having not more than ten years to run or to prohibit the Company from acquiring the freehold of land for such a purpose. Consents have already been given for the acquisition of freeholds in Australia by foreign companies for the purpose of erecting factories where the intended operations and the position of the companies were found to be satisfactory. Unless there is good reason for acting otherwise a similar permit will be granted to the Company under notice when the occasion arises.

6. As to Condition (d) (2) requiring a list to be furnished showing (inter alie) the nationality of each shareholder, it is not desired that the Company shall ascertain the nationality of its shareholders in view of the fact that they number about 1500. It will

be regarded as a sufficient compliance with this condition for the present if a statement is furnished as to the total number of shareholders and their ordinary place of residence, or the ordinary place of residence of the persons whose holdings enable them to control the company.

7. Condition (e) enjoining that Treasury consent is to be obtained before any alteration is made in the constitution and By-Laws of the Company is hereby amended to provide that the Treasury shall be supplied with a certified copy of any alteration that may be made in the Company's constitution or rules.

8. With regard to Condition (f) requiring information as to any alteration in the shareholders of the Company, it will be regarded as a sufficient compliance with this condition if a statement is furnished half-yearly showing the total number of shares that have been transferred during that period and the ordinary place of residence of the persons to whom they have been transferred."

Yours faithfully,
(Sgd.) For SECRETARY TO THE TREASURY.

As the name of the Act would indicate, it was put in force during the war and the present day tendency is to encourage new undertakings. Nevertheless, such American firms as Cudahy, Wrigley's, National Cash Register, etc., carry on their business in Australia as local Companies, though full control may be held by the home concern.

In New South Wales a limited company is required to have seven shareholders and as a shareholder may be a person holding but one share of the Company stock, it follows that they do not necessarily form the Company's Policies.

This happens to be the Company Law in New South Wales, all other information unless otherwise specifically mentioned, shall also be in reference to this State.

Like the Law, labor organization and legislation may differ in each State, but they are based on the same general principles so that a description of these in any one State may do for the whole of the Commonwealth.

After the Company has been formed, building erected or rented, machinery installed, the necessary registration under the Shop and Factory Acts complied with, one then comes in contact with labor and labor unions. Small concerns employing but few hands are not likely to experience trouble. It is the larger concerns where the personal touch is lacking that trouble might be expected.

Labor is highly organized and out of a total population of five and one-half millions, quoting the Commonwealth Year Book of 1922, there are seven hundred and ninety-six unions with a membership of 703,009. As labor unites and organizes for mutual interests and protection, employers do likewise, by forming associations in similar industries.

The Industrial Arbitration Court is the judicial body of the Government whose function is to settle disputes between employer and employee in regards to labor conditions, wages, hours, etc. When strikes occur, compulsory arbitration must follow if the trouble is not settled between the contesting parties; it does not necessarily follow that the decisions are always followed out, even though a heavy fine or de-registration of the union may be the result.

(*Continued on page 97*)

R E E D A I R *IS* C L E A N A I R

AMERICAN LINSEED COMPANY
297 FOURTH AVENUE
AT 23RD STREET
NEW YORK

November 27,1923

Reed Engineering Company,
50 Church Street,
New York, N.Y.

-Attention of Mr. A.F.Hinrichsen-

Gentlemen:-

To answer your inquiry as to how well your air filtering equipment is serving us probably the best way is to give you a copy of a letter that I have from our Chief Chemist, Mr. L.O. Copes, dated November 26, 1923.

There seems to be no doubt as to the efficiency of your cell filters from our constant bacteriological examinations. As you know, bacteria and mould spores are very minute and if your cell filters will exclude these with the efficiency shown by our bacteriological tests, they ought to absolutely eliminate all dust and smoke.

We are very well pleased with the installation and are ready to talk with you on equipping our other two plants.

Very truly yours,

THE NUCOA BUTTER COMPANY
REFINERS OF EDIBLE NUT OILS
CHURNERS OF NUT MARGARINE
BAYONNE, New Jersey

BAYONNE, Nov. 28,1923

Dear Mr. Thurman:

In reply to your letter of November 22nd, I beg to advise that a bacteriological examination of the Margarine Plant prior to the installation of the Reed Air Filters showed an average of 144 moulds per plate after a fifteen minute exposure. After the installation of the air filters, the mould count per plate was reduced to 0.6 moulds.

Yours truly,

(Signed) L.O.Copes

Chief Chemist

This illustrates only a portion of the hundred unit installation

Nucoa Butter Co's Tests Show "REED AIR—99.6% Clean"

The Nucoa Butter Co. had more than a dust problem—bacteria and mold spores had to be eliminated from the air to insure the highest quality of product.

Reed Air Filters were installed and bacterialogical tests now show the air in their plant to be free from dust, dirt and bacteria—99.6% clean.

Reed Air Filters are being used by many of the largest industrials. Repeat orders total more than 7,000,000 C.F.M.—evidence of satisfactory service.

If you have a dust problem our Engineering Department is at your service without cost or obligation.

REED AIR FILTER COMPANY, Inc.
211 Central Ave., Louisville, Ky. 50 Church St., New York
Offices in principal cities

Reed Air
TRADE MARK

REED AIR FILTER COMPANY, Inc.
Engineering Department
211 Central Avenue, Louisville, Ky.

Gentlemen: Please send me without obligation your informative folder, "Are You Interested in Clean Air?"

Application.................................C.F.M.

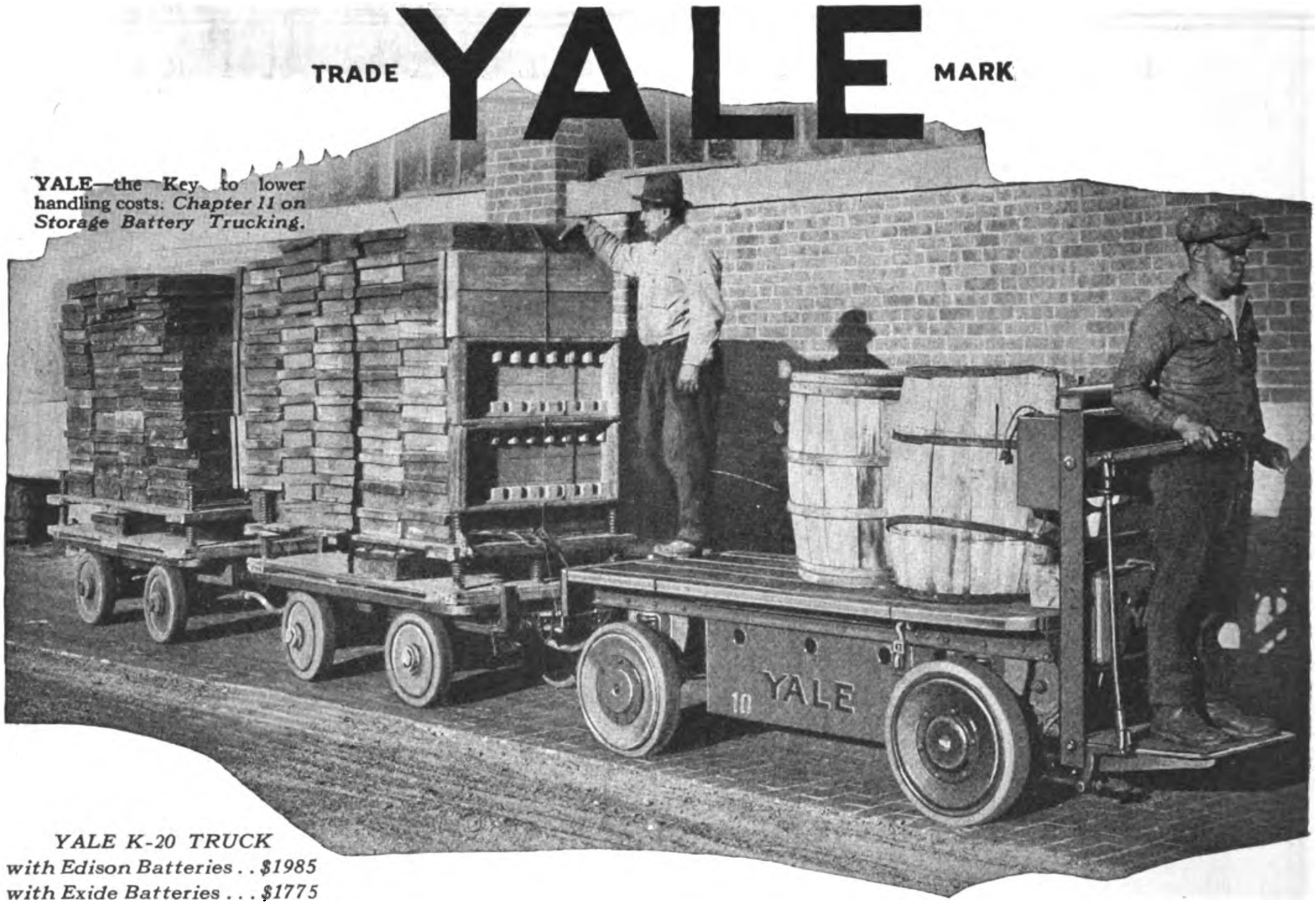
....

Name..

Address.......................................

Note: SIGN ON THE "REED AIR" DOTTED LINE.............FOR CLEAN AIR AT MINIMUM COST

TRADE **YALE** MARK



YALE—the Key to lower handling costs. *Chapter 11 on Storage Battery Trucking.*

YALE K-20 TRUCK
with Edison Batteries . . $1985
with Exide Batteries . . . $1775

"IT CAN'T BE DONE— BUT HERE IT IS!"

Foundrymen say cores must be handled by hand because they are fragile. Yale engineers worked out the system illustrated. The Yale K-67 trailer with a *full floating platform* on properly balanced springs carries hundreds of delicate cores safely every day.

The labor cost by hand was $28.80 per day — now it is $8.40 per day. The core breakage has been reduced to practically nothing.

This is Yale Service.

Many other manufacturers are faced by costly handling methods. There is a way of cutting those costs. Perhaps a Yale Trucking System is the answer. We will gladly help you find out. Yale Service produces lower handling costs and that service is yours for the asking.

Our men are trained to study your conditions and to work out and develop in your own plant a *going* system of handling your materials at "lower cost."

Don't worry about methods. When we show a saving in your operations we are sure Yale design, construction and prices will convince you that Yale Storage Battery Trucks are indispensable.

Yale Material Handling equipment includes Electric Industrial Trucks, Tractors and Trailers, Spur-Geared, Screw-Geared and Differential Chain Blocks, Electric Hoists and I-Beam Trolleys.

YALE

Chain Blocks
Electric Hoists } *For Lifts*

I-Beam Trolleys
Industrial Trucks } *For Shifts*

FACTORY LOCKING EQUIPMENT

To acquire locking control, security and convenience throughout the factory, use the Yale Master Key System.

The Yale & Towne Manufacturing Co.
Stamford, Conn., U. S. A.
YALE MADE IS YALE MARKED

YALE Hoisting and Conveying Systems

(Continued from page 94)

It may be said that the Arbitration Court is that judicial body that deals exclusively with labor and capital, its powers are broad in scope and special bodies or boards are appointed by it to deal with specific purposes. Thus the Board of Trade was created to promote harmonious relations between capital and labor as well as to determine the cost of living.

This last function is important insofar as it really is the basis on which all wages are determined. After taking into consideration the cost of food, rent, etc., the Board of Trade declares a living wage which is supposed to represent the lowest sum that can be paid an unskilled adult worker and on which he can support a wife and two children. It follows that, using this figure as a basic wage, the rewards of skilled workmen are guided by this rate. In fact, that basic wage acts as a barometer on the entire wage system in the State. Increases or decreases in this wage are usually followed by application to the Industrial Arbitration Courts, by either the Unions or Associations, whichever party it may benefit, to have the given award rates in their industry altered, to meet the rise or fall in the cost of living as declared by the Board.

The basic wage varies from year to year, and at present, according to the latest declaration, is £3. 18. 0. a week. Roughly, when the Exchange is normal, about $19.00. The wage for women over twenty-one years of age is—£1. 19. 0., roughly $9.50.

A change of awards in any industry is published in the "Industrial Gazette," which is a monthly publication, printed by the Government. The Government also publishes award sheets, which contain information for each particular trade and copies of which must be posted in each shop, covering all classes of labor employed.

For instance, should one workshop employ three men, a painter, a carpenter and plumber; it would then be necessary to have posted in some prominent place three different sets of award sheets dealing with each class of work. These sheets contain such information as wages and hours in force in these trades, how they shall be worked, under what conditions, etc.

The Eight Hour Act as passed in 1916 stated that the forty-eight hours would be considered the length of the working week. In 1920 this Act was amended, changing forty-eight hours to forty-four hours and on September 20th, 1922, it was amended once more, making forty-eight hours again the full working week. With but few exceptions, forty-eight hours a week are being worked in the different trades.

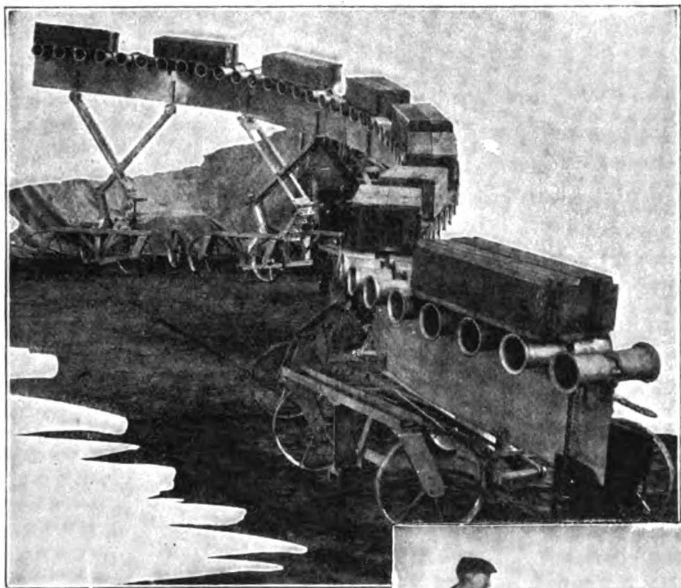
According to the Workmen's Compensation Act, injured employees must be compensated in case they are hurt while at work, the amount of compensation depending upon the nature of the injury. In some cases this amount may be two-thirds of the man's weekly wage, but in no instance will it exceed three pounds per week. Most employers insure their employees with some Insurance Company, the Premiums depending upon the class of work and risk involved and usually paid at the end of the year.

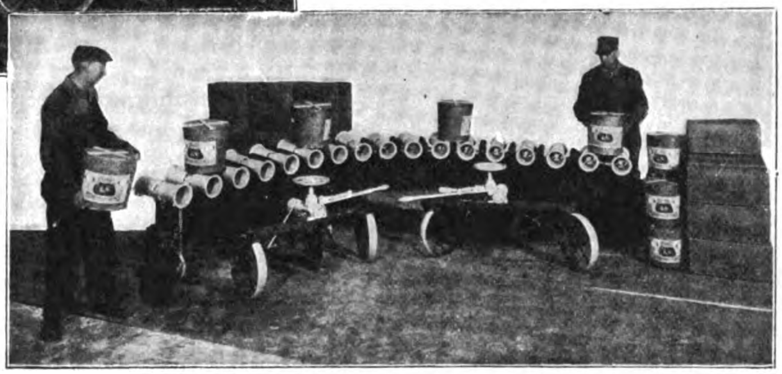
It will be seen from the short description given that the Government interests itself to a considerable extent in the labor question and in some instances assumes a parental attitude. The wisdom of this course would naturally be judged by the results obtained.

(Continued on page 101)

OTTUMWA
PORTABLE FLEXIBLE CONVEYOR

Performs Operations that Cannot be done by Straight Belt Conveyor, Gravity Rolls or Gravity Chutes





Illustrating

Three Connected Sections Conveying Boxes for Stacking

and

One Section in Operation Conveying Buckets.

Many sections can be connected and operated together.

The Latest Step in Materials Handling

What it Does

Loads Box Cars, Unloads Box Cars, Conveys and Stacks in Warehouse, Conveys around various Turns and performs many other Handling Tasks.

At last; the first successful POWER DRIVEN FLEXIBLE PORTABLE CONVEYOR with almost unlimited possibilities. It is, without doubt, the most economical equipment for handling such items as boxes, bags, kegs, pails, lumber, pig iron, and many others including almost any medium sized articles manufactured.

Write for all the details.

OTTUMWA BOX CAR LOADER CO.
OTTUMWA, IOWA

Patents Pending

Purchase—*The First Arm of Industry*

Here is an installation of Plant "B," Detroit City Gas Co., that has proven profitable to its owners and admirably suits their particular requirements.

Coal is elevated by a Hunt Pivoted Bucket Conveyor and discharged through a chute into tank shown at the right, from which it is loaded into Hunt Industrial Cars and taken to storage bins.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

"We may liken an industrial organization to a living body which has three arms to do its work," said John J. Van Deventer, in an address delivered at the Ninth Annual Convention of Purchasing Agents, May 20, 1924.

"Each of these arms," continues Mr. Van Deventer, Editor of this journal, "has its own task assigned to it in maintaining the prosperity of the industrial body." The first of these arms he called *"Purchase,"* the second *"Production,"* and the third *"Sales."*

He then compared the importance of each arm of the fanciful body individually and collectively in their relation to each other and to the industrial organization as a whole.

Continuing, he said:—"Thus, purchasing, the *first* arm of industry, * * * * * is becoming recognized as being as necessary and as useful to the industrial body as is the arm of production and selling."

How important it is then, for the purchaser of coal and ash, and other bulk materials handling equipment, to carefully choose the apparatus that will give the most efficient and longest service with the greatest economy.

If past performance is a gauge to present and future service Hunt apparatus merits every consideration. Hunt Cost-Cutting Equipment for handling coal, ashes and other bulk materials has proved its value in real savings since its introduction over half a century ago.

Numerous cases exist where Hunt apparatus is still giving excellent service after from 18 to 35 years with only minor repairs. In selecting the type of apparatus best suited for particular needs, Hunt Engineers from their broad experience in solving intricate problems in materials handling can render valuable assistance. A word will bring quick action.

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc.,
431 South Dearborn St., Chicago, Ill.

ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.

(*Continued from page 97*)

The wealth of the country lies in her primary industries and each year exports that amount to millions of dollars, leave Australia in the form of wool, wheat, skins, hides, coal, copper, butter, etc. Manufacturing is mostly resorted to in supplying the needs of the local market or in treating raw material. There are some 5,837 factories within the State, with an average of twenty-five hands employed in each.

It is not to be induced from this that all plants employ but twenty-five workmen, for some firms have employees on their pay roll that run well into the thousands. As other countries, Australia was affected by the war and the industrial boom that followed, resulting in the establishing of new plants and increasing the output of those already established. Now with the high protective tariff in vogue this increase may be expected to continue.

Specialization in Plant Equipment and labor saving devices, in most large enterprises such as the shipbuilding yards, making of steel, treating of copper, supplying public utilities, etc., compare favorably with those of similar modern plants in other parts of the world. For instance, the works of the Australian Gaslight Company of Sydney are one of the four largest in the world, with a storage capacity of twelve and a half million cubic feet of gas, with a maximum utilization of by-products and actual manual labor reduced to a minimum. Foreign Companies when establishing their industries in Australia usually bring with them such special machinery or equipment as they have found to advantage in their Home Plants and other enterprises that are formed in Australia, generally bring out men from other countries who are experts in that particular class of work. The extent of specialization, however, must be guided, to some extent at least, by the output required.

After a firm has decided to manufacture its product locally, and general location chosen, an engineer, who is perfectly familiar with the fabrication of this product, should be sent out and allowed sufficient time in the country in which to make an industrial survey. The questions for him to decide would be along the following lines:—

Necessity of bringing out expert workmen or getting them locally, machinery to be sent out or purchased in Australia, choice of site, type of building, etc.

In passing, a few figures in regards to cost of machinery might not be amiss. When figuring the landing cost at factory in Sydney on heavy machinery and motors shipped from Indiana, after a number of test cases, the following figures were adopted for approximate values:

Charges considered were—Boxing, Inland and Ocean Freight, Insurance, Brokerage, Import Duties, and Local Haulage.

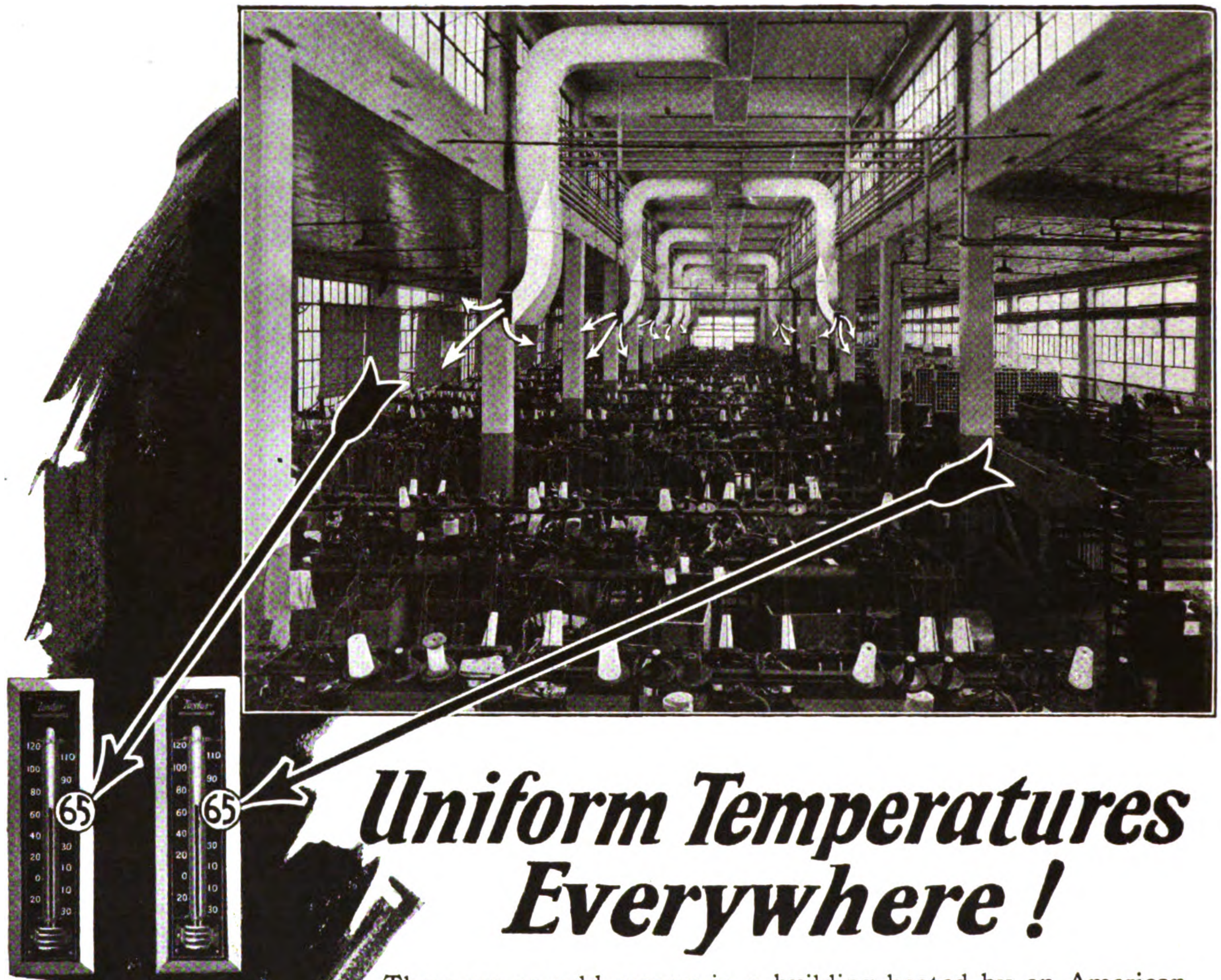
When an article pays a 10% import duty the increase of cost over that in Indiana was 50%.

When it pays 20%, the increase was 60%.

When it pays 30%, the increase was 70%.

When it pays 40%, the increase was 80%.

However, as there are a number of variable factors in the above results, such as inland freight, local haulage and size or weight of article, these figures cannot be applied indiscriminately.



Uniform Temperatures Everywhere!

There are no cold corners in a building heated by an American Blower system of mechanical circulation. There are no overheated areas near radiators. Warm air is circulated throughout the building, and there is comfort everywhere.

You can save a large part of your radiator surface, because forced circulation of air over the steam coils increases their radiating capacity five times or more. The heating apparatus is centrally located. Radiators and steam pipes extending to all parts of the building are done away with, thereby reducing upkeep expense and attention. "Heating up" in the morning is much more rapid than with the ordinary system.

The cost of the complete American Blower Heating installation is very reasonable.

Our bulletins on heating will show you how to save fuel and money and how to reduce the cost of maintenance. Write for them.

MAIL THIS COUPON
For Information

Name ....
Address ....
City & State ....
Kind of Bldg. ....
Size ....
Used for ....
....

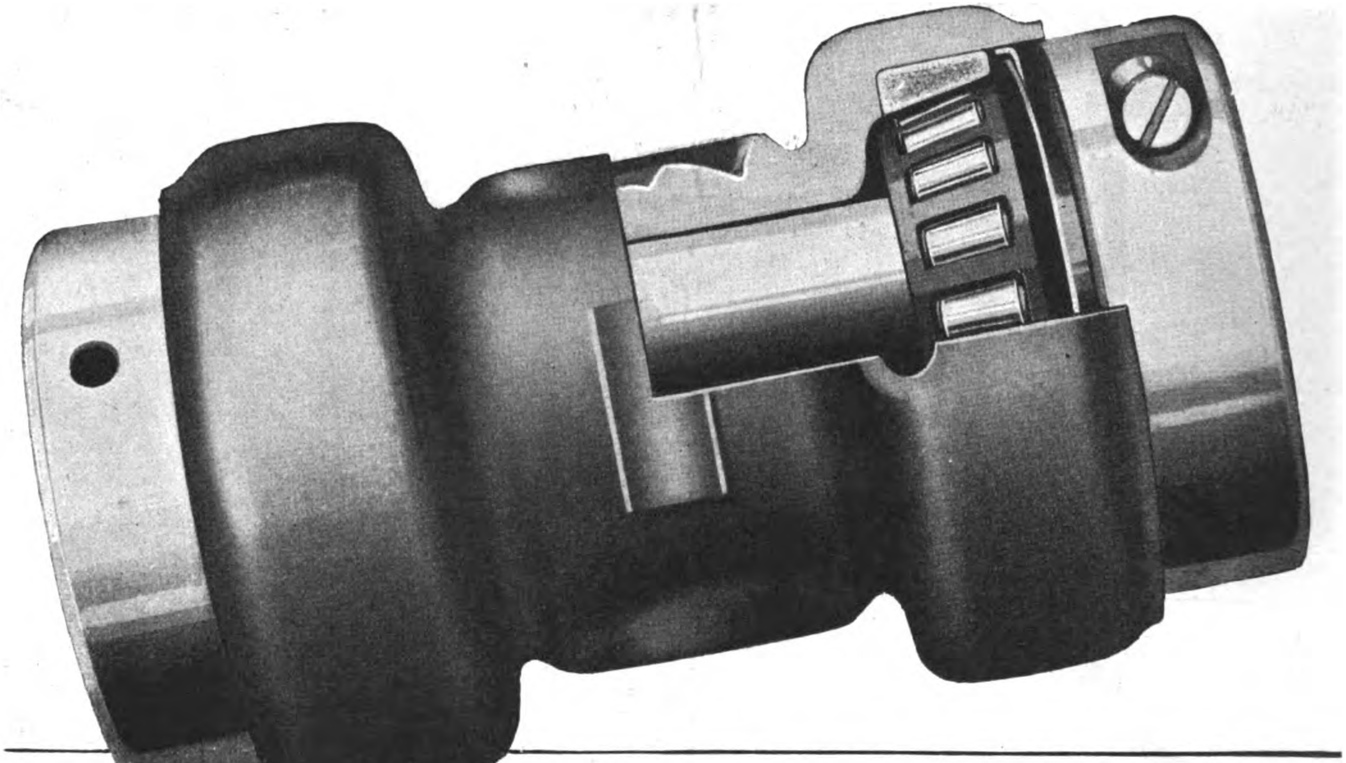
AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
(381)

American Blower

"Sirocco" TRADE MARK **VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT**
Manufacturers of all Types of Air-Handling Equipment — Since 1881

Index to Advertisements

Editorial Contents, see page 4



Another Important Dodge Development

FOR many years Dodge engineers have watched the evolution of ball and roller bearings. It was only after one hundred and ten million Timken Tapered roller bearings had been made, sold and thoroughly proved their right to pre-eminence in their field that they were adopted as worthy to be built into a product bearing the Dodge trade-mark and endorsement.

The Dodge-Timken Roller Hanger Bearing is first of all a rugged bearing, fully capable of continuously withstanding the shock loads encountered in power transmitting service.

Simplicity, interchangeability, long life and trouble-free lubrication are other outstanding features of this new Dodge product.

There are only five parts in the complete assembly. The housings are interchangeable in all Dodge and practically all other types of drop, post and bracket hangers.

Write for full information about this new Dodge power-saving unit.

DODGE TIMKEN
ROLLER HANGER BEARING

DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Ind. *Works:* Mishawaka, Ind., and Oneida, N. Y.

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF Power

Branches: New York, Philadelphia, Pittsburgh, Boston, Cincinnati, Newark, Chicago, Atlanta, Minneapolis, St. Louis, Houston, Portland, Seattle, San Francisco

This Lamson conveyor table, as used by General Electric Co., does away with idle time walking and waiting for material

Do you pay piece-work rates for idleness?

IF an average worker can turn out say eighty parts an hour, the piece work rate is calculated to give a fair hour's pay for that production.

If by cutting out walking, waiting, and other idle time, the average production can be raised to a hundred parts an hour the piece rate can be cut ten per cent, yet the worker will make over ten per cent more money.

This is just what is accomplished by the conveyor table, shown in the picture. The conveyors do all the carrying, lifting, and lugging that ordinarily waste so many minutes, and permit the workers to devote all their time to production.

As a result, the workers can make more money with less effort; while the company can secure the product at lower cost. Everyone is benefitted.

Materials come out from stock to the workers on the conveyor installed flush with the table. Finished product goes back into stock room on the conveyor under the table. The upper conveyor carries back empty tote boxes.

This new "Out and In" system can be applied to both assembly and manufacturing operations. It will save money in practically every industry. It will bring the lower costs and increased production of the conveyor plan to thousands of plants whose executives now believe they cannot profit by mechanical handling.

It will pay you to investigate. A Lamson man will be glad to call, and tell you how the new system will help you. His suggestions may point the way to large and unlooked for economies.

If you prefer, send for booklet, G. E. In either case, there is no obligation.

THE LAMSON COMPANY

SYRACUSE, NEW YORK

Branches in the principal cities

Ellert Printing Company, Inc. 318-326 West 39th Street, N.Y.

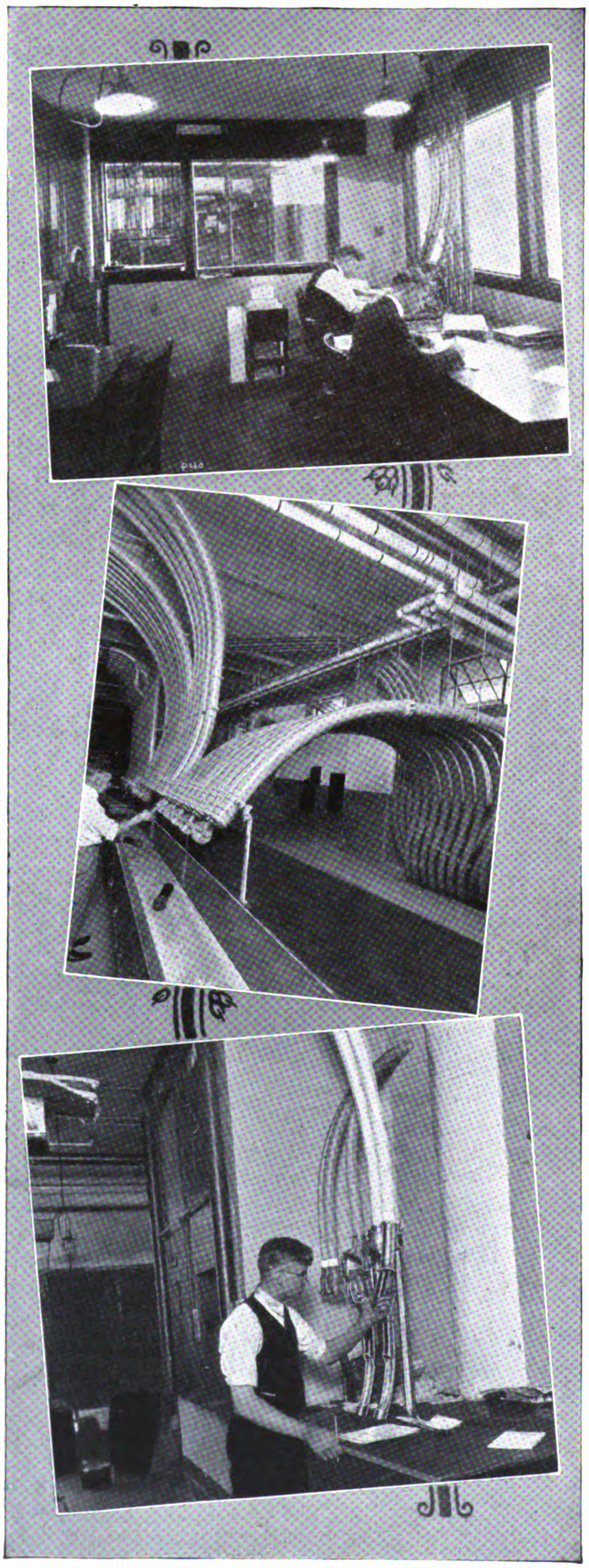
OCTOBER 1924 10 CENTS

Industry Illustrated

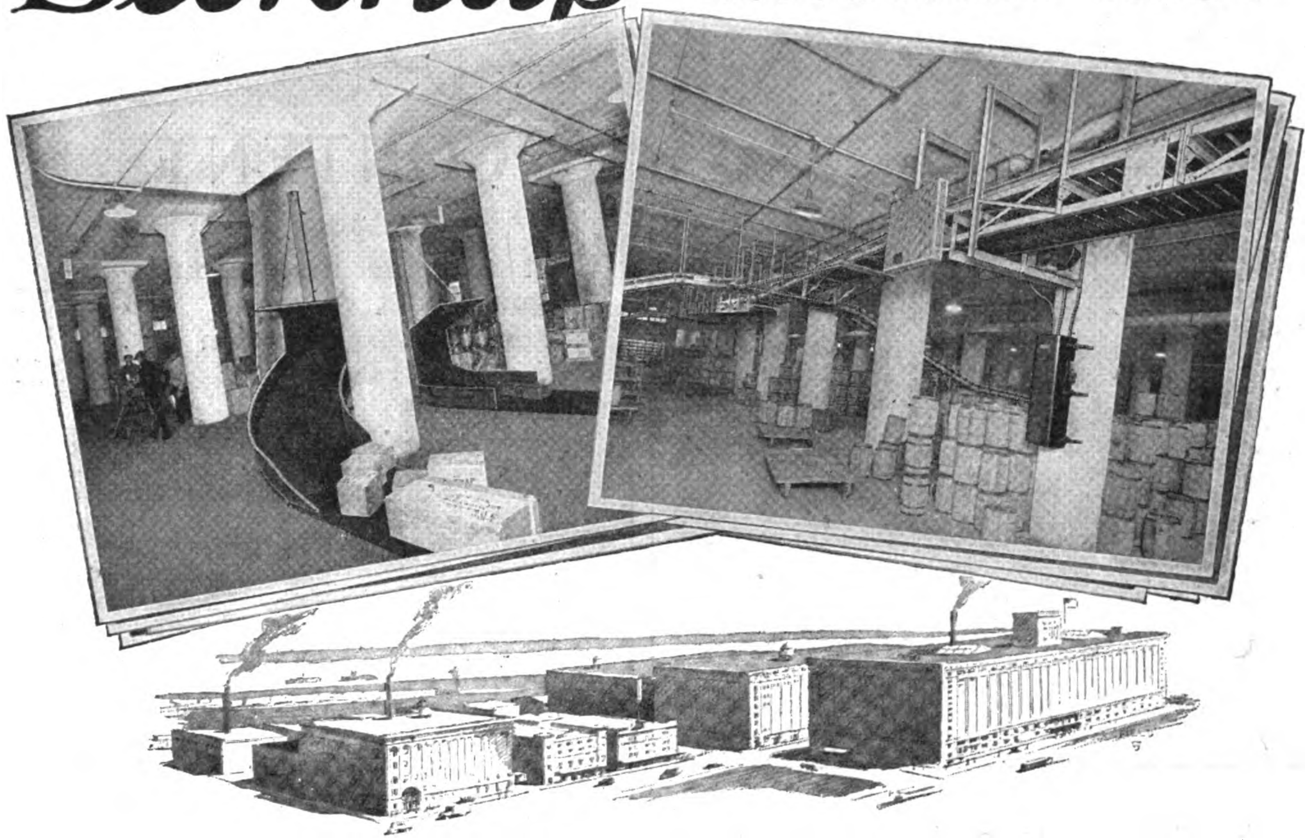
Men, Methods and Machinery of Modern Management

Reg. U.S. Pat. Off.

at the Executive Should Know



Belknap - another user



FROM pins to plows, a multitude of products in endless variety passes through the warehouses of Belknap Hardware and Manufacturing Co., each year.

To handle this mass of material as easily, quickly and economically as possible is naturally a matter of prime importance. To assist toward this end, the Belknap Company, largest single-unit hardware company in the world, has recently installed a large and complete system of Dow Conveyors which each day transports a healthy tonnage beneath its widespread roofs.

Photograph at left shows a double-bladed steel spiral chute which receives material from nine upper floors and lowers it to the first floor and basement for packing and shipment. Right-hand photograph shows slat conveyors, supported from ceiling to save floor space, used to carry kegs of hardware from incoming cars to cross lines of gravity conveyors leading to storage in various parts of the basement.

Many businesses, large and small, with diversified products are cutting corners and costs with Dow Conveyors. Are you?

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DOW LOUISVILLE CONVEYORS

Industry Illustrated

The Pictorial Presentation of Practical Management

CONTENTS

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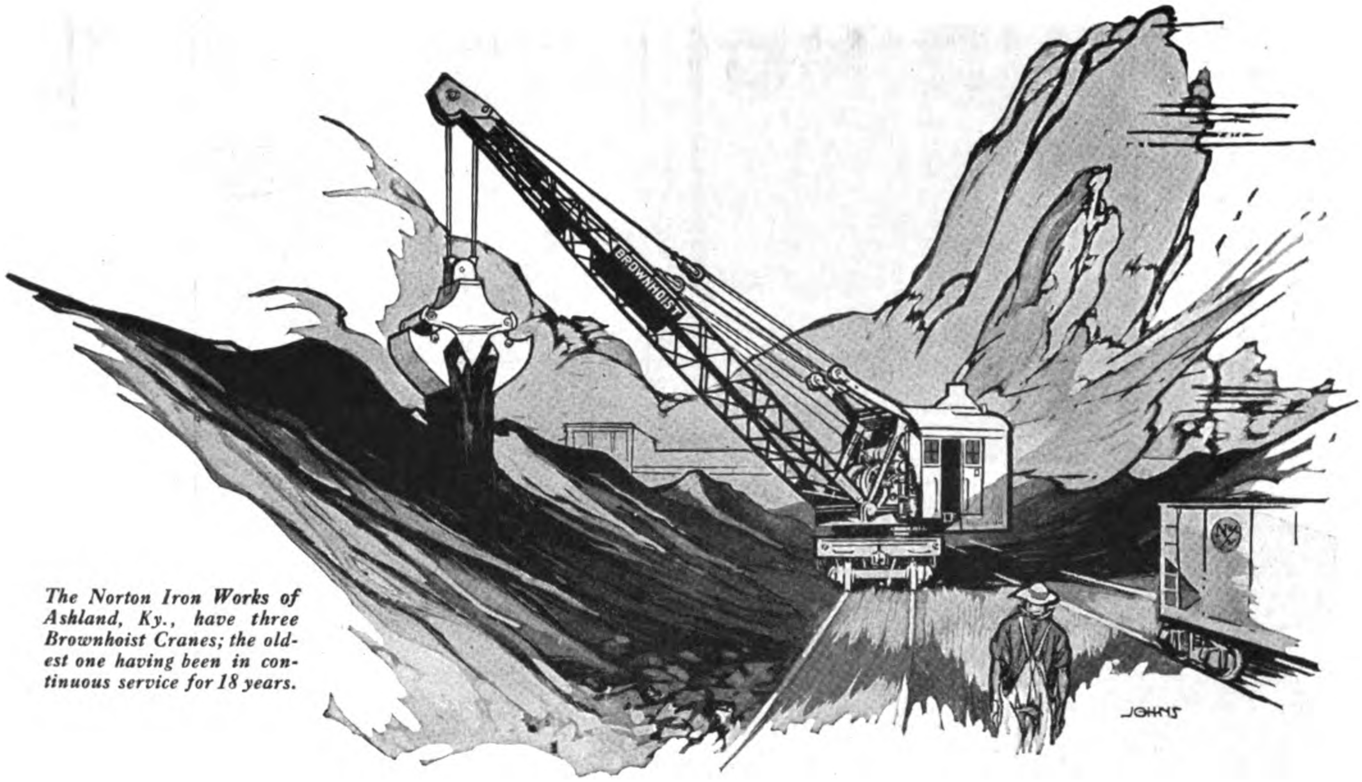
Index to Advertisers see page 108



The Norton Iron Works of Ashland, Ky., have three Brownhoist Cranes; the oldest one having been in continuous service for 18 years.

Untiring, Economical Service Over Many Years

Once you make your investment in a Brownhoist Crane, your handling problem is solved for many years to come. For, the rugged strength of a Brownhoist enables it to stand up—year in and year out—at the hardest sort of work.

Eighteen years ago a Brownhoist Crane was installed for the Norton Iron Works, of Ashland, Ky. Since that time it has been used almost exclusively in loading and unloading ore with a clamshell bucket—the hardest, heaviest work a crane can be called upon to perform. In addition, it has done much shifting of cars around the yards.

Even after such lengthy service, the life of this crane is far from spent. It is still actively on the job and continues to do its work economically and well.

This is typical of the long efficient service given by Brownhoist Cranes.

If you have a handling job where speed is a factor and low cost is essential, a Brownhoist Crane will prove eminently worthwhile.

The Brown Hoisting Machinery Co., *Cleveland, Ohio*

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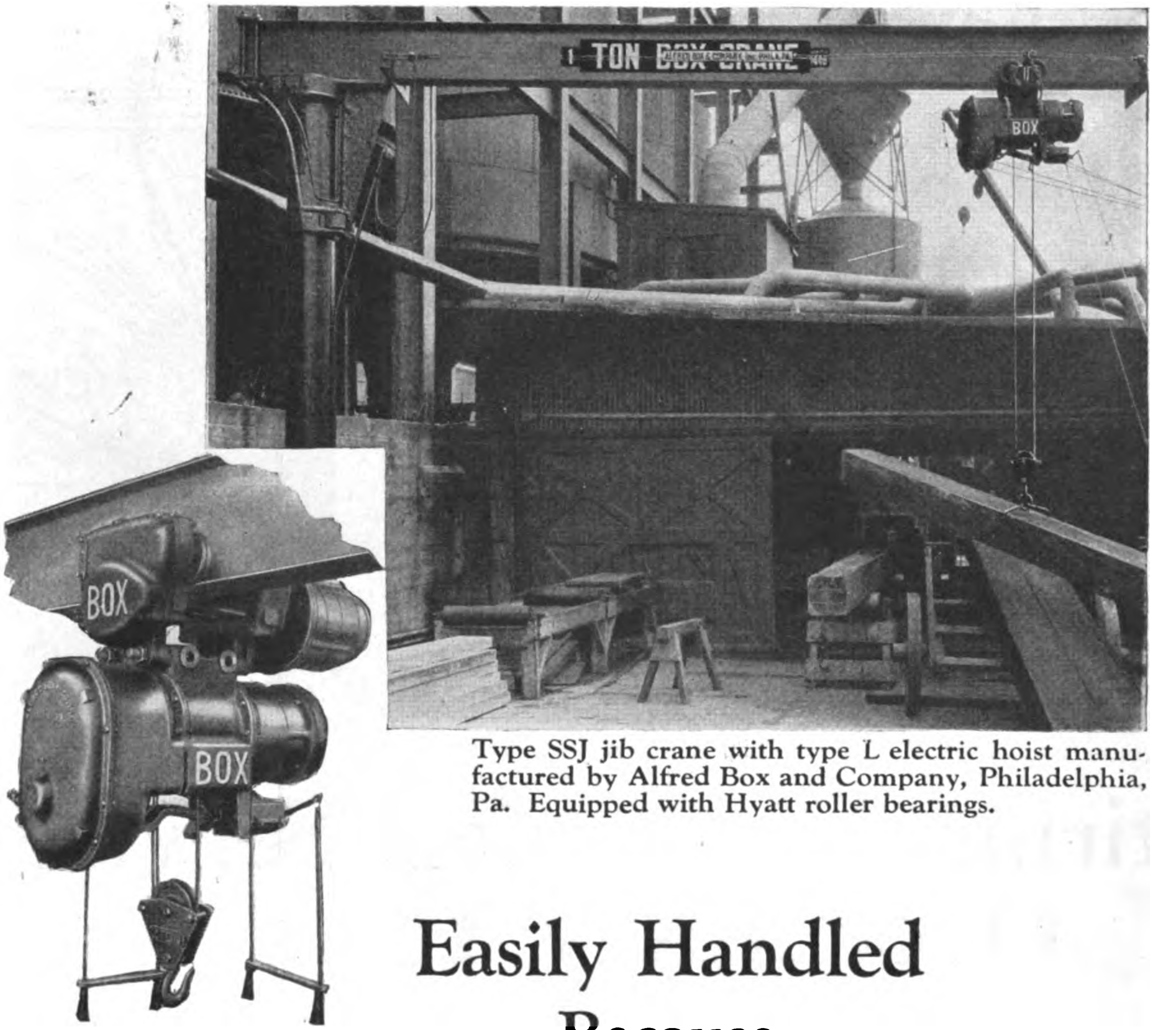
Heavy Dock Machinery, Locomotive Cranes, Bunkers, Conveyors, Bridge Cranes, Buckets, Etc.

BROWNHOIST

MATERIAL HANDLING EQUIPMENT



Type SSJ jib crane with type L electric hoist manufactured by Alfred Box and Company, Philadelphia, Pa. Equipped with Hyatt roller bearings.

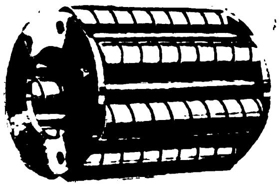
Easily Handled
Because
Hyatt Equipped Throughout

THIS is a self supporting jib crane, having no overhead support. In spite of the high bearing loads, the use of Hyatt roller bearings in the top pin and thrust rollers enables one man to revolve the loaded crane with ease.

The trolley wheels and hoist are also Hyatt equipped, making this a 100% Hyatt bearing crane. Alfred Box and Company install Hyatt bearings on their extensive line of cranes and hoists as standard equipment.

By eliminating plain bearing friction and providing ample strength, these bearings yield smooth operation, power saving, lubrication economies and long life without repairs or adjustments.

You can insure these definite operating advantages in your overhead handling system by specifying Hyatt bearings.



HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA PITTSBURGH
CLEVELAND MILWAUKEE

HYATT ROLLER BEARINGS FOR CRANES, TROLLEYS AND HOISTS

1—Unloading coal from car to storage, without shovelers, at the McCord Radiator Co., a Barber-Greene Coal Feeder and two Barber-Greene Conveyors increased the speed of storing 250%, cutting its costs 75%. No track pit is required.

2—Another McCord Radiator scene. The feeder, in a permanent track hopper, feeds to the first conveyor, which relays the coal to the second conveyor. In this manner, a car was unloaded in 50 minutes. This equipment saves the company $17.31 on every car handled.

3—A Barber-Greene Conveyor coaling a ship at the Tampa Coal Co. Before noon, this and two other Barber-Greenes had loaded a car with gravel, coaled a ship, and unloaded and stored a car of coke.

4—Showing how a single Barber-Greene Conveyor has enabled the D. L. & W. Coal Co. to increase their storage 75,000 tons. It will handle atleast 25 cars a day.

5—Barber - Greene Conveyors unloading a car of coke at the Tampa Coal Co.—one of three widely differing jobs completed in five hours.

75,000 Tons Increased Storage —with a Single Barber-Greene

The D. L. & W. Coal Co., of Dover, N. J., bought a Barber-Greene 30-foot Conveyor to increase their coal storage, later lengthening it to 45 feet, and then to 60 feet.

When asked about the Barber-Greene's performance, the superintendent of the company said: "It will do all you claimed for it—and then some. I figure that with the 60-foot conveyor, we can stock an additional 75,000 tons. It will handle at least 25 cars per day."

The layout is instructive. The photograph above shows the 30-foot Barber-Greene shortly after installation. It was placed on top of an 85-foot coal pile, and laid horizontally on rollers so that it could be pushed out as the pile advanced. Taking the coal as it came from the "trimmers," it distributed it well out over the pile.

One of the invaluable features of the Barber-Greene is that its intermediate sections are of Warren Truss Construction, standardized and interchangeable. Thus you can start with a short conveyor, and as the need arises you can lengthen it in multiples of 3 feet to any desired length—at the same time maintaining a powerful, rigid conveyor that will not get out of alignment.

With wages high, and immigration restriction threatening to raise them even higher, coal and industrial plants that are large employers of unskilled labor face a costly and serious problem.

The only effective solution is to stop depending on unskilled labor to handle your product. Reports of Barber-Greene performances under every conceivable condition, prove clearly that Barber-Greene methods will accomplish this work at several times the speed of hand labor, and at far less cost. For instance, the McCord Radiator Co., with a Barber-Greene Coal Feeder and two Barber-Greene Conveyors, have increased the speed of storing coal 250%, reducing its cost 75%.

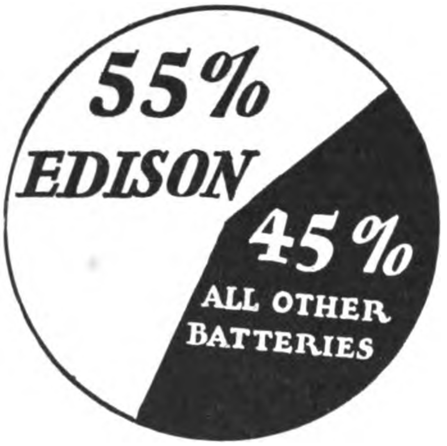
Send for Catalog E. It may hold the key to your unsolved material-handling problems.

BARBER-GREENE COMPANY—*Representatives in 50 cities*—500 West Park Avenue, Aurora, Ill.

BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Coal Loaders . . . . Automatic — Ditch Diggers . . . Coal Feeders



More Edison Batteries Than All Others Combined

According to the admission of a competitive company, Edison Batteries constitute 55% of all batteries in use in the power fields—that is, propelling industrial trucks and tractors, electric street trucks, and mine locomotives. The remaining 45% is divided among all the other battery manufacturers.

This is particularly significant when we remember that all this has been done in fifteen years. It is a wholesale endorsement of the Edison Battery principle and Edison Battery endurance and economy in operation.

There could be no stronger recommendation than that so many users, large and small, find it profitable to replace other batteries with Edison and continue to use Edison.

Leading Industrial Truck and Tractor Manufacturers gladly furnish Edison Batteries.

Built like a watch,
—Rugged as a battleship

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Edison Batteries Haul More for Less Money

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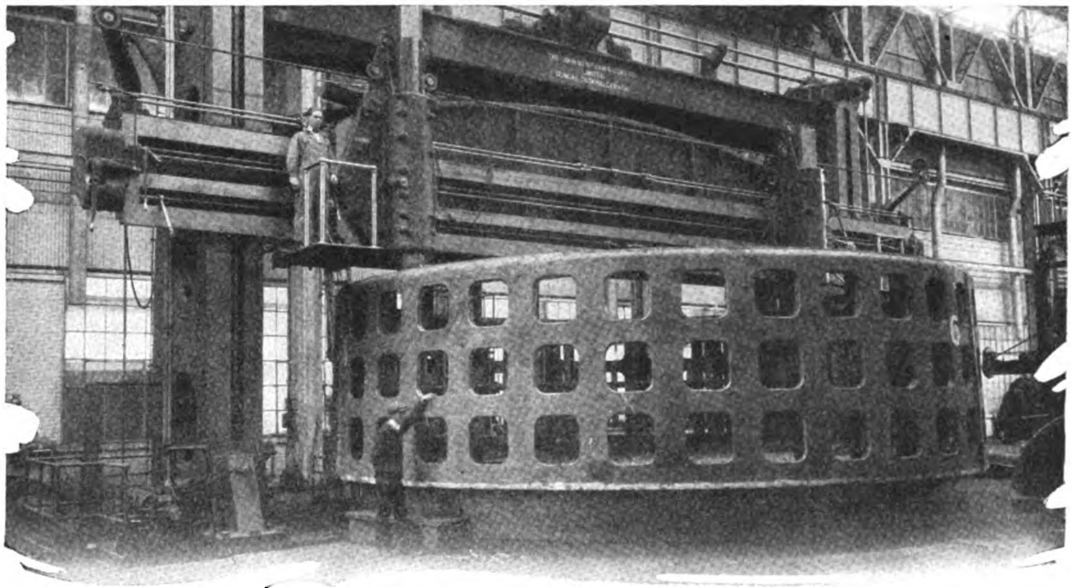
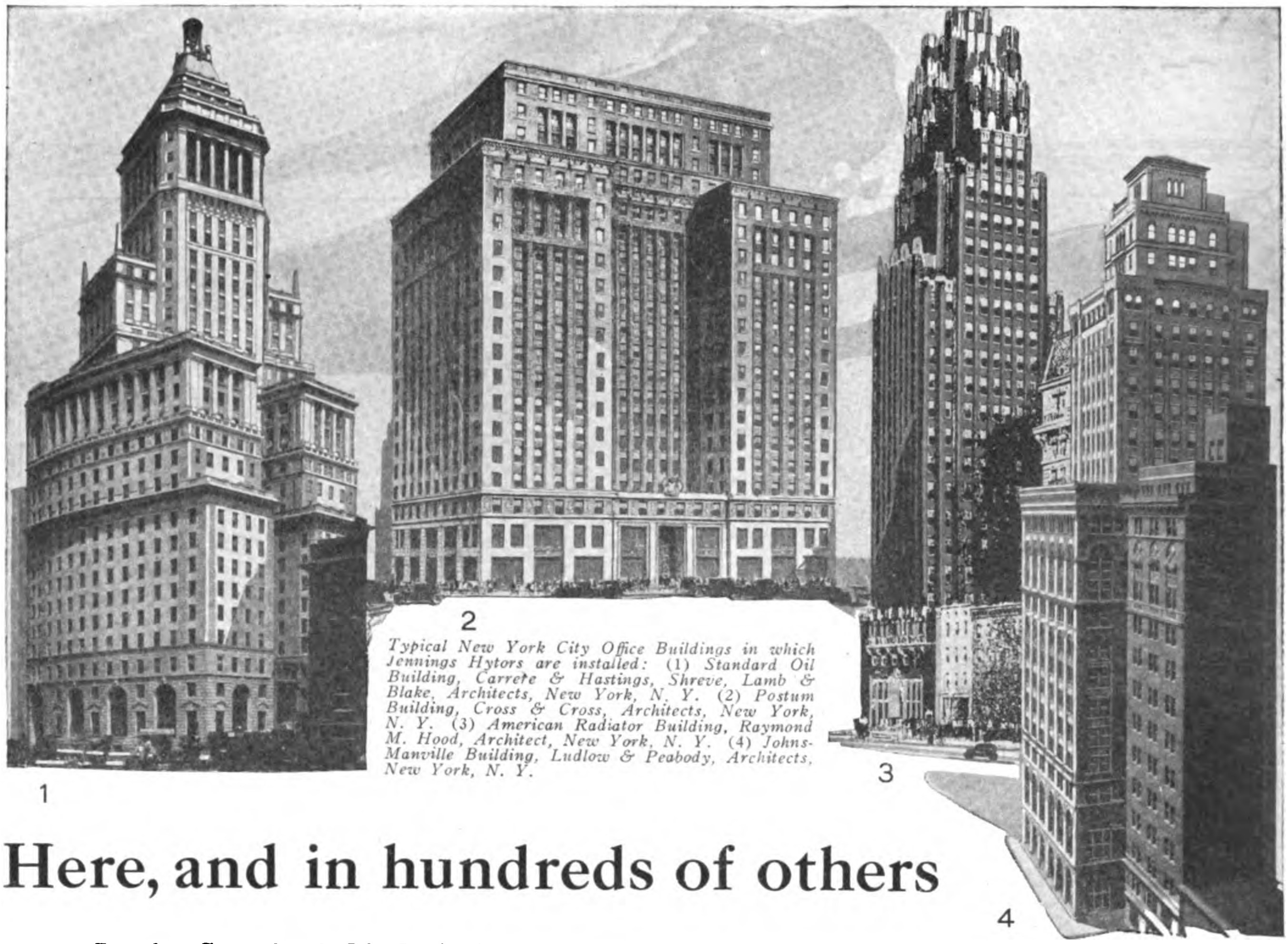


Normal View

Deflected View



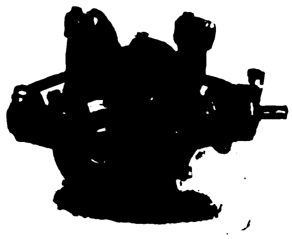
Typical New York City Office Buildings in which Jennings Hytors are installed: (1) Standard Oil Building, Carrere & Hastings, Shreve, Lamb & Blake, Architects, New York, N. Y. (2) Postum Building, Cross & Cross, Architects, New York, N. Y. (3) American Radiator Building, Raymond M. Hood, Architect, New York, N. Y. (4) Johns-Manville Building, Ludlow & Peabody, Architects, New York, N. Y.

Here, and in hundreds of others

In the Standard Oil Building, Postum Building, American Radiator Building, and Johns-Manville Building, all in New York, as in hundreds of other fine office buildings throughout the country, Jennings Hytor Vacuum Heating Pumps are depended on to help in securing the best results from the heating system.

Jennings Hytors are worthy of this confidence and recognition. They are well-known for the unsurpassed year-in and year-out performance they always give. They embody the reliability, quietness in operation, compactness of design, and economy in power consumed characteristic of all Jennings turbine apparatus.

Where heating service is paramount, it pays to standardize on Jennings Hytors.



The Jennings Hytor Vacuum Heating Pump removes air and water from steam heating systems, and returns the water to the boiler or hot-well.

It consists essentially of two independent turbine units, an air pump, and a water pump, combined in one casing. Impellers of both units are mounted on the same shaft.

By handling the air independently of the water, about 50% of the horsepower ordinarily required is saved.

Jennings Hytor

NASH ENGINEERING CO N SOUTH NORWALK CONN

Industry Illustrated

The Pictorial Presentation of Practical Management

JOHN H. VAN DEVENTER, *EDITOR*

W. THOMSON LEES, MATTHEW W. POTTS — *Associate Editors*

ADOLF SCHILDKRAUT — *Art Director*

Editorial

What the Executive Should Know About Power

FOR the past two decades engineers have given ever increasing attention to what has become known as Super Power—a scheme to develop power resources in accordance with the utmost attainable efficiency. In the years since the World War these ideas have become more crystallized, until, today, there is little doubt that ultimately we shall do away with the wasteful practice of hauling coal hundreds of miles for burning in isolated, inefficient power plants. Already we can look forward to the day when the energy in coal will be efficiently converted, near its source, into electric power; when this power, supplemented by current generated from water power, will be linked into vast networks of wire constituting a series of huge "power reservoirs"; when electric energy will be available to household and industrial plant much as water is available in present day municipalities—and at a cost which will make present day individual power plants obsolete.

But this new era is only dimly in sight; it has not yet dawned. From a standpoint of increased human comfort and happiness, it could not come too soon—but there are many obstacles to overcome, and many years will pass before this beneficent dream can ripen to fruition.

Meanwhile—what about the present, and the immediate future? We cannot close our plants and sit waiting for the millennium. We must carry on, meanwhile, to the best of our ability with existing power facilities. Measured in terms of the Super Power ideal, these facilities may seem poor indeed; measured in terms of fifty years ago, they are colossal. What we need to do is to ignore both of these aspects, and to apply the measure of efficient usage of the facilities at hand.

That is what the executive should know about power: —he should know whether he is getting the utmost possible power-dollars from his combination of coal, and power equipment, and power labor, dollars.

The same amount of money which, ten years ago, would buy 100 tons of coal, today will buy less than 30 tons; the same amount of money which then would pay four men's wages, today will pay only two men. And these increases in power costs cannot be passed on to the consumer in higher priced production.

How far can we go toward making up these increased costs, by more efficient methods in our power plants?

Theoretically, a perfect steam engine and boiler would require about 600 pounds of coal to produce 1,000 horsepower hours; but that is the unattainable ideal. Actually, under modern best practice, we have steam plants which produce 1,000 horsepower hours from twice the theoretical minimum—about 1,200 pounds of coal. This, then, is a practical and attainable mark at which to aim. How nearly does the average industrial power plant approach this figure?

Instead of wasting but 600 pounds of coal for each thousand horsepower hours, a report of the United States Geological Survey shows that in *average practice* in industrial power plants we waste 9,400 pounds of coal; instead of requiring the 1,200 pounds which our best power plants require, the average industrial power plant burns 15,400 pounds of coal for each 1,000 horsepower hours produced!

The "best practice" cited above is, chiefly, central station practice; it obtains under conditions which would be unattainable in many industrial plants. On the other hand, a very large slice of the four tons of coal wasted producing 1,000 horsepower hours in the average industrial plant, is *preventable waste*. If we can save only half of it, we are cutting our total coal bill in half; if we save but a quarter of this wasted fuel, we pile up a tidy profit.

That is what the executive should know about power: —how much of his present power bill is waste; how far can this waste be reduced; what changes in method or equipment are necessary?

These are, today, questions as vital to the executive as are questions of production methods, handling methods, costs. In fact, power costs have assumed so large a place on the general cost sheet that the executive of today cannot afford to leave his power problem in the hands of his engineer.

That is why we are undertaking to publish in succeeding issues of INDUSTRY ILLUSTRATED a series of articles especially planned to inform the industrial executive on this most important function of management. In this series of articles will be outlined the principles underlying executive control of power plant operation, as well as a presentation of the methods employed by progressive managers to decrease their power costs.

Thus armed with the knowledge of what to do and how to do it, the executive cannot but be better equipped to study his own plant with a view to tapping this neglected source of increased profits.

And that—the fact that his power plant *does* hold an untapped source of profits—is what the executive really should know about power.

Is Your Factory Location

By John

THE executives of a hundred of the largest industries in the country were asked by the writer why their great manufacturing establishments were located where they were, and to what sections they would move if relocation was deemed advisable. Their answers were fairly illustrative of the haphazard geographical development of industry in the United States, and afford an explanation of the increasing trend since 1900 toward a wholesale relocation of manufacturing plants to meet changing conditions.

Only sixty-five had any definite idea as to why the concern started, or was located, in its particular city, and a large majority of those stated that the impelling reason was that the founder built or acquired his plant because it was in his own home town! Sentiment and the inertia of life-long habits and custom have had much to do with the location of industry, with not always favorable results.

The more practical of reasons given were, in order of importance: the presence of skilled workers from overseas; the distribution points for materials gathered by water or trade route; water power; and the obtaining of capital. Nearness to customers and markets was not given, probably for the reason that in those early days population was centered in the Northeast, and sales confined, by slow transportation, to the immediate locality.

How conditions have changed! The covered wagons and new, shining rails of our grandfathers' days opened up howling wildernesses to a sturdy population clear to the Golden Gate, while to the south the conduct of magnificent plantations gave way to the rapid development of rich minerals, fertile fields, and rushing streams. Population was spreading everywhere.

Today, our captains of industry were quite unanimous in stating, the market, the consumer, must be culti-

Fig. 1. The rapid manufacturing rise of many Western cities is partly due to their beautiful surroundings which attract visitors and investors from all over. This is Mt. Rainier, near Seattle.

Fig. 2. The motorship (left) and the ocean freighter (right) carry Long-Bell products to world markets.

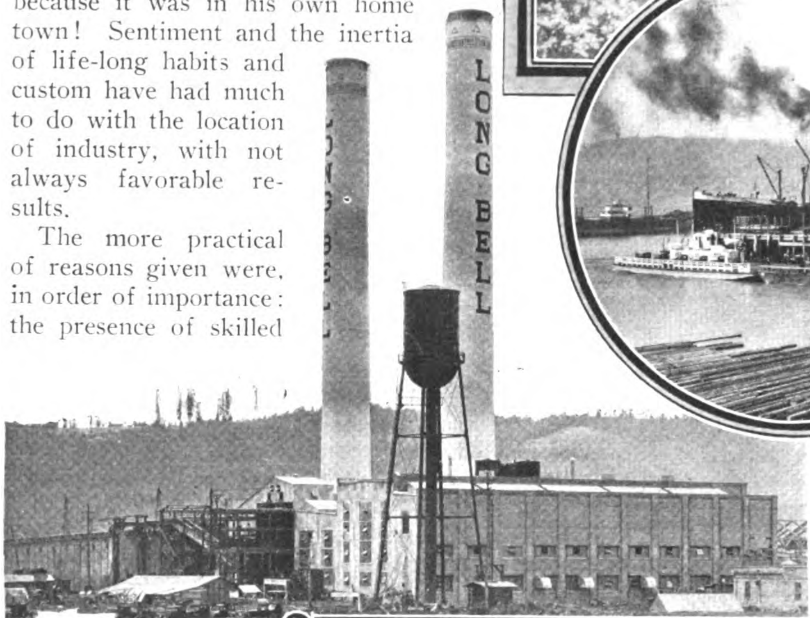


Fig. 3. These great smokestacks of the Long-Bell plant, each as high as the Statue of Liberty, give an idea of the amount of power needed in this big plant.

Fig. 4. Millions of shrimp from Southern waters find their way into innumerable cans made at this New Orleans plant of the American Can Co.

an Asset or a Liability?

A. Piquet

vated, and the plant located near him; and the other human factor, labor, is equally important. The market causes regional plants and the decentralization of industry. From labor troubles a dozen industries flee, cotton and textiles from North to South; cigars and silk, shirts and shoes, from city to country.

Why would these sixty-five concerns move, if necessary? Five factors, five questions to ask themselves, stood out as the general sentiment. They were:

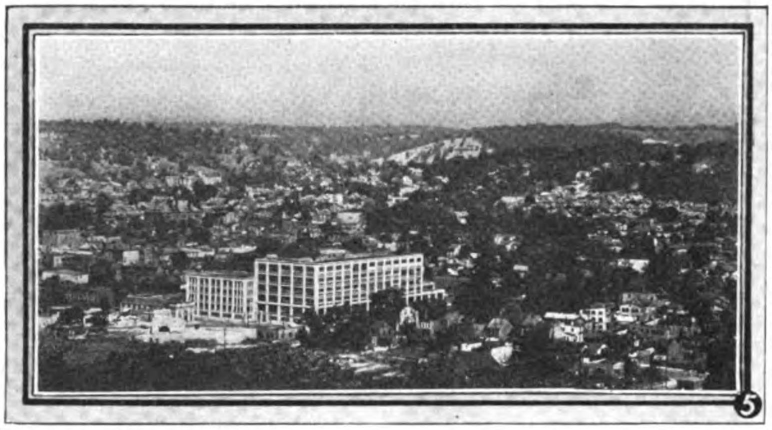


Fig. 5. The myriad plants of the American Can Co. locate at the markets for tin cans to save freight rates and give service. This is the Cincinnati plant, located in a suburb with plenty of space and good labor conditions.

Fig. 6. One of the main plants of the Coca-Cola system. This is at Chicago.

Fig. 7. One of the twelve Coca-Cola main plants which supply a thousand-odd smaller plants with materials for Coca-Cola manufacture. This is the New Orleans factory.

Fig. 8. Three big machine shops are maintained by the American Can Co. to build equipment for its many factories. This is the Newark shop; the others are at Cincinnati and Oakland.

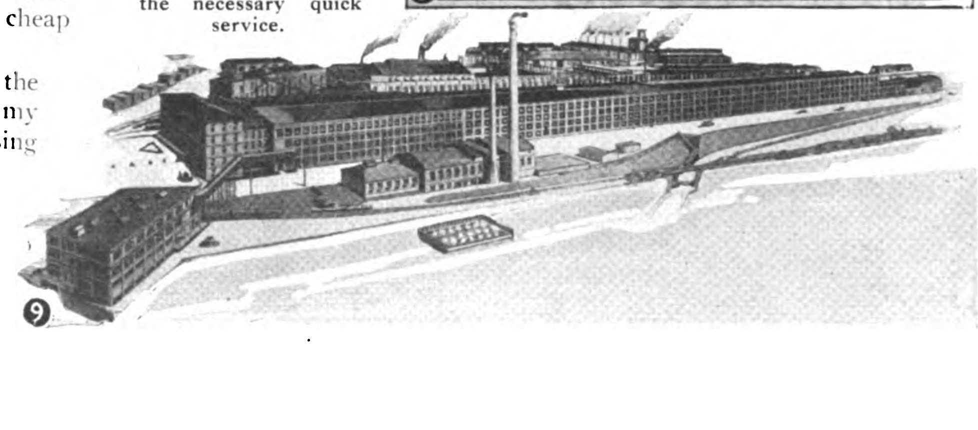


Fig. 9. First-class rail facilities are often lacking in large congested cities or small isolated towns. The Morse Chain Co. moved from a small town to nearby Ithaca on the Lackawanna main line, where its great plant receives the necessary quick service.

1. *Markets.* Can my products be distributed from the plant to customers at least as quickly and cheaply as by my leading competitors?

2. *Labor.* Can I obtain or import here labor of sufficient skill to do my work properly, and of sufficient intelligence or habits to recognize efforts on my part to give them a square deal?

3. *Materials.* Can I obtain here a steady flow of materials at a low competing rate or price? Is transportation adequate?

4. *Power and Fuel.* Am I sure of a present and future steady supply of coal (or oil)? At reasonable prices? Am I convenient to cheap electric power

5. *The Right Town.* Are the living costs and conditions of my workers good or bad? Is housing adequate? Is transportation to and from work good? Are there recreation and good schools? Is citizenship interest such that the local government levies taxes justly, pro-

vides proper fire and police protection, and encourages neither radical movements nor anti-labor crusades? Has the town diversified industries and a balanced industrial and labor situation? Is the climate conducive to health and optimism? In short, is my town a happy place to live and work in, for my worker and myself?

Transportation is not mentioned as a factor, because it runs through all factors. The railroad, the steamship, the telegraph, and the automobile have bound people together, extended markets, and made the world one; local, sectional, and nationalistic isolationists to the contrary notwithstanding.

Like these great executives, you have asked yourself these five questions. Can you answer them? It is as exciting as the new rage of a cross-word puzzle, as involved, and sometimes as depressing!

To each industry, some particular factor is more important. One can be far from the market, if country labor is all important. Such is the Southern cotton industry, which ships to far horizons, but which enjoys a fine labor situation, low living costs, nearby cotton, hydro-electric power de luxe, and the healthy air of the Piedmont plateau. The first four factors must be properly weighted, according to the industry, and a fair average struck. The fifth factor is the only safe harbor in a scene torn now and again with economic and political upheavals.

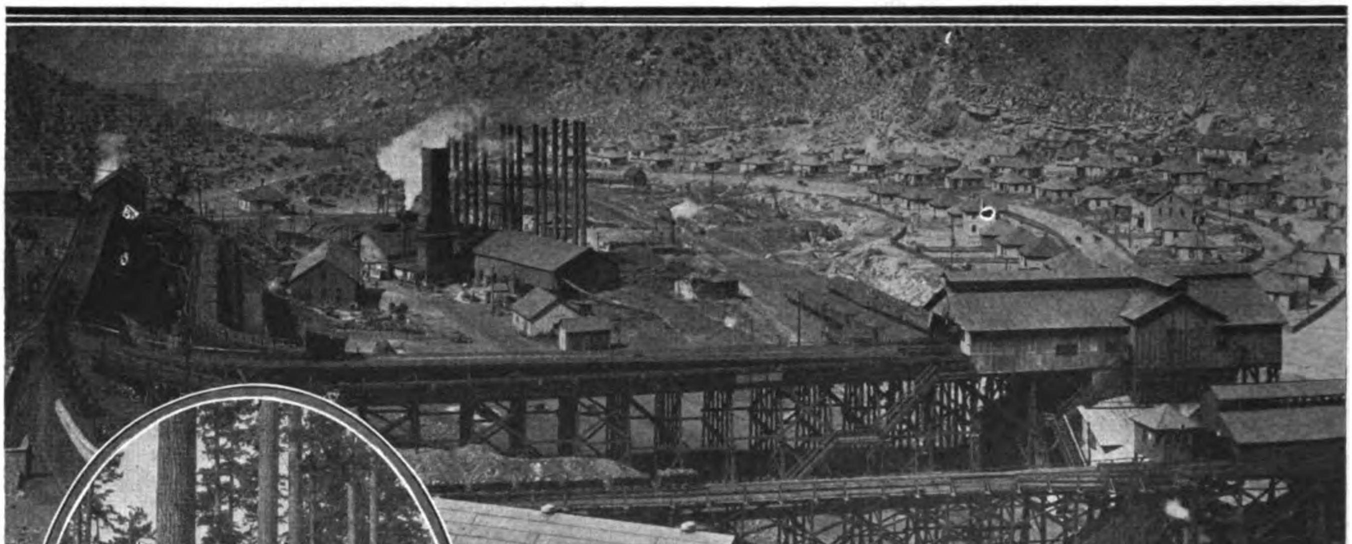


Fig. 10. The presence of coal in the West means the location there of industries like steel mills that have located not far from the mines of the Utah Fuel Co. shown above, near Salt Lake City.

Fig. 11. Reforestation may provide a constant lumber source for the paper and pulp, furniture and other industries which locate near the forest.

Fig. 12. The head offices and Atlanta plant of the Coca-Cola Co., which has twelve syrup factories in different parts of the country supplying 1,250 associated bottling plants, which cover every local market.

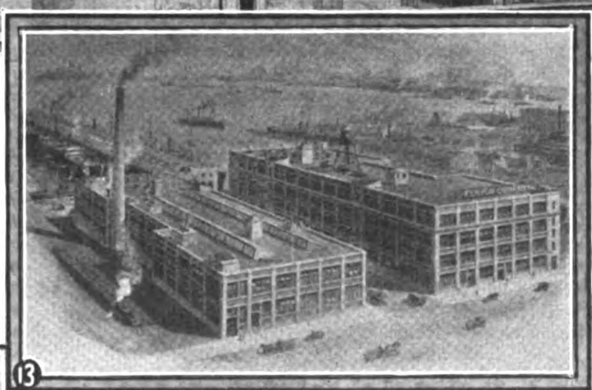


Fig. 13. Market and raw materials. The Kenyon Co. makes its cord tires and tubes on the waterfront in Brooklyn, in the heart of the great Eastern consuming market, and where rubber comes in cheaply by boat.

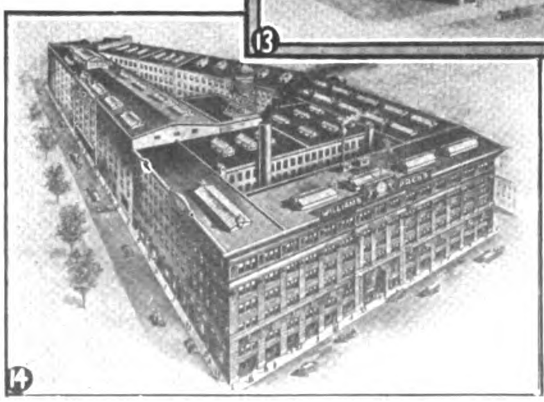


Fig. 14. To find stable labor conditions many concerns are locating in smaller cities. The Williams Printing Co. of New York moved this plant to Albany for the above reason.

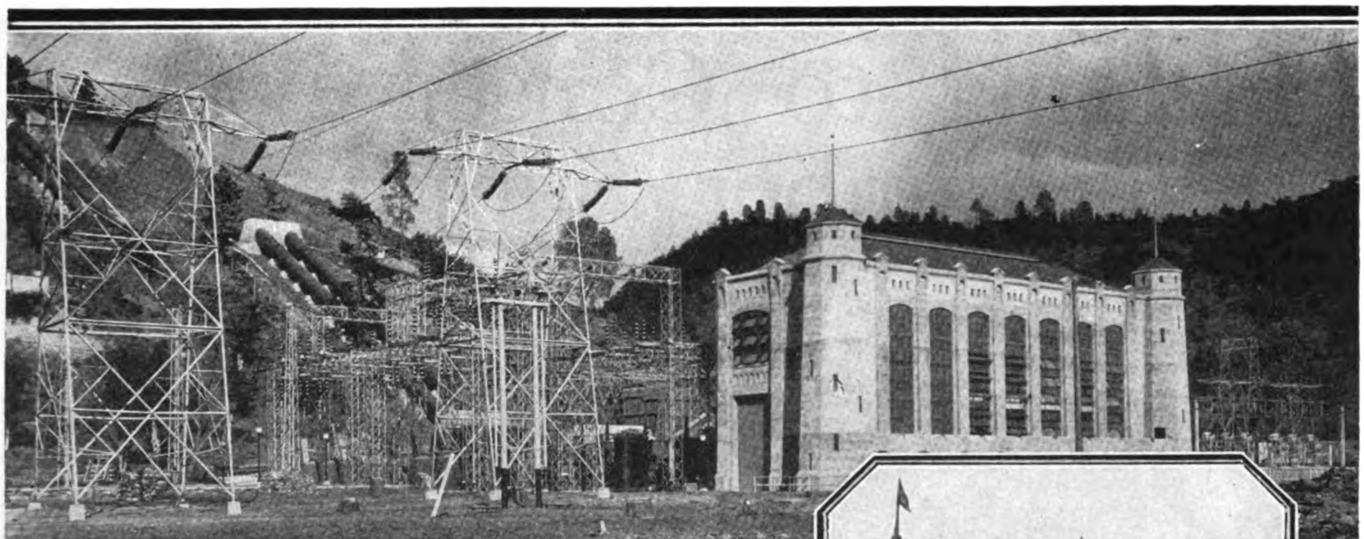


Fig. 15. Manufacturers establishing Western branches in California find power available almost wherever a wire can be strung, thanks to that state's hydro-electric super-power system.

Fig. 16. Local enterprise brings industries. The splendid dock and terminal system at Mobile, Alabama.

Fig. 18. The Long-Bell mill on the Columbia River, west of Portland, Ore., near great forests, and magnificent rail and water facilities.

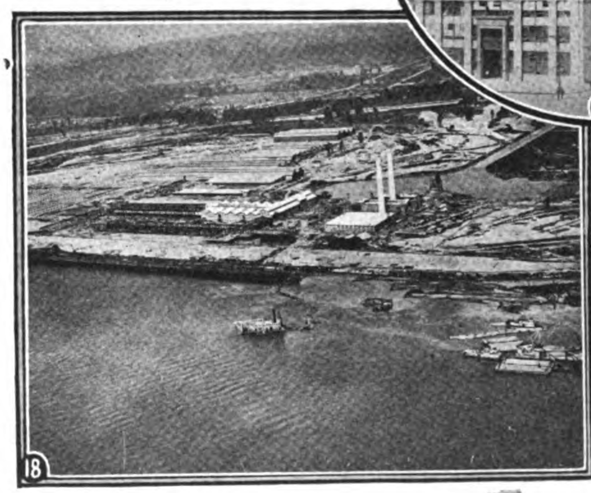
Fig. 17. Locating near the market. The Sperry Gyroscope Co. establishes itself in Brooklyn at New York Harbor where its customers, steamship companies and ship officials center.

A splendid example of relocation to reach markets, the first factor, effectively, is the Coca-Cola Company, which through 400,000 dealers provides to the public about two billion drinks a year, fresh, at any time, anywhere. It is a stupendous problem. This company believes that the proper location of their factories and distribution system is a good talking point in their advertising campaign. Listen to this:

"Coca-Cola is sold in every corner of the United States and in 27 foreign countries.

"In order to adequately supply the demand for this beverage, there are eight Coca-Cola syrup factories in the United States. In addition there are four in Canada and two in Cuba. These factories are strategically located to make quick deliveries and gain low freight rates—in Atlanta, New York, Baltimore, New Orleans, Dallas, Chicago, Los Angeles, Kansas City; Toronto, Montreal, Winnipeg, Vancouver, Canada; Havana and Santiago, Cuba. Supplementing these are 24 regional warehouses."

(*Continued on page* 92)



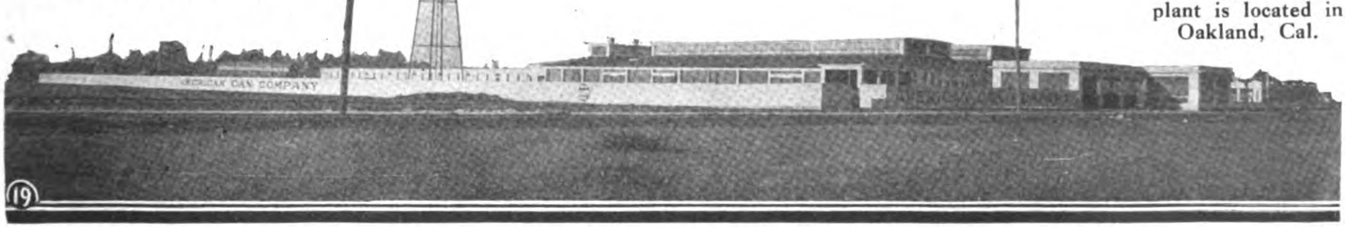


Fig. 19. Another American Can. Co. factory. This beautiful one-story plant is located in Oakland, Cal.

Helping to Conserve Our Lumber Supply

How Ford, at River Rouge, Minimizes Waste in Sawing

BY methods new to large scale lumbering and woodworking, the Ford Motor Company has installed a new wood sawing system which has demonstrated savings of from 35 to 50% in the cutting of fine hardwood for automobile body parts by sawing them direct from unedged planks as they come from the log. This is an achievement in wood conservation as important as the generation has produced. The system is already on a production basis at the saw mills and woodworking plants of the Ford Motor Company at Iron Mountain, L'Anse and River Rouge.

In the past, body parts have been made out of kiln dried boards, which were sawn to uniform size and grade. Much of the youngest and best wood was wasted in this process, and in cases where the log was curved or irregularly shaped the scrap often exceeded the merchantable timber obtained.

The Ford system is absurdly simple. Planks with the bark left on are cut from a log in parallel planes varying according to the shape of the log. These are sent to "layout tables," where patterns for various parts are marked out until the plank is completely covered with patterns right up to the bark. Any irregularities, such as the swell at the butt, are taken advantage of in laying out curved or irregular parts. Instead of trimming off a large piece to avoid a knot or check, the layout men simply go around it. This method permits the utilization of nearly all the wood, the scrap being extremely small. The various parts are then cut out with a high speed band saw.

Under conventional methods the proportion of board feet in body parts by actual measure-

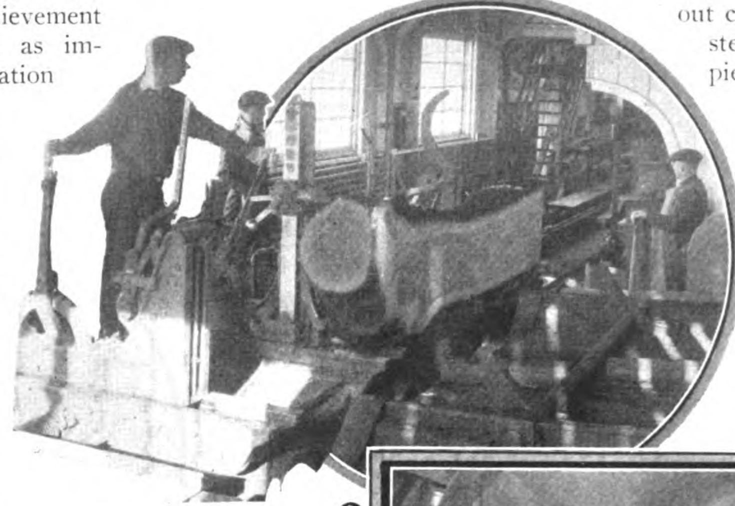


Fig. 1. Without removing the bark, logs are sawed into planks of a thickness suitable for the parts to be made.

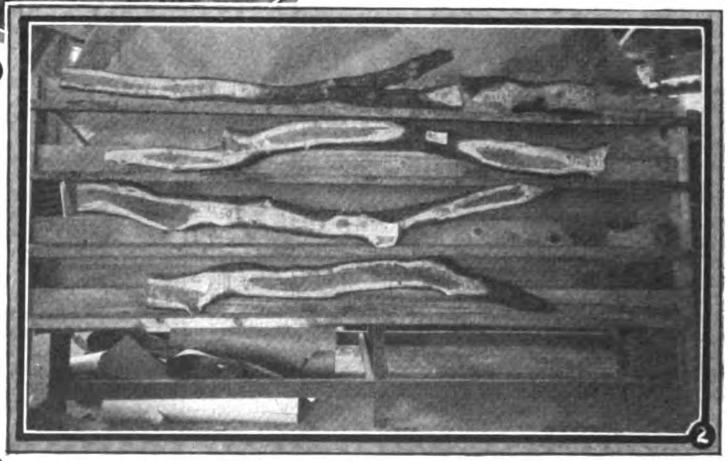


Fig. 2. Limbs—which ordinarily are worthless except as fuel or for chemical byproducts — are sawed into "flitches" and parts laid out for sawing.

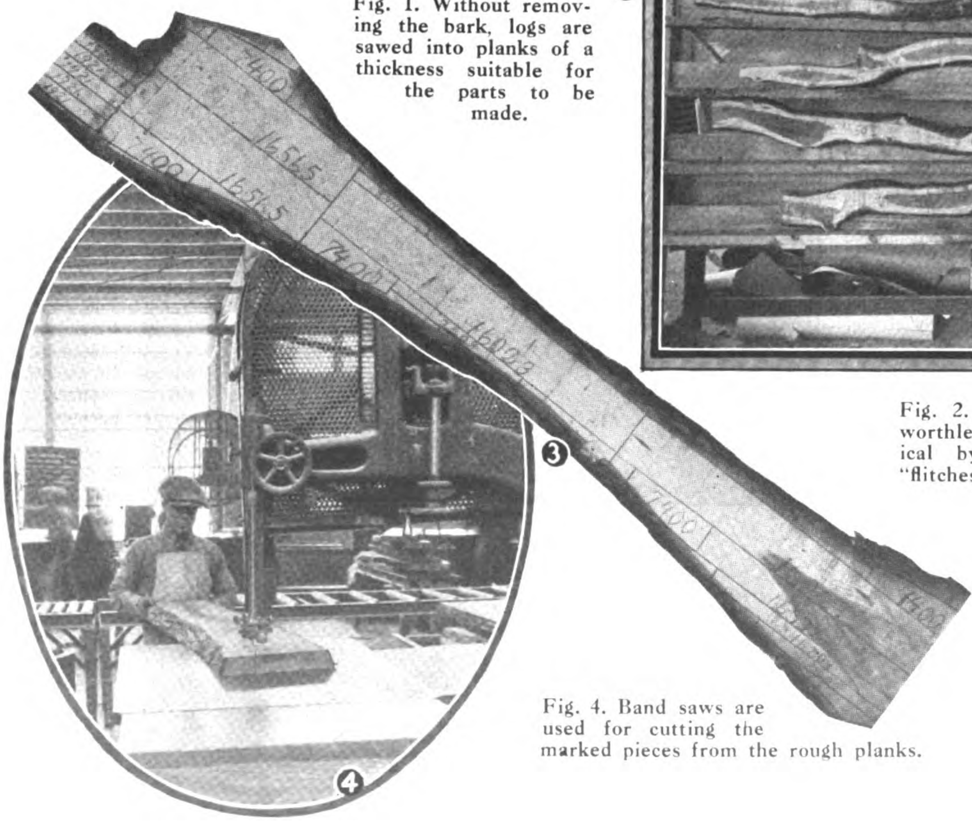


Fig. 3. This shows how little waste is involved in the Ford method of laying out parts to be sawed.

Fig. 4. Band saws are used for cutting the marked pieces from the rough planks.

ment to the wood content of the entire tree is distressingly low. One-third of the tree (the limbs and top) is wasted before the log gets to the mill. Only 55 to 60% of the log is actually converted into body parts.

A sample tree was cut up into body parts under the new method and the results compared with the amount of parts which the old method of edging and sawing would have given. The results were so startling that the system was put into effect at the various Ford plants as soon as possible.

The tree gave two irregularly shaped logs which scaled 238 board feet. There were also a number of branches and the top. The best use that could be found for these under conventional lumbering methods would be to send them through the wood distillation plant. Instead they were sawed up and marked for parts sawing.

After the logs had been sawed by the Ford method and the patterns laid out, the planks were measured up according to the boards which could be obtained under the old edging and trimming method and the number of available parts in each computed. All parts were reduced to board feet in actual lumber content. The edging and trimming method gave 127 board feet of body parts. Under the Ford system the same planks

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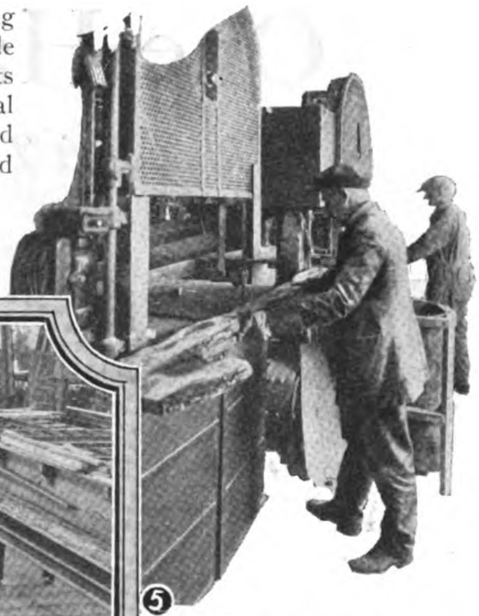

Fig. 5. Another view of the cutting out of parts on band saws. Note the odd-shaped piece, which, under ordinary methods, would involve much waste lumber.

Fig. 6. The layout bench, where parts are marked off for sawing. Note how advantage is taken of natural curves in the plank.

Fig. 7. The scrap pile, nowadays, consists of the irreducible minimum of waste lumber.

Fig. 8. These are the finished wood parts sawed from the plank shown in Fig. 6.

Fig. 9. Another example of the use of tree limbs ordinarily worthless as lumber. Note the economy of layout.

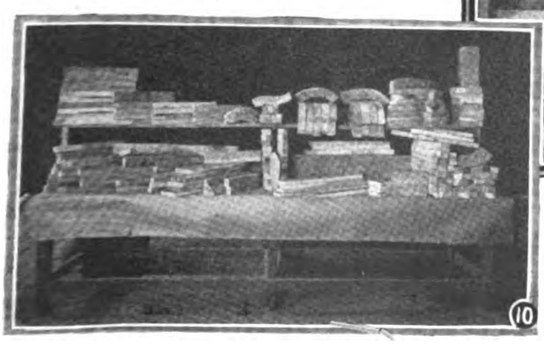

Fig. 10. Under the ordinary method, production of these parts would require almost half again as much lumber as is used under the new method.

One Handling or Many?

Hand Lift Truck Skid System of Transportation

By Matthew W. Potts

THE day of greater efficiency in management is here and with it has come a realization of the urgent need for a flexible and economical method of lifting and carrying transient materials in course of manufacture, shipment or transfer. While the need for improved and automatic machinery to multiply the output of skilled labor was long ago recognized, and the machines to meet it were developed and adopted, yet it is only within the last decade that the wastefulness of the manual method of lifting and moving loads has been, to any extent, appreciated. Even today the costly practice of using hand labor for lifting, carrying and storing loads is by no means uncommon. This is amazing when we consider that hand lift trucks have been in operation for the last fourteen years. It would seem that by now we should all be thoroughly educated and ready to grasp the enormous savings which can be made by installing such a system for internal transportation. Especially as the losses sustained through inefficient and costly handling exert a far-reaching influence on the ultimate costs and profits.

The accompanying illustrations and text present systems of hand lift trucks in various industries, handling numerous materials under practically every condition. The busy executive can learn much by simply glancing at the photographs. If he will go further and investigate trucking conditions within his own

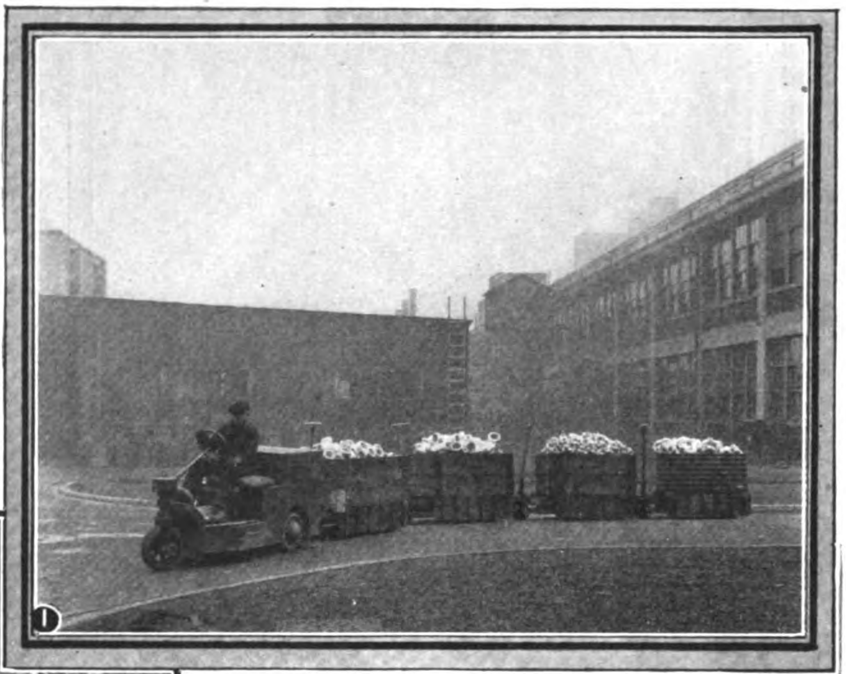

Fig. 1. Lift trucks, equipped with trailer hitches, drawn by tractors, make an efficient handling system.

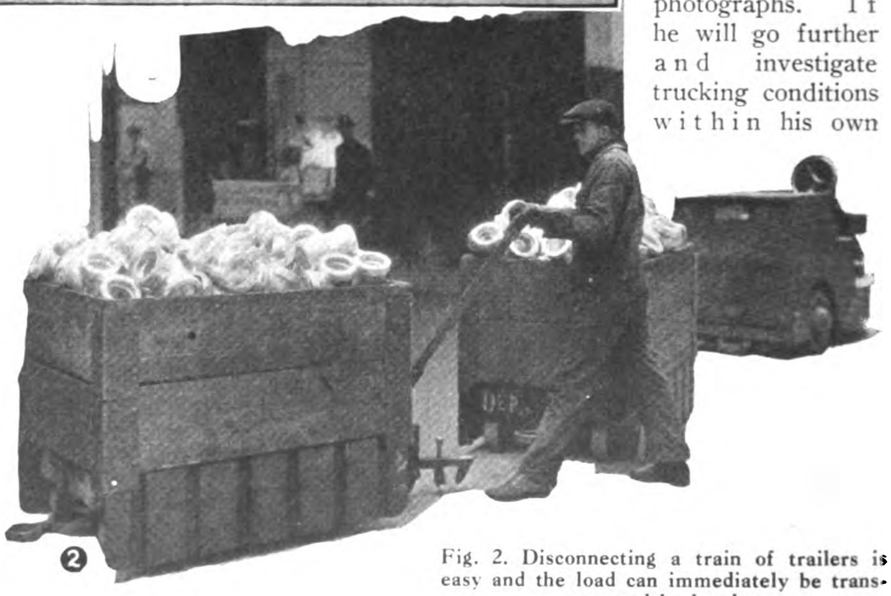

Fig. 2. Disconnecting a train of trailers is easy and the load can immediately be transported by hand.

Fig. 3. The advantage of this truck is the fact that it can weigh when goods are picked up or deposited, thus doing away with the necessity of transporting a load to a regular scale.

plant and make comparisons, he will undoubtedly find many places where his handling costs are excessive. Costs are generally lowered when an efficient, flexible and inexpensive method is employed. By using more modern methods we can effect more savings, thereby increasing profits.

Let us consider the example set forth in Figs. 4, 5, 6, and 7. Here is a complete revolution of old time methods and one that not only assists the contractor to reduce his costs, but also eliminates congestion in the city streets, which is now quite a problem in most cities.

In building the Business Men's Club, at Cincinnati, the Harig Company, who were the contractors building this structure, were awarded same on a favorable bid, made possible by the low mater'als handling cost on the job. With them the hod carrier

Fig. 4. Large savings can be effected by loading brick, cement, tile, etc., at the railroad yards in this manner.

Fig. 5. Loads placed on skids at the railroad yards are taken direct from the motor truck into the building without rehandling, by means of hand lift trucks.

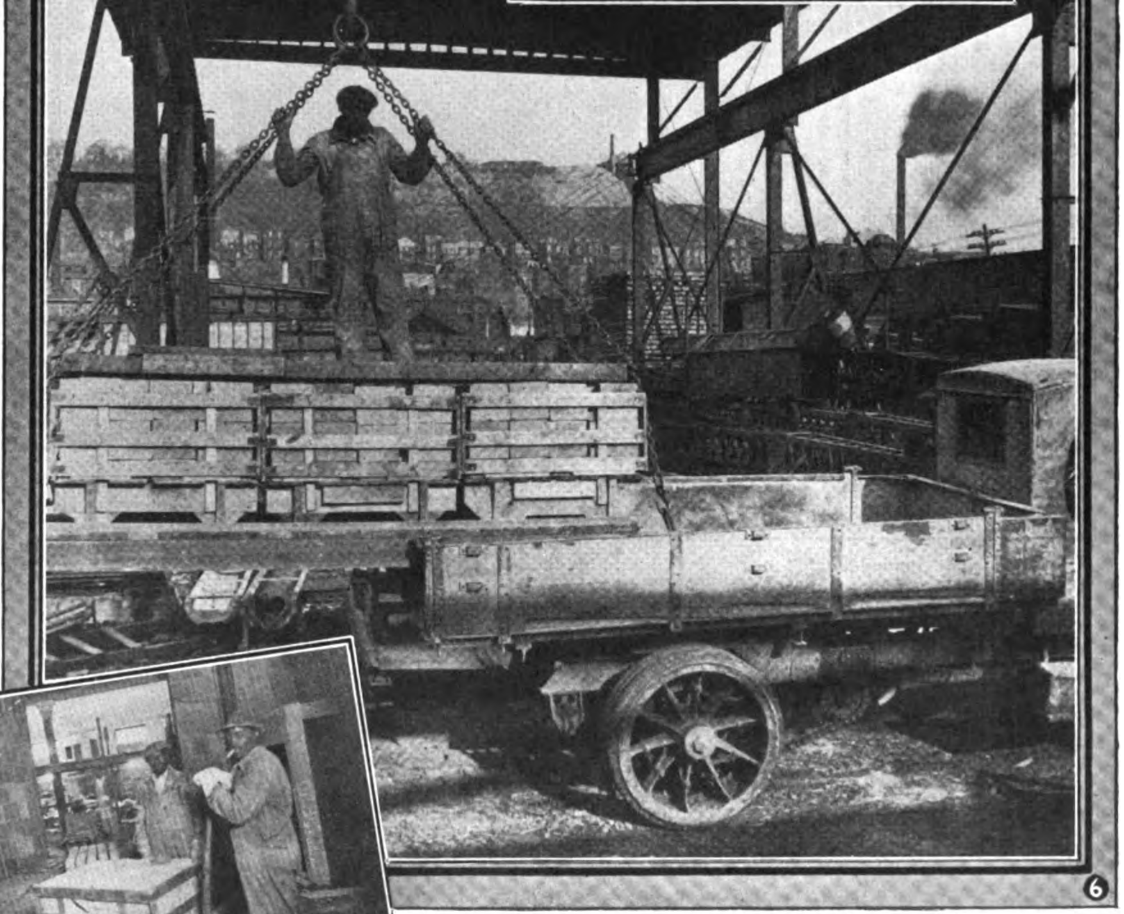

Fig. 6. This is one method of transferring load from freight car door to motor truck. Note the lift platforms.

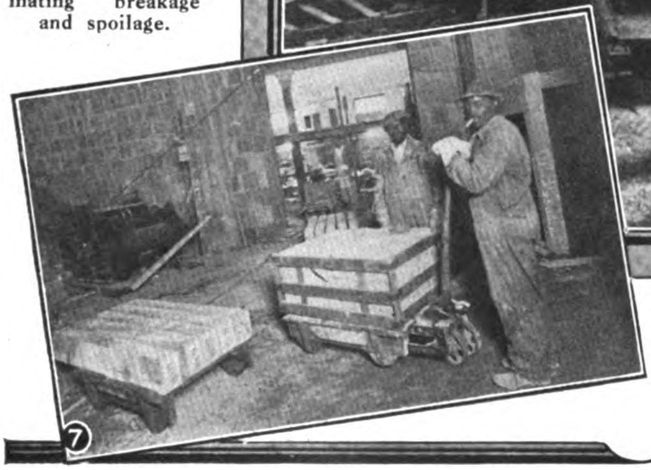

Fig. 7. Again without rehandling, the material is deposited in the building at the point required, thus eliminating breakage and spoilage.

had to become a trucker, his carrying capacity had been multiplied many times, and by using the lift truck system of transportation they anticipated that one trucker would replace five hod carriers.

For years and years the hod carrier has been an "institution" in building construction; but times change, the value of an hour of a man's time has steadily increased, and his production must increase with it or costs become prohibitive. The illustrations mentioned above show how this company increased the man-hour production. All of the brick, cement, tile, etc., as it was received at the yard, three miles distant, was stacked on skids of the rack and bin type at the car door (Fig. 4), then loaded with an overhead crane onto the motor truck (Fig. 6), then hauled to the building under construction,

Fig. 8. The operator soon gets the knack of lifting the load by means of the truck handle.

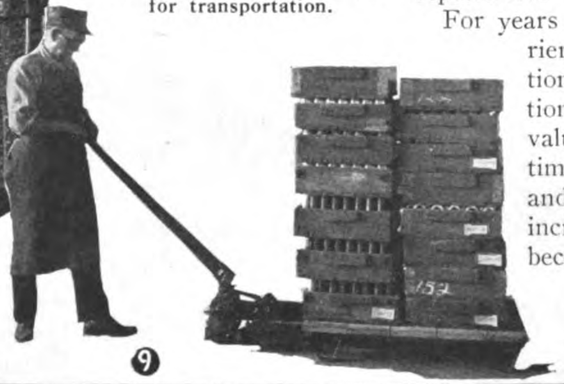

Fig. 9. Here we visualize the simplicity of placing the truck under the loaded skid for transportation.

Fig. 10. The trucker is just depositing a load of material while the other workman is loading up another skid with Sagers of fragile material.

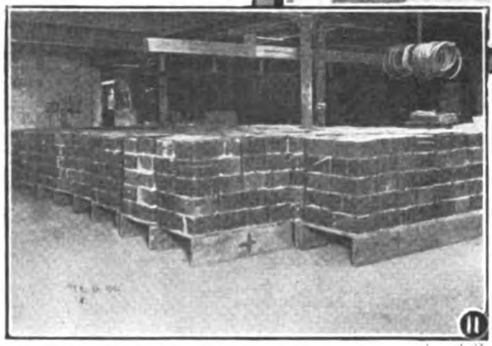

Fig. 11. The loaded Sagers are stored in this manner both before and after kiln firing.

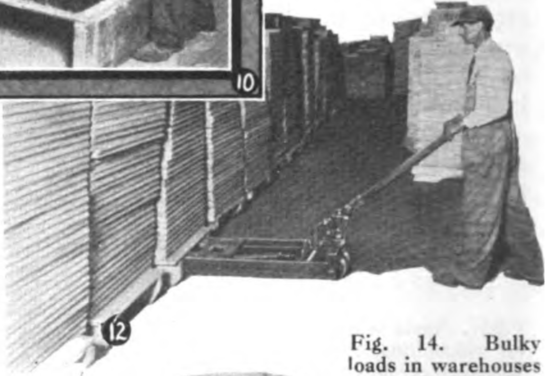

Fig. 12. Care should be taken in laying out aisles, as narrow aisles impede the operation of lift trucks.

Fig. 13. Simple attachments on skids permit the handling of loads by cranes as well as hand lift trucks.

Fig. 14. Bulky loads in warehouses and production plants are costly to handle. Each handling eliminated further reduces the cost.

Fig. 15. Sheet metal stampings are easily piled on skids and transported between operations.

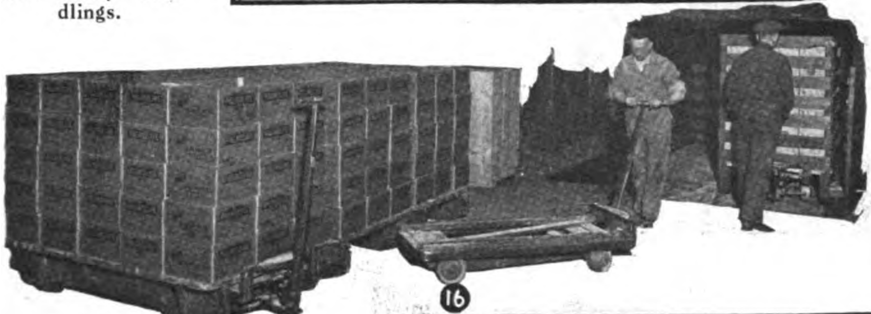

Fig. 16. For intra-plant transportation, or intra-building transportation, the loading of motor trucks with materials on lift platforms will save many handlings.

Fig. 17. By using the lift platform system, car unloading costs are materially reduced, as there is no time wasted waiting for truckers.

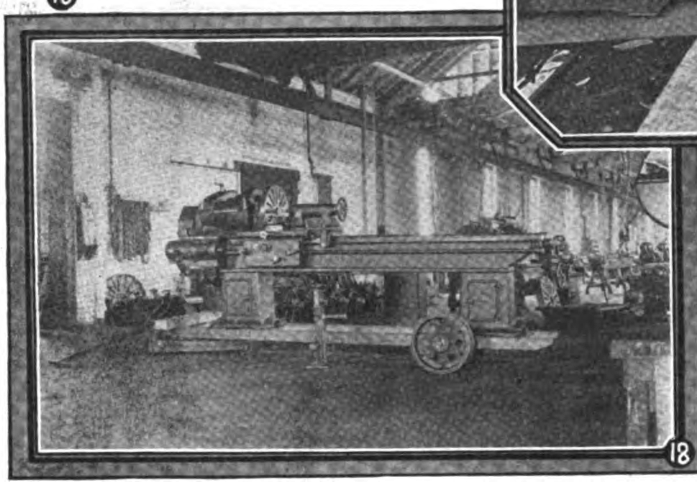

Fig. 18. Lift trucks can be used in many ways, one of which is shown. Here the truck acts as a low platform hand truck.

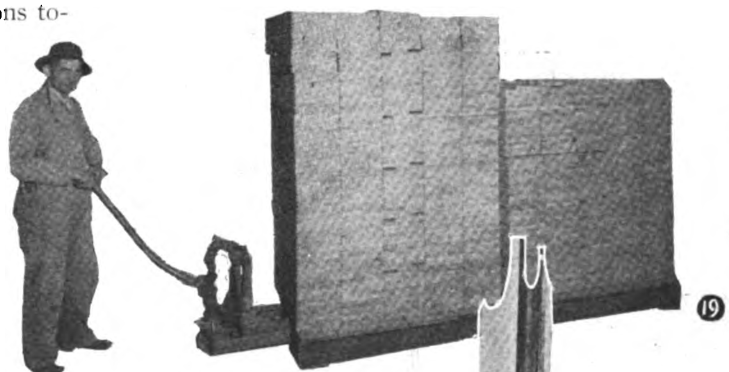

Fig. 19. Some hand lift trucks are made for lifting the load by a single lift, others are known as multiple lift trucks, one of which is here shown.

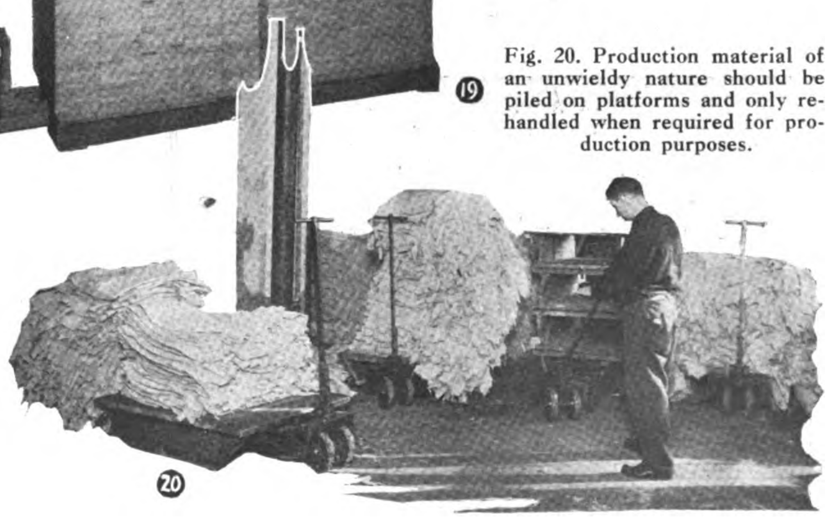

Fig. 20. Production material of an unwieldy nature should be piled on platforms and only rehandled when required for production purposes.

unloaded at the first floor with a hand lift truck (Fig. 5), then hoisted to the floor, where it was immediately needed. With this system, the bricks, tile, etc., were piled high on conveniently placed platforms. The load was right where it was needed, not haphazardly strewed around, and breakage was practically nothing for rehandlings were eliminated. Fig. 7 shows how easily the workmen handle loads on the various floors.

Our economic conditions today make it imperative to consider the hand lift truck system because it is one of the many materials handling methods by which profits can be quickly increased. During the last twenty-five years production machinery has been steadily improved until it is now apparently at the peak of refinement. In the past, principal attention has been focussed on short cuts in manufacturing, such as making machinery work faster, so as to turn out more stock in a given period. With this condition existing and the apparent limits of machine improvements reached, it is highly desirable to consider a point that has been overlooked very largely for years: namely, how most economically to pass materials through production. The great advantage of the lift truck and skid system lies in its ability to fit into practically any manufacturing plant without disorganizing routine and manufacturing schedule. This adaptability makes the system extremely flexible and unusually well suited to practically any class of handling in a wide range of industries.

For example, we direct the reader's attention to Figs. 1, 2, and 3. The first two mentioned are taken in the plant of a large valve manufacturer where small parts, in great quantities, presented a problem in handling. In 1917, this problem was given proper consideration and today nearly two hundred hand lift trucks with an unknown quantity of various types of skids are simplifying the hauling of tons and tons of material, and also effecting a saving up to 80% of the former handling costs by eliminating rehandling of materials. We also see in these illustrations how hand lift trucks can be hauled in trailer trains by means of tractors. This development of the trailer hitch is opening a new field and broadening the scope of the lift truck as a transportation medium.

Fig. 3 shows another improvement on the lift truck: namely, making the

Fig. 21. For handling fragile materials, lift trucks are now equipped with springs which absorb shock in transportatoin.

Fig. 22. In shipping rooms and warehouses, hand lift trucks are economical units. They facilitate easy and quick handling.

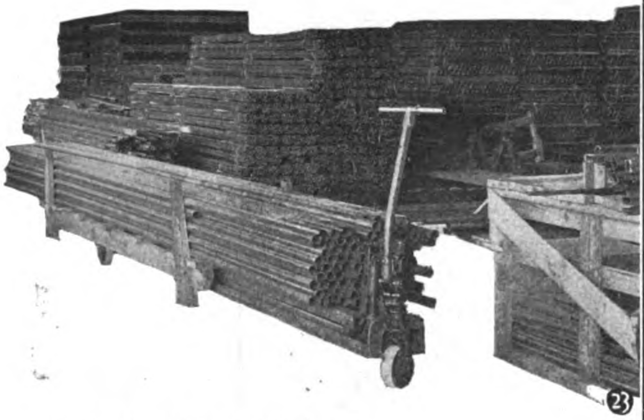

Fig. 23. Trucks can be built for handling long pieces, but these are really special equipment.

Fig. 24. The printing industry, as well as the paper industry, has found the lift truck method of handling best suited for their needs.

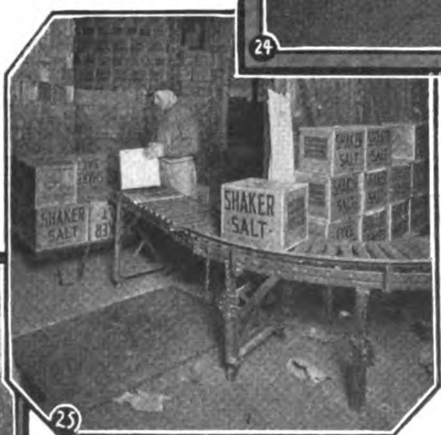

Fig. 25. This illustrates a method of unloading direct from freight cars to hand lift truck platforms without entering the car.

Fig. 26. Rack skids can be built to meet the requirements of the industry in which the systems are operated.

scale a part of the truck. In handling process material, it is frequently necessary to weigh the goods, or batch, between steps in process. An advantage of this truck is the fact that it can weigh when goods are picked up or deposited, thus doing away with the necessity for transporting a load to a regular scale. Frequently, this eliminates many steps in hauling, thereby conserving time and energy.

We hear much about a shortage of common labor and the need of conservation, but executives seldom realize that the highest type of saving and the best way of overcoming a shortage in anything is to make unproductive movements productive. The savings which are effected by materials handling equipment are not in the strictest sense of the word *labor-saving,* for the savings are derived mainly because unproductive labor is converted into something productive and time previously wasted is devoted to other, and more important, work. In many plants, this can be brought down in terms of hundreds or thousands of dollars annually, depending upon the quantities of materials moved and how effectively the system is employed.

Today the hand lift truck and skid system, because of its adaptability to

(*Continued on page* 63)

Fig. 27. Even milk companies have found hand lift trucks a safe and convenient method for handling their products.

Fig. 28. Bags of flour in bakeries are now stored on platforms so as to eliminate unsanitary conditions and also to reduce handling costs.

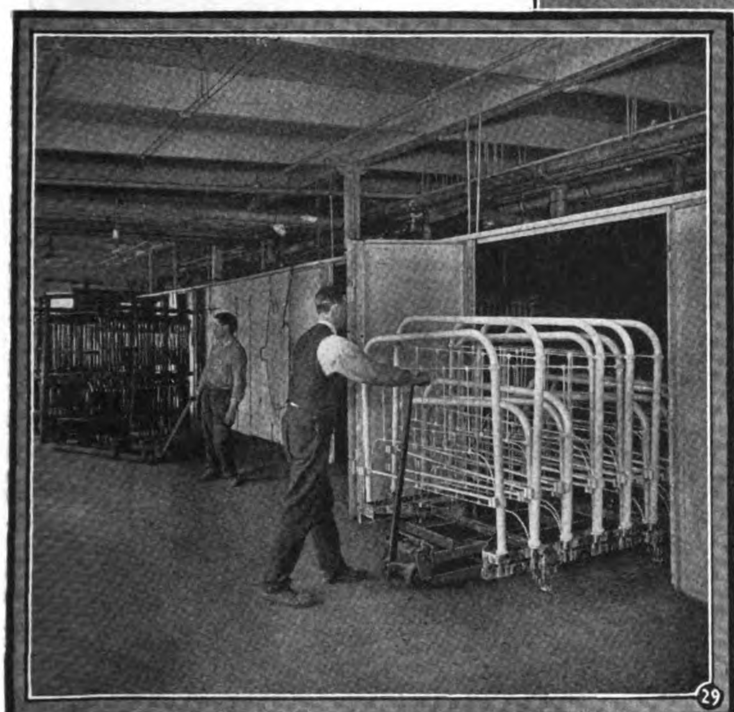

Fig. 29. Practically any industry can adapt lift truck methods to their transportation problems.

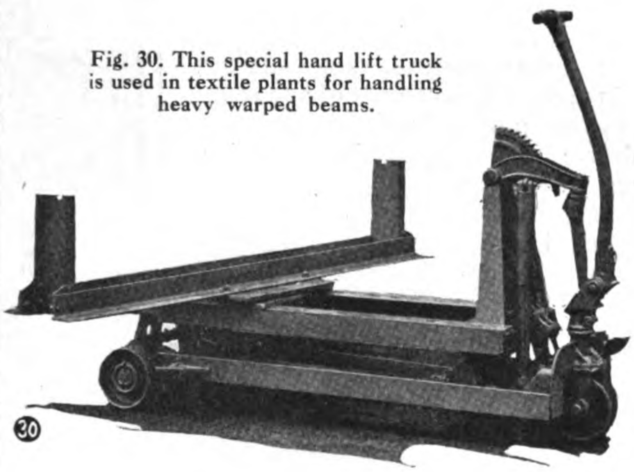

Fig. 30. This special hand lift truck is used in textile plants for handling heavy warped beams.

Fig. 31. Heavy loads under severe conditions and for long storage can be conveniently handled by pressed steel platforms.

Fig. 32. Aisles should be at least as wide as the lift truck is long, preferably slightly wider. The necessity for this is clearly shown.

Combating Rust and Corrosion

Practical Suggestions for Prolonging the Life of Iron and Steel Work

By Roy C. Sheeler

IN considering the various problems met by the Maintenance Engineer in the ceaseless effort to combat the forces of deterioration, it must be borne in mind that there are certain principles to be observed, that will apply in practically all cases. The treatment recommended will depend upon the circumstances governing each case with respect to the nature of the surface and the conditions which the surface must meet. In some instances the use of a paint of a different character or makeup is all that might be required to keep the surface in good condition indefinitely. In still other cases the conditions to be met are entirely too severe and out of the ordinary to permit of any paint application that would meet with any degree of success the corrosive action of the forces with which it must come in contact.

In the upkeep of industrial buildings in which manufacturing processes are carried along perfectly normal lines, the matter of their proper upkeep is comparatively simple. This is true, however, only to the extent that when the structure was

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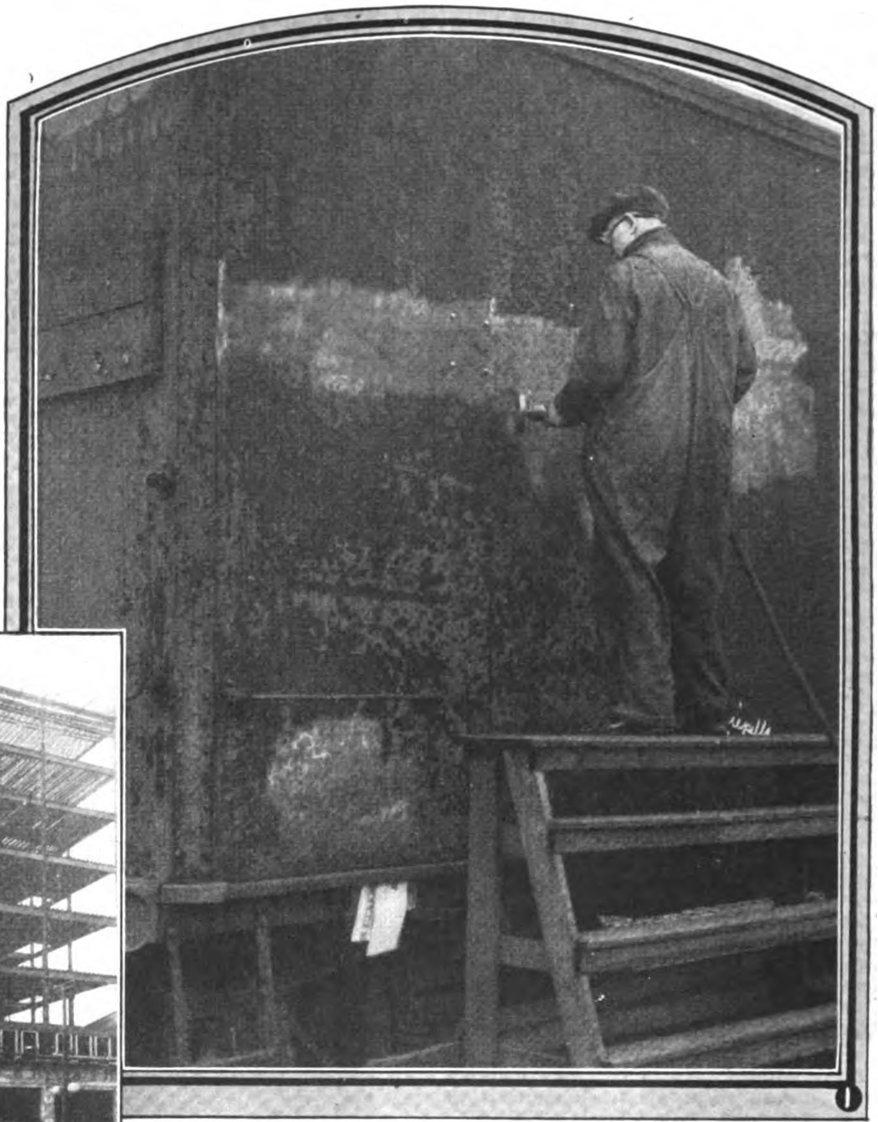

Fig. 1. It is vitally necessary to remove all the rust, by wire brushing or even with a cold chisel, before painting the surface; else corrosion goes on under the new paint.

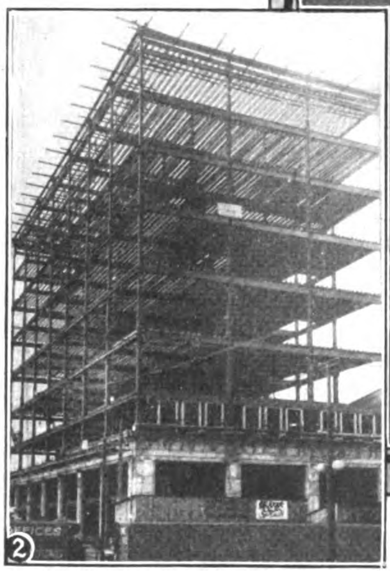

Fig. 2. A good rust-inhibitive coat next to the metal is usually applied to structural steel by the fabricator; but transportation often produces worn spots, which should be taken care of.

Fig. 3. The color of paint used on tanks is important. Dark colors absorb more heat rays and cause a rise of temperature within the tank.

Aerial Transportation

An Interview, by D. G. Baird, With Colonel J. G. Vincent Vice-president in Charge of Engineering, Packard Motor Car Company

BUSINESS men hopping back and forth between their offices and their homes fifty miles out in the country, millions of pleasure planes swarming the air, non-stop flights of a thousand miles so common as to attract no attention, regular transcontinental air service, giant air liners encircling the globe without stopping, crack limited trains and ocean liners reduced to the status of freight carriers—these are some of the dreams of the man of today who has become accustomed to read of some revolutionary discovery every morning over his coffee.

Colonel J. G. Vincent, who—as vice-president in charge of engineering of the Packard Motor Car Company—has done perhaps as much as any other man toward perfecting aerial power plants.

He is as positive that these things will come to pass as he is that his eight-cylinder motor car will transport him to his office without stalling this morning. Nothing is impossible, he assures one with a complacent air, as if he himself were accustomed to solve a few problems that have been baffling mankind every evening before retiring. Some of these days we'll read that the helicopter has been perfected, that motorless flight has been accomplished, that wireless transmission of electrical power has been found feasible, or some other Jules Verne discovery has been made, then all we'll have to do to realize our dreams of conquering the air—and with it time and space—will be to get down to quantity production. Aeroplanes will be as cheap, as durable, and as safe as motor cars.

Those who are engaged in the industry have only slightly less highly-colored visions of the future of aerial transportation, but they are not expecting to make any discoveries of the Jules Verne type referred to. They expect to reach the stage of quantity production, all right, but they expect to get there by taking short, laborious, and sometimes even painful steps, rather than by any spectacular leap.

There is Colonel J. G. Vincent, for example, who played so important a part in developing army aircraft for the Government during the World War and who, as vice-president in charge of engineering of the Packard Motor Car Company, has done perhaps as much as any other man toward perfecting aerial power plants.

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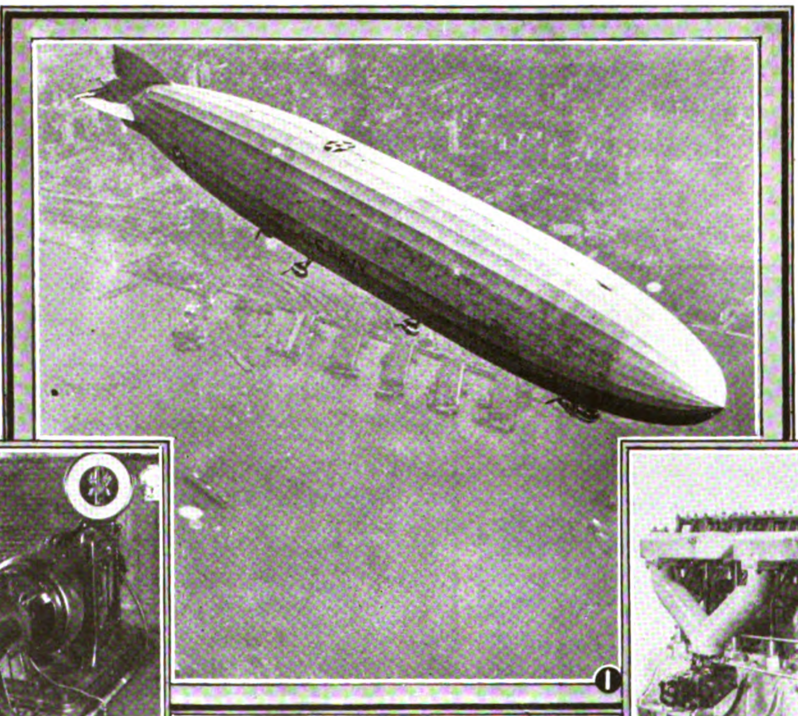


Fig. 1. The United States Navy dirigible *Shenandoah*, flying over the Hudson River.

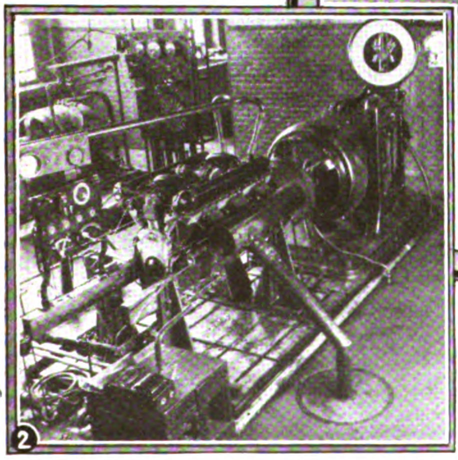
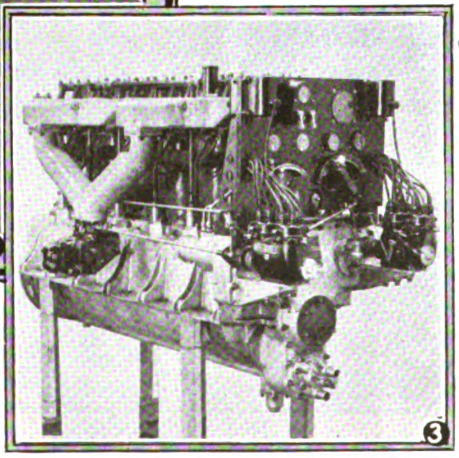
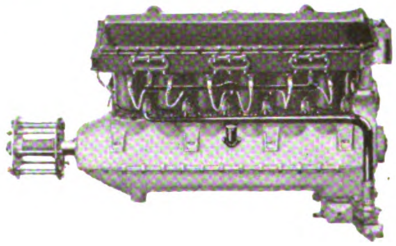


Fig. 2. A modern aircraft motor undergoing dynamometer test at the factory.





Figs. 3 and 4. Aircraft motors; the one above being one of the *Shenandoah* engines.

Chain Drives and Their Lubrication

By Allen F. Brewer

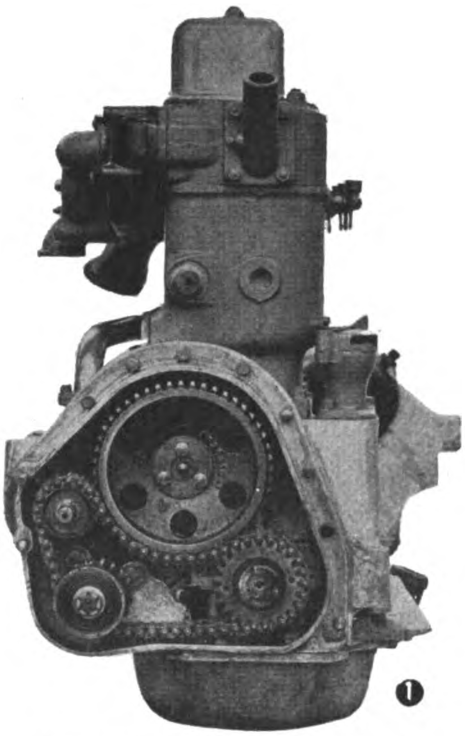


Fig. 1. The extent to which a single chain can be made to serve a number of separate drives is clearly shown in this picture of a front end drive on a gasoline engine.

A RATTLING clank of roller to sprocket tooth, a metallic clicking incessant in its monotony. What more is necessary to inform us that something is radically wrong with the working of our driving chains? How could we ever be better notified that abnormal friction and wear are taking place? Wear which is continually leading towards a day when a link may break and leave our motor truck helpless by the roadside, or bring about the closing down of perhaps certain plant machinery upon which the production of the entire works depends. Nor can any of us justly disclaim an interest in chain drives. The extent to which chains of this nature have come into use over the past few years is too evident. But a glance at the engine and transmission of certain of our automobiles and motor trucks will suffice to dispel any idea that you and I, Mr. Layman, need not worry about driving chains. The fact of the matter is, nine-tenths of us use them daily, whenever we "step on the gas," for the automobile engine in many cases has a silent chain hidden away in its "innards" which most of us have never seen. In brief, power is frequently best transmitted from the crank shaft to the timing gears, etc., by means of a silent chain drive. In the motor truck, however, we are all more familiar with the roller type of chain which serves as the driving medium. Its clanking, in fact, is almost an ex-

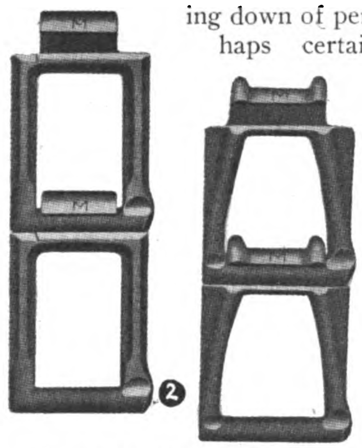


Fig. 2. Two types of detachable chains showing the essential features of design and construction. The facility for entrance of foreign matter into the chain connections can be readily appreciated.

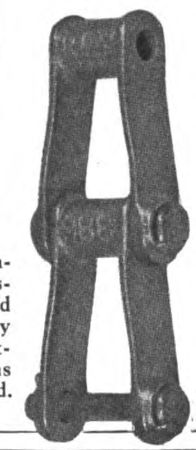


Fig. 3. It is more feasible, however, to lubricate the pintle type of chain as shown above.

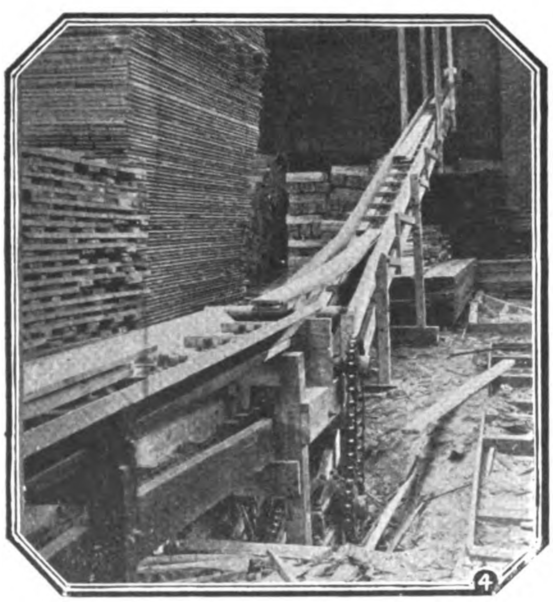


Fig. 4. The chain drive of a lumber conveyor in a boxing mill. Here is another instance of a chain operating exposed to considerable dust and dirt, yet it must function positively and economically.

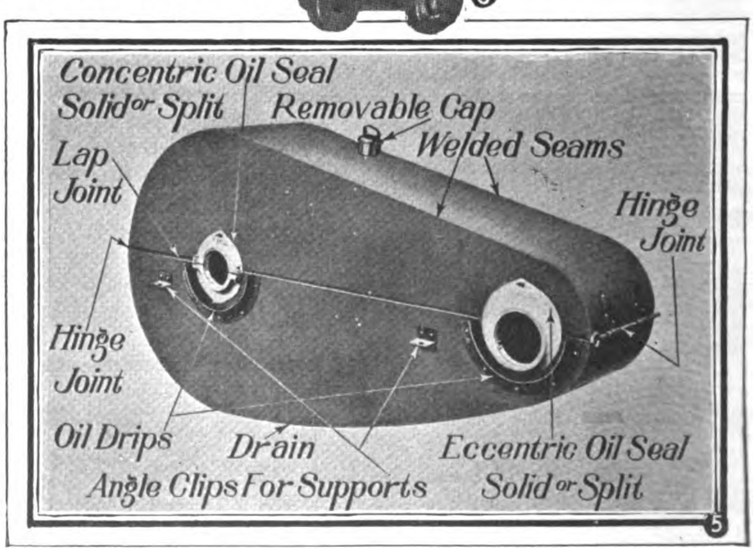


Fig. 5. An oil retaining silent chain casing. The essential details of constructions are clearly shown by the respective notations.

pected sound on road and highway.

But what does this noisy clanking indicate? We have already mentioned it as being the harbinger of abnormal wear; in addition it is indicative of insufficient or improper lubrication. Sometimes this is a necessary evil, and the best of care will not be able to overcome entirely detrimental operating conditions. As a rule, however, lubrication properly carried out in accordance with the construction of the wearing parts of the chain drive and its lubrication should be understood by us all, for only thereby can we hope to maintain continued successful and economical operation of any machinery involved.

Where lubricants are to be selected for chain drives, the types of chains and their methods of operation must generally be taken into consideration. In fact a discussion of chain lubrication would be relatively incomplete without a few words in regard to the constructional features of the various types of chains in common usage today.

Malleable iron and stamped steel chains which are in general designed for relatively rough service, and known as detachable and pintle chains, are probably the simplest types of driving chains encountered in

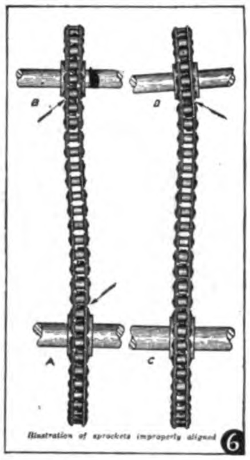


Fig. 6. An illustration which is intended to bring out the effect upon a chain drive where the sprockets are improperly aligned. As a rule in such cases considerable side wear will take place, with resultant damage to the chain parts.

the chain and the operating conditions involved, will be a decided eliminator of noise and will increase the life of our chain indefinitely by the simple expedient of reducing wear. So positive have been the results over years of operation and observation that certain manufacturers will not sell a chain if they know that the customer plans to operate it dry or without lubrication. The reason is self-evident. The cost of repair parts and the task of straightening out complaints would probably mount beyond all reason, and would certainly not be within the realm of modern engineering practice. So

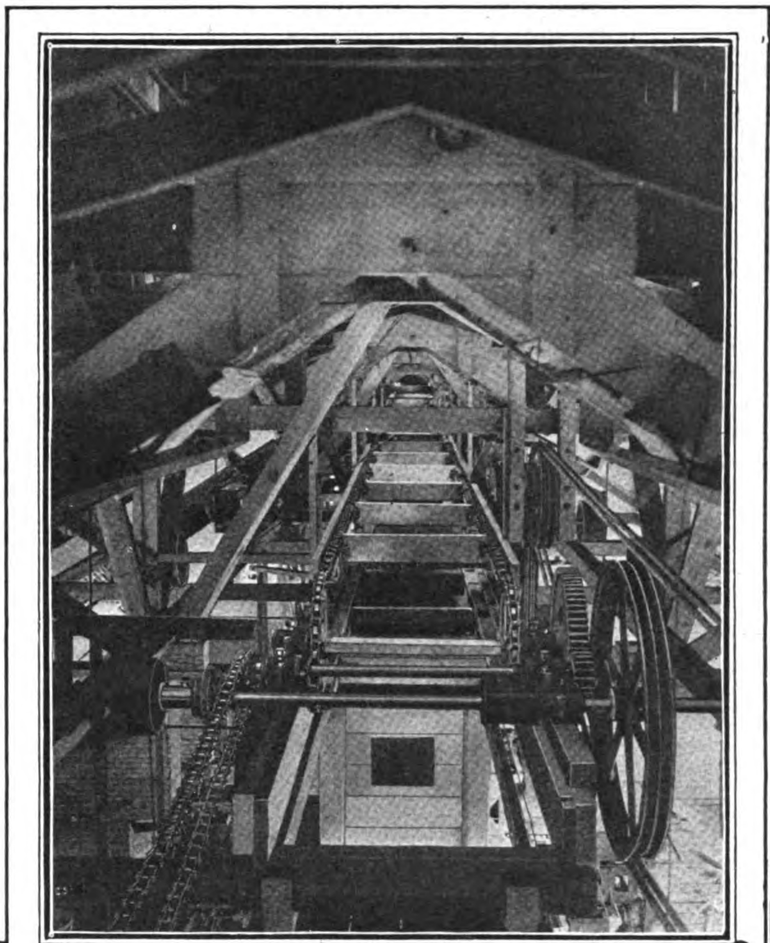


Fig. 7. Showing the application of the malleable iron type of chain to a distributing conveyor serving the huskers in a canning plant. The extent to which the chain operates exposed is clearly shown.

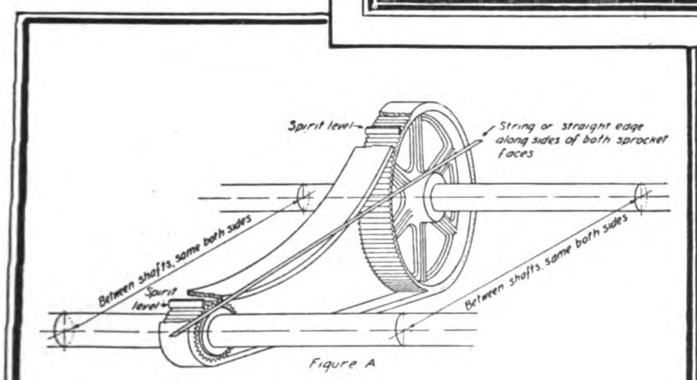
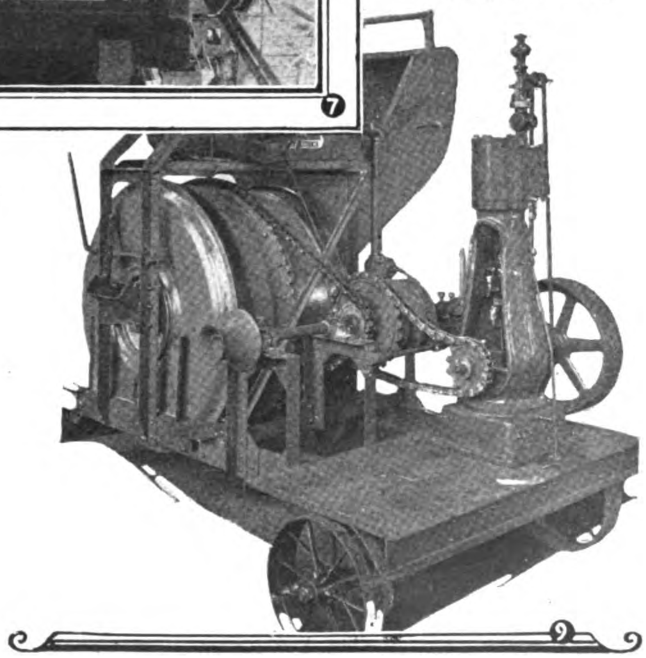


Fig. 8. Layout of a silent chain installation showing clearly the manner in which the sprocket shafts and chain can be tested for **parallel, levelness, and proper alignment.**

Fig. 9. In the concrete mixer the driving chain which rotates the drum is one of the important features of construction wherever it is installed. Its relation to the entire machine is clearly shown in the accompanying illustration.



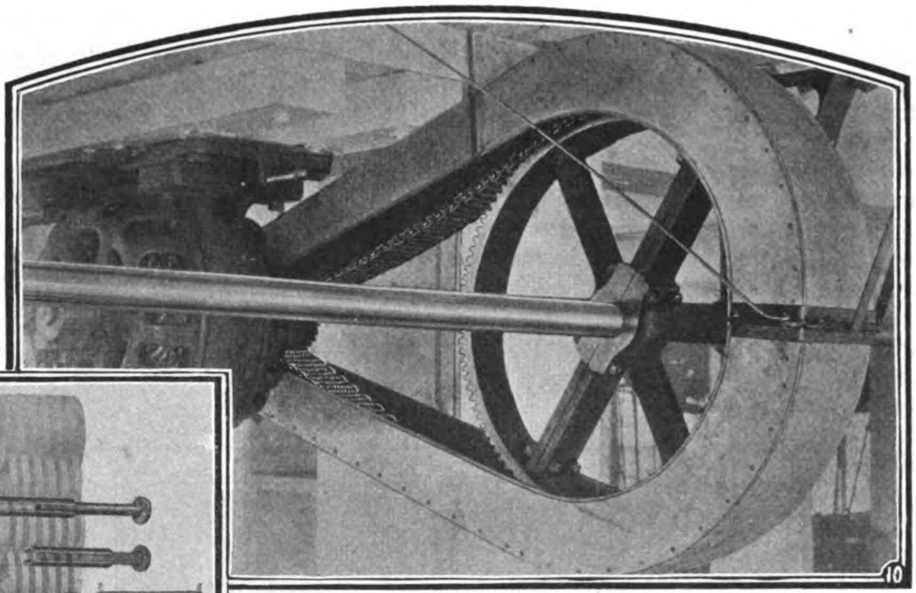


Fig. 10. A silent chain on a line shaft drive equipped with a guard. The latter serves both to protect the chain and prevent chance dripping or throwing of lubricant.

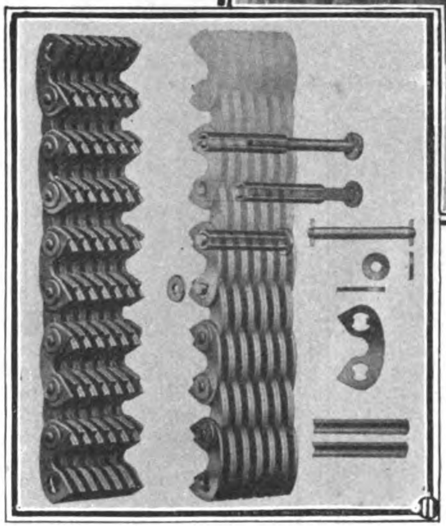


Fig. 11. The details of one type of silent chain which features a bushed joint. The relation of the several component parts to the entire chain is clearly shown by this illustration.

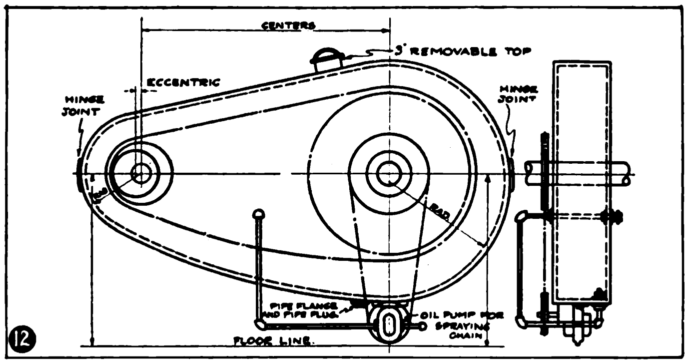


Fig. 12. A dust-proof, oil-retaining casing equipped with an oil pump, which is especially designed for the type of silent chain shown in Fig. 11.

the average plant. The former consists of stamped iron or steel links so designed as to be capable of hooking or engaging with each other. Such a chain, when stretched taut, cannot usually become separated at any link. It is a relatively simple matter, however, to bend or fold the links over and disengage any particular one from its neighbor. Naturally chains of this type have relatively high clearances between their link connections, therefore, a semi-solid, highly adhesive, residual mineral lubricant must generally be used in order to insure the filling up of the clearance spaces so that foreign matter will be unable to gain entry.

Where it is desirable to build a chain of this type so that it will be incapable of disengagement, pin connections are used to join the stamped links together. Chains of this nature are commonly known as pintle chains. They are usually more suitable than detachable chains wherever operation must be carried on in the presence of an excess of abrasive foreign matter. Also, they are stronger and capable of undergoing heavier service. The use of a pin connection enables a more effective retention of the lubricant than in a detachable chain, just as it prevents the ready entrance of foreign

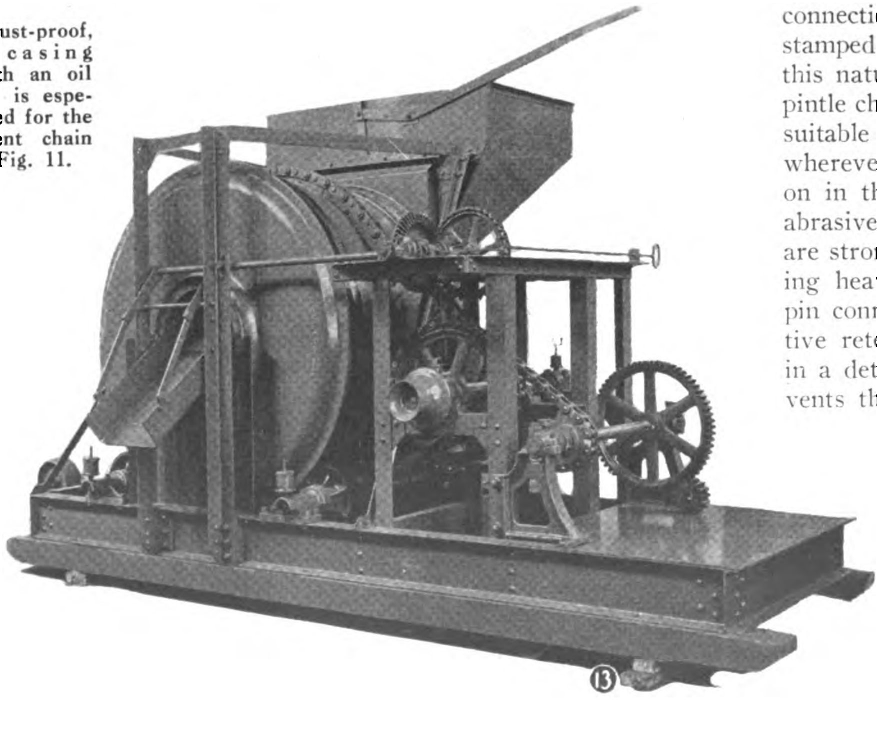


Fig. 13. Close-up view of a concrete mixer showing the driving chain which rotates the drum and drum rollers, and also the several necessary gears which serve to operate the hopper and chute. Note the exposed condition of both chains and gears.

matter. On the other hand, clearances are relatively high, as compared with roller and silent chains, therefore, a grade of lubricant must be used of essentially the same characteristics as mentioned above for the detachable chain.

A step further in chain construction involves the roller chain such as is often used as the driving medium on the motor truck. Chains of this type are used for service where a comparatively economical, durable chain is required, capable of withstanding heavy service. The use of the roller chain can be summed up in the statement that it is adaptable for service which is of such nature as to render a silent chain too costly, and yet is not rough enough to warrant the use of a pintle or detachable chain. In other words, roller chains bring about the attainment of the efficiencies of the chain drive on work where formerly the more usual economies of modern industrial power transmission used to be regarded by many as not applicable. For this reason roller chains are constructed with considerable care in order to insure the maintenance of a suitable lubricating film and preclude abnormal wear. As a result, if a suitable grade of lubricant is used, the wearing surfaces within will, in all probability, be so effectively lubricated that they will be adequately protected against the entry of an

(*Continued on page 38*)

Fig. 14. Details of construction of a typical roller type of chain showing the connecting links, rollers, bushings and method of holding the pins in place by means of cotter pins.

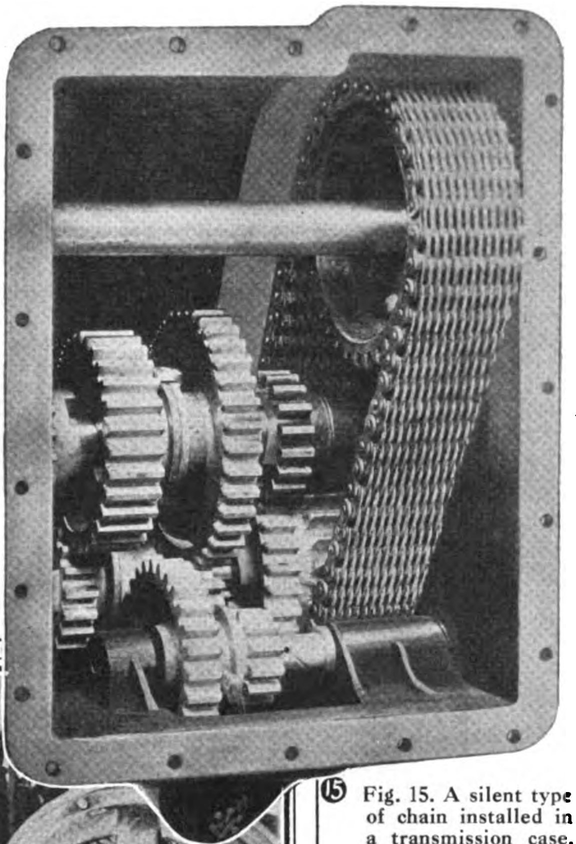


Fig. 15. A silent type of chain installed in a transmission case. Here is another excellent example of a combination of gearing, bearings and a chain, all of which must be properly lubricated practically simultaneously.

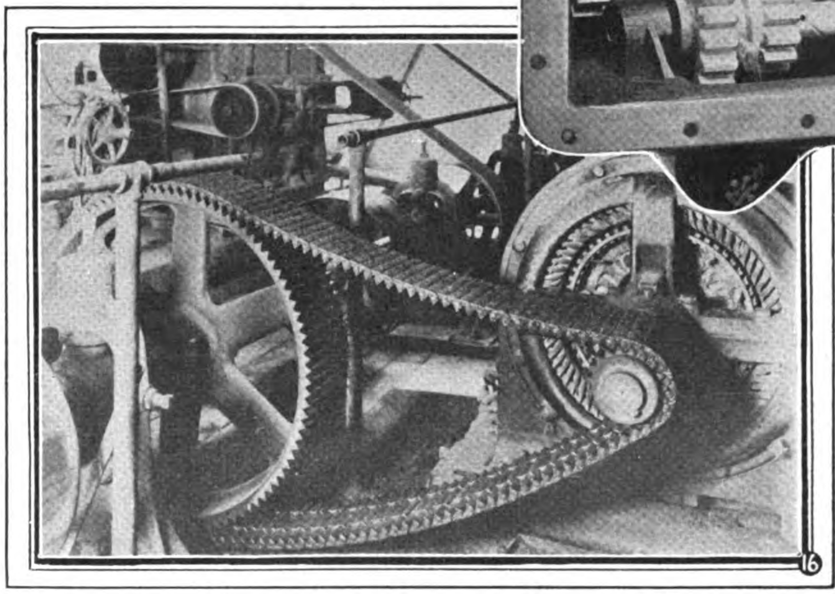


Fig. 16. A silent chain drive installed on an exciter. Belt drives shown in the background are a contrast to this modern method of power transmission.

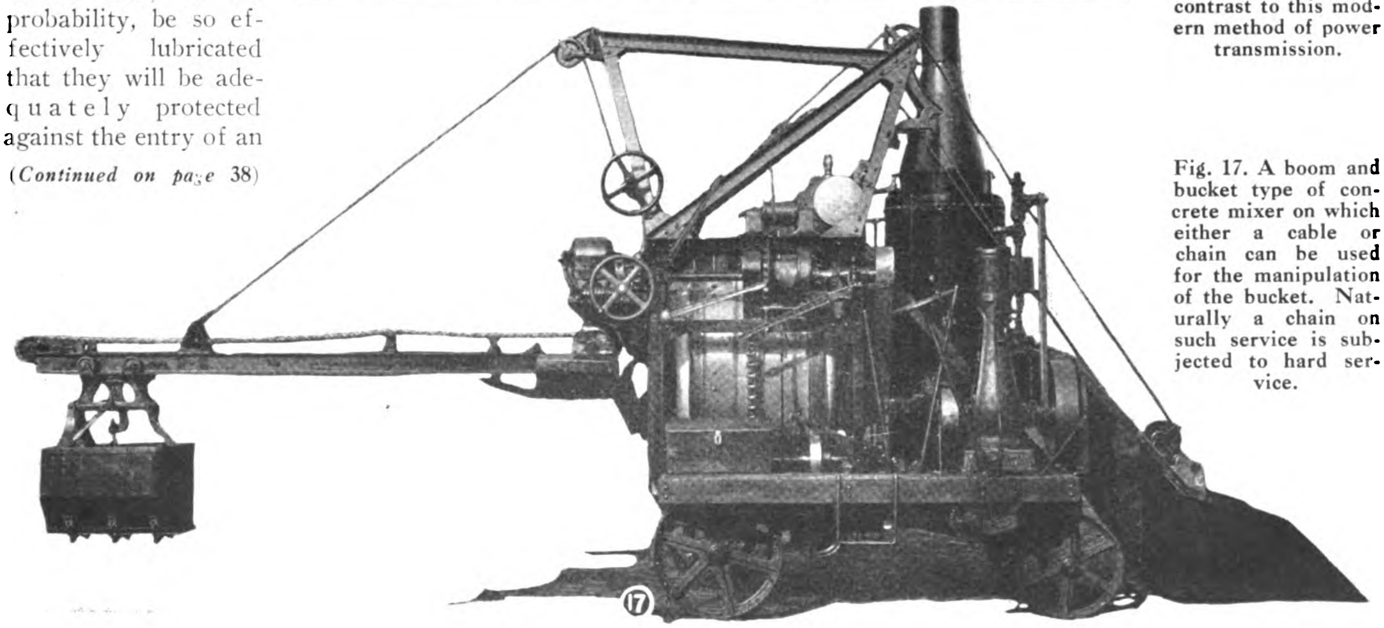


Fig. 17. A boom and bucket type of concrete mixer on which either a cable or chain can be used for the manipulation of the bucket. Naturally a chain on such service is subjected to hard service.

Making Ready for

Putting—and Keeping—the

By William

IT is not until the first cold days in the fall make us think of a little heat that most of us give any attention to the many repairs or improvements in the heating system that we promised ourselves last winter that we would take care of before another winter. Most of us do not realize the enormous savings in fuel that may be effected by proper design and maintenance of the heating equipment. Many plants are improperly heated, with too much heat in some spots and not enough in others. By calculating the heat losses with due regard to the type of construction, infiltration of air, exposure and other kindred items, the heating engineer can usually re-arrange mains and radiation to get an even distribution of heat. The cold air leaking into a building on the windy side and the warm air leaking out on the other side is called the infiltration loss. This loss depends very largely on the type of building construction and the number of cracks around windows and doors. With concrete construction and steel sash, the sash should be kept caulked around the edge with a plastic cement if the joint is not airtight. Steel sash are often not

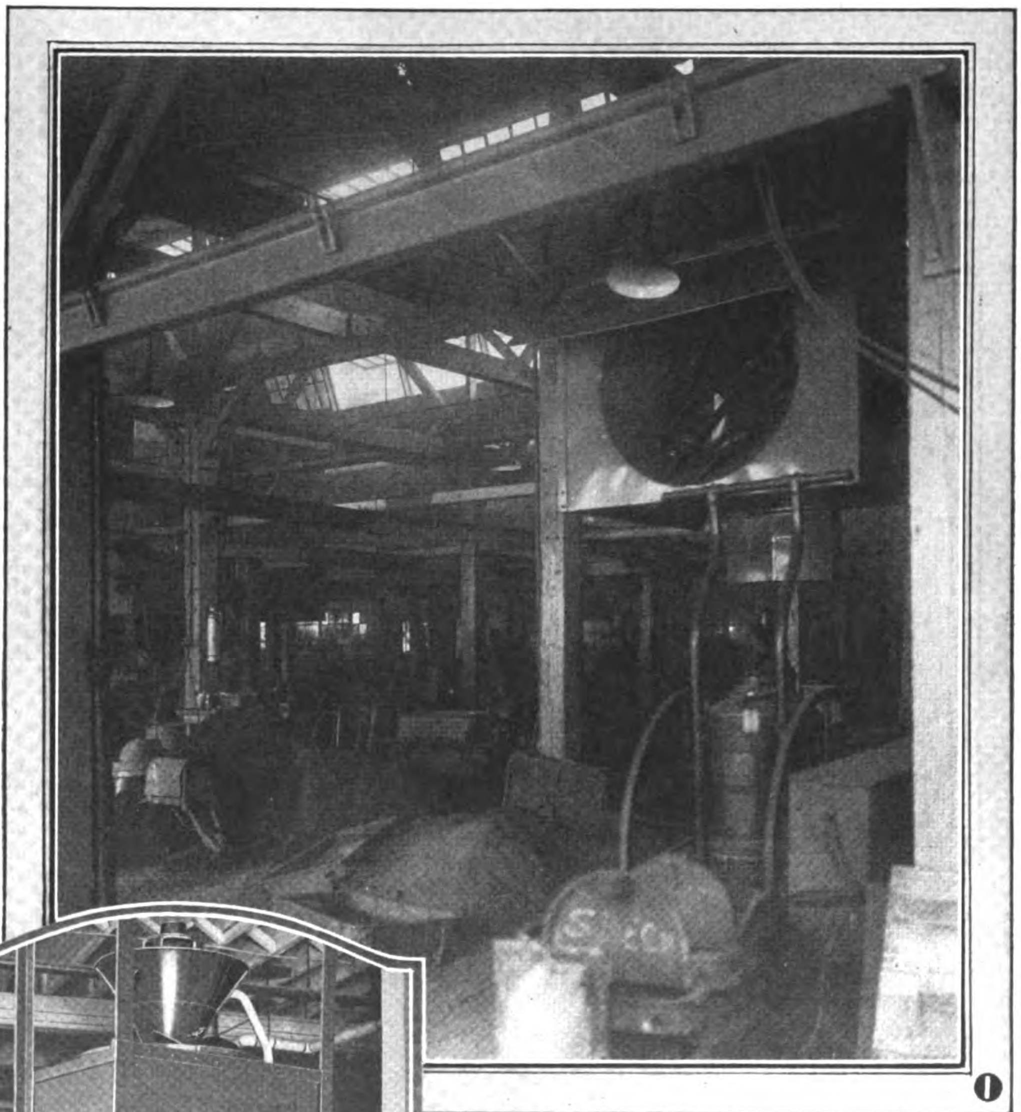


Fig. 1. For large, high ceilinged rooms such as erecting shops, heating can be economically done by unit heaters properly located.

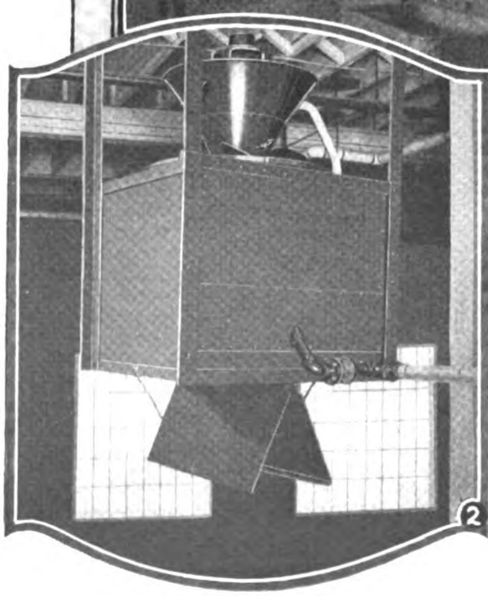


Fig. 2. The maintenance of unit heaters resolves itself into maintenance of the blower unit and of the steam line.

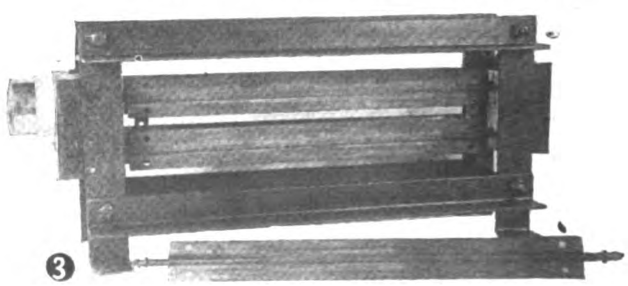


Fig. 3. Space heaters are adaptable to a variety of cases where ordinary heating methods are barred.

Cold Weather

Heating System in Order

G. Ziegler

tight on account of being slammed and they should be straightened so they will close tightly. On sliding wooden windows, it is easy to install metal weather strips, and if the frames are caulked, it is possible to make this type of windows quite tight even in old buildings. The cold air coming into the average plant amounts to from one to three times the cubic contents of the room each hour. This infiltrated air must be heated, and in windy weather it puts a large additional load on the boilers. In fact it might be said that infiltration should be the first item to be considered in figuring the size of the boilers necessary. Most people do not realize the importance of heat losses due to infiltration, and the result is that large quantities of coal are wasted each winter.

We all know that heat flows from a warmer to a colder temperature at a certain rate that is dependent on the material through which the heat flows. Knowing the heat transmission from floors, walls, ceilings, windows and roofs, it is possible to figure the heat loss from a building. Heat must be added at the rate at which it is lost, so the amount of heat necessary to maintain a certain temperature is the same as the amount that is lost. The accepted unit for figuring is the British thermal unit, usually written B. t. u. Heating up a plant in the morning must be accomplished in a certain time and this item must be taken into consideration in addition to the total heat loss. The velocity of the wind has a great deal to do with infiltration losses and this too must be consid-

(*Continued on page* 98)

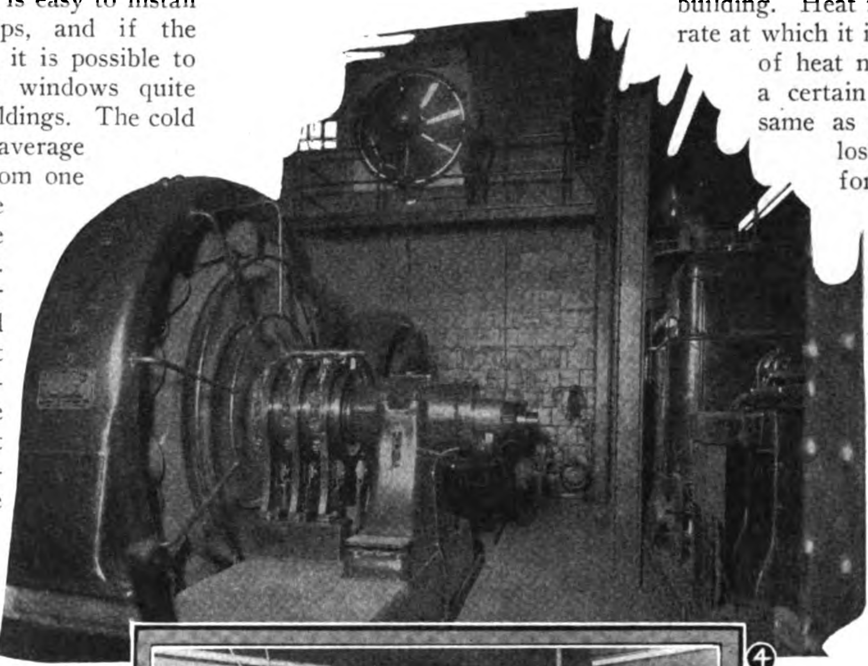


Fig. 4. The fan in the background, above, draws out the heat so that the generators may operate under better temperature conditions.

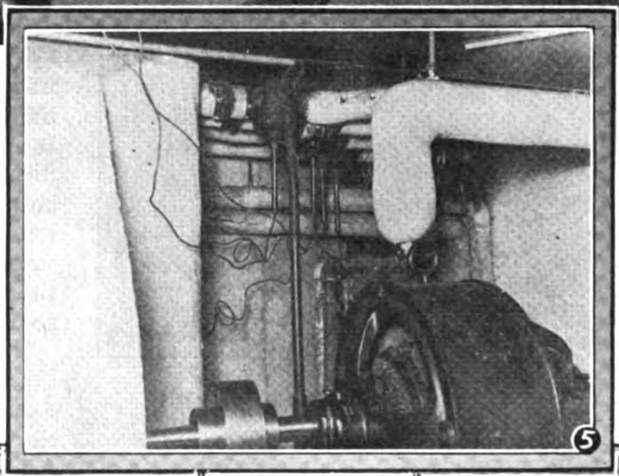


Fig. 5. Automatic temperature control has proved, time and again, to pay for itself many times over.

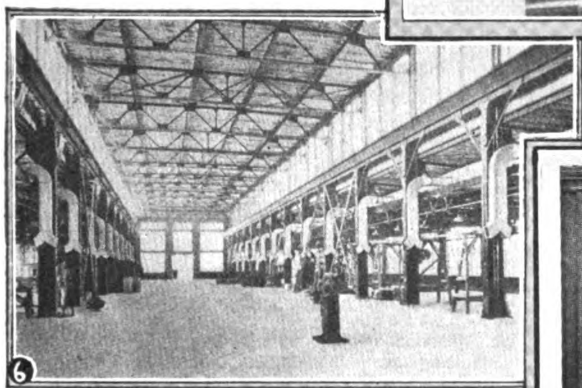


Fig. 6. Distributing ducts must be properly laid out, with due regard to equalized distribution of heated air.

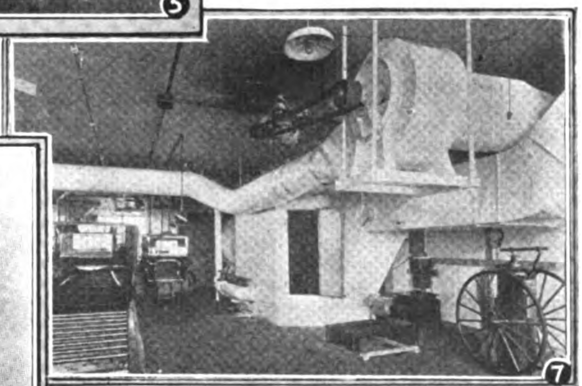


Fig. 7. Air filters are excellent for removing dust and bacteria, and their maintenance is very small.

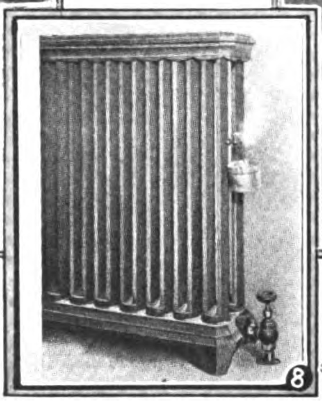


Fig. 8. This is the kind of thing—all too common—which never should exist; its prevention being a matter of installing good valves.

Handling a Yearly Production of 1,200,000 Tons

By Edward J. Dies

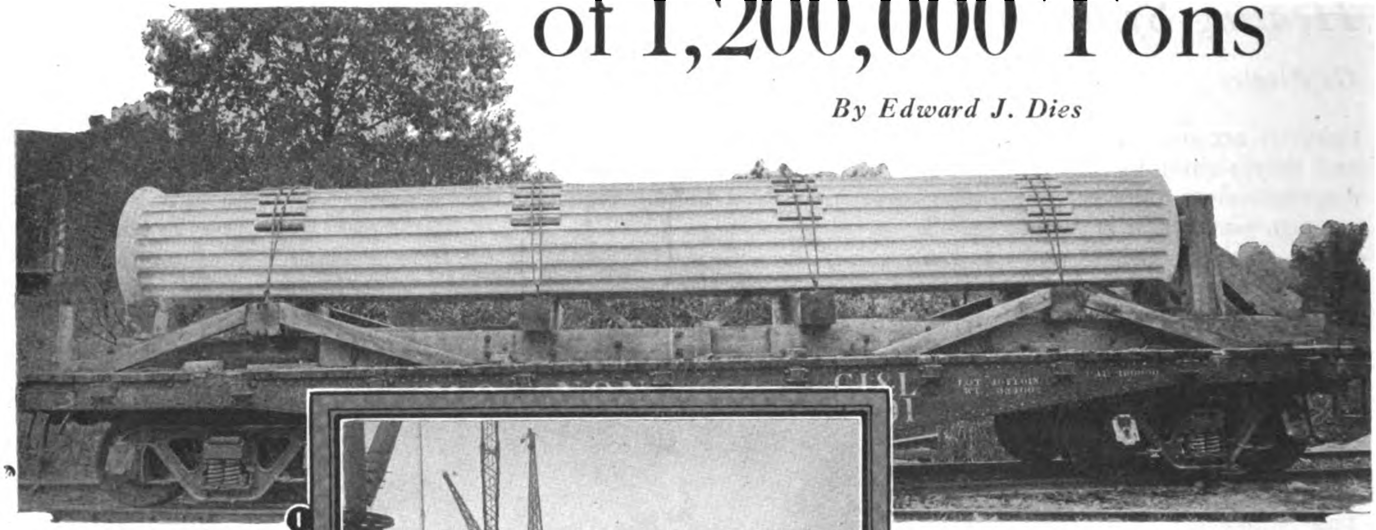
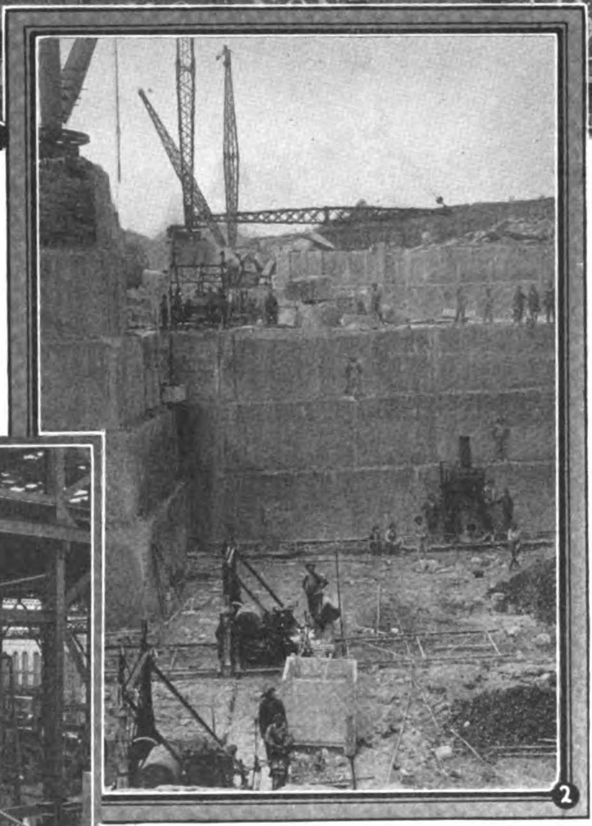
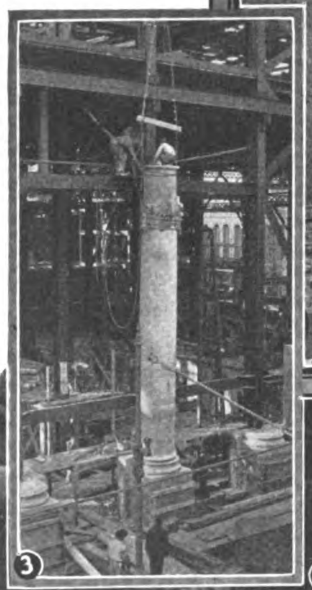


Fig. 1. This column, which now sets at the front of the National Bank of Commerce, Detroit, gives an idea of the huge "productive units" handled in quarrying and milling stone





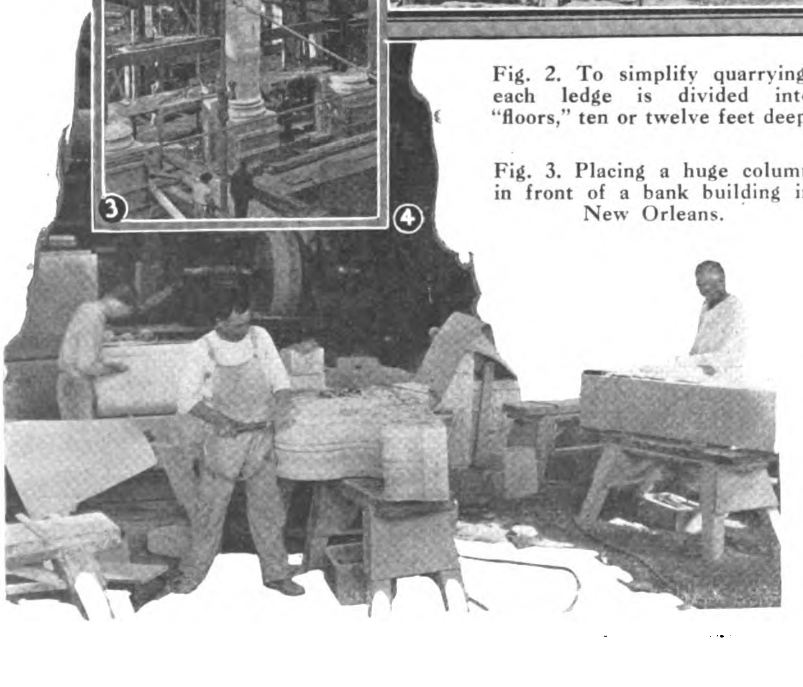


Fig. 2. To simplify quarrying, each ledge is divided into "floors," ten or twelve feet deep.

Fig. 3. Placing a huge column in front of a bank building in New Orleans.

Fig. 4. Modern tools have furnished the stone-cutter with facilities for making the most of his art.

PICTURE a district forty miles long and five miles wide. Picture heavily-laden trains crawling slowly between the hills. Here and there are huge cranes stretching their gaunt, naked arms skyward. Deep caverns are screaming under the powerful thrusts of steam and steel, and belching clouds of smoke to the surface.

This, in composite, describes the world-famous limestone quarries of the Bedford-Bloomington district. It is to this district that the nation turns for at least two thirds of its building stone. It is to this district, too, with its tremendous production capacity, that will go a large share of the credit for building the nation securely.

To visualize the gigantic proportions of the stone region let us take a single freight train. Keep adding cars to this train until the line extends a distance of 250 miles. The train will then have 30,000 cars. All these cars loaded with limestone represent the building material hewn from the rugged hills in a single year. Reduced to pounds there would be a total of two billion four hundred million. In cubic feet the yearly output equals twelve million.

Surveys just completed show that the 1923 production figures approached those of the banner year, while there are prospects of the present year shattering all previous records.

Fig. 5. Each 76 inch saw contains at least 100 black diamonds, and a sawing rate of an inch per minute is fast work.

Fig. 6. Machine tools, on a huge scale, have made possible the commercial production of ornamental stone.

Fig. 7. The shaper—an adaptation of the familiar shaper of the metal worker — has revolutionized hand work in stone mills.

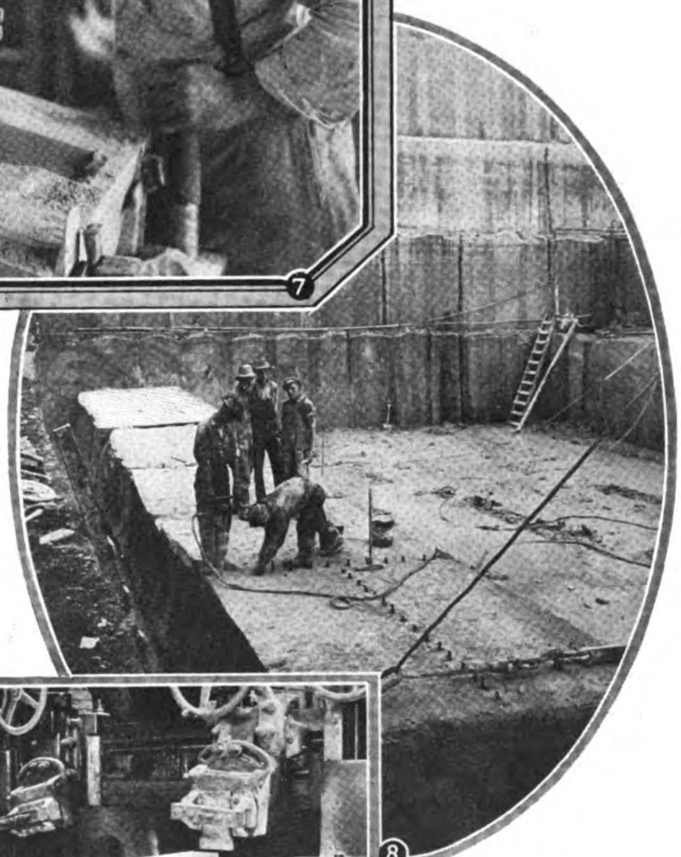


Fig. 8. The gigantic blocks, after quarrying, are split up by means of wedges, to a size permitting railway shipment.

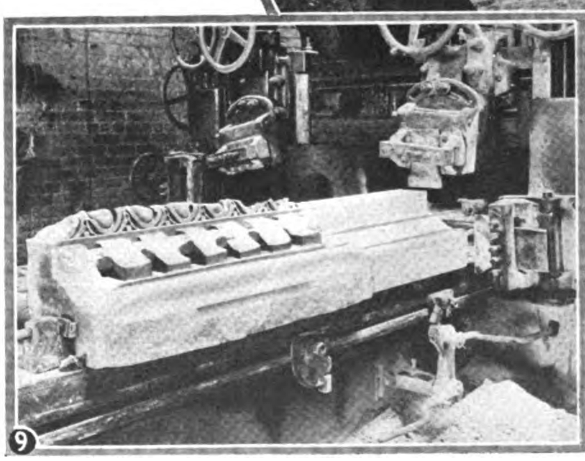


Fig. 9. While machinery cannot entirely supplant men, it enables the stone cutter to multiply his production immeasurably.

And in point of supply, the district's surface has hardly been scratched.

For more than half a century the beautiful tumbling countryside, with its deep gashes here and there, has been yielding building stone. But it is only in very recent years that production has risen to such vast figures. This has been made possible through the ingenuity of machinery inventors. They have so simplified quarrying as to attain economical production on a huge scale.

The known deposit forms a solid sheet over sixty miles long, about five miles wide and seventy feet thick. Mathematicians have estimated that this is equivalent to something like eighteen billion tons. From openings already made, it is reasonable to suppose that enough stone is available to supply the needs of the nation for a century to come.

How and when the deposits were formed has been a matter of wide speculation among scientists. Certainly it all took place long before Palaeolithic man swung into a treetop to make room for a passing mammoth. Perhaps, as some contend, the formation occurred when this spinning globe on which we live was still a mass of flame. Geologists and astronomers and those who study physics have been able to tell us something of the origin and his-

(*Continued on page* 48)

The Economic Aspect of the Plant Restaurant

By Sanford DeHart

Director of Hospital and Employment Department.
The R. K. LeBlond Machine Tool Co.

THERE are more than 5,000 industrial restaurants in operation in this country at the present time, and the number is increasing every year. The well managed shop restaurant is no longer operated at a great monetary loss. New methods of bookkeeping, modern equipment and in some instances changes in the dining room personnel have transformed the plant restaurant from a white elephant to a department that has as good standing as any other in the plant.

Practically no industrial manager expects to make money out of the plant restaurant, but many hope to break even. Many industrial managers were of the opinion a large loss was inevitable in operating a plant restaurant, but these managers have discovered how wide were their preconceived notions from the actual facts.

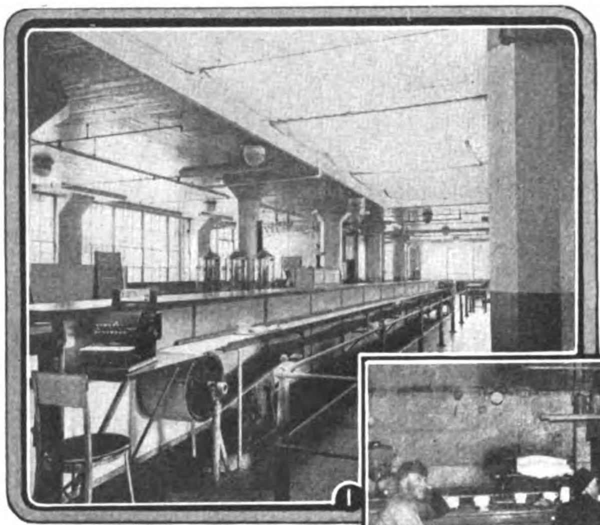
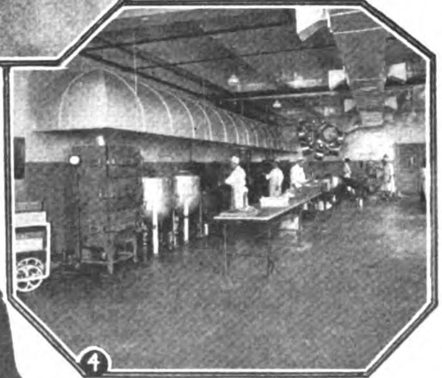


Fig. 1. The conveyor system does much toward reducing the cost of meals.

Fig. 2. Workmen obliged to eat in such surroundings as these, can hardly be expected to show a high degree of efficiency.

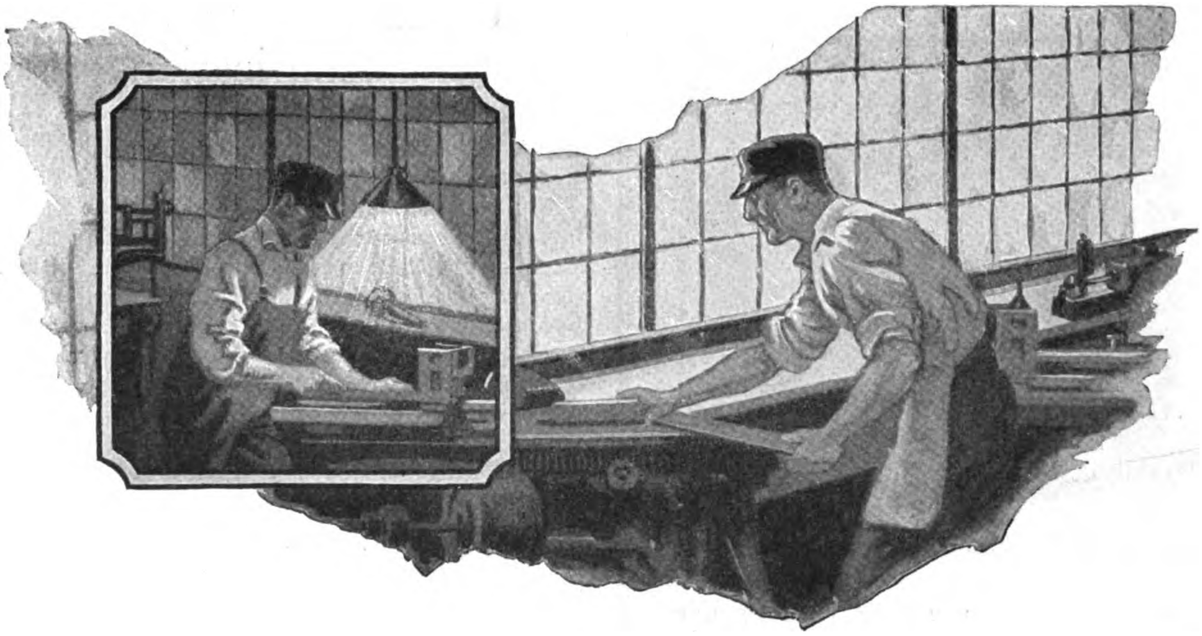


Figs. 3 and 4. Bright, cheerful dining rooms and a clean, well-planned kitchen are aids not only to digestion but to morals and general efficiency.

This is best illustrated by the experience of a large manufacturing concern of national importance, whose restaurant was started with the idea of its being a waiter and table service restaurant, but was unsuccessful for the reason that the employees wanted quick service, which is not always possible with waiter service. Parenthetically, I wish to say, that the manager of this plant was intensely interested in the plant restaurant and spent large sums of money to make it a success. He was of the opinion that the secrets of health and efficiency lie in the kitchen. He gave his earnest attention to the problems of food, its fitness, care and preparation for his employees. Every effort was made to make the dining room attractive for the employees. An orchestra was organized among the employees and played during the noon hour on certain days. A motion picture apparatus was installed, and used on the days the orchestra did not play. Surely, these features should appeal to anyone, but the efforts went for naught in this plant. The employees complained that

(*Continued on page* 56)

Fig. 5. Stacks of sandwiches exposed to street dust, flies, and dirty fingers—a condition which one company promptly remedied.



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Skybryte in bbls. $2.50 per gallon freight allowed.

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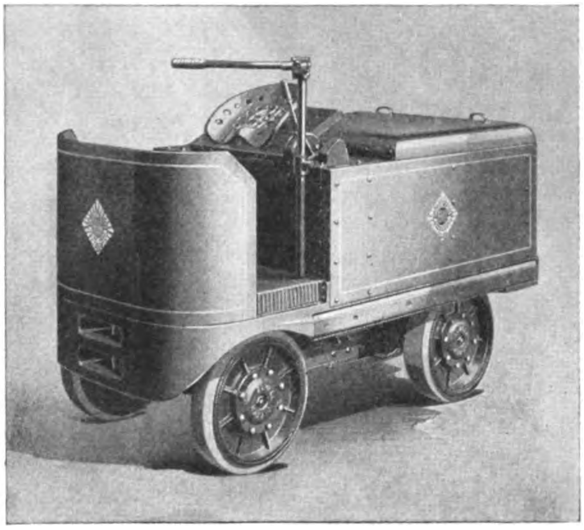
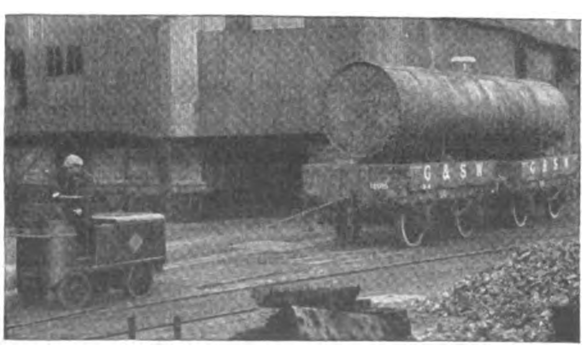




Chain Drives and Their Lubrication

(*Continued from page* 31)

excess of abrasive foreign matter and the consequent wear which would result.

The highest refinement of the driving chain, however, involves the so-called silent chain or chain belt. Constructionally they are the most intricate of all. Yet they are, in turn, the most efficient if used on service to which they are adapted, and if they are properly lubricated. The silent chain involves, in general, a number of parallel links which are held in position with respect to each other by means of pins and bushings, or a combination of seat and rocker pins. Silent chains are capable of exceptionally free bending by reason of their construction. Therefore, they are adaptable to many types of intricate power transmission work. Although the number of parts involved in the average silent chain is relatively greater than in any other type of driving chain, wear will ordinarily be very low, provided the several parts involved receive the right kind of lubrication. The usual economy from the viewpoint of lubrication, which is attainable in the silent chain, renders the subsequent cleanliness of operation a factor of decided advantage. Even under higher operating speeds, inasmuch as the greater part of the lubricant will be contained within the chain, but little of it will be thrown off by centrifugal force. This is, of course, especially important wherever the chain is to be operated exposed, installed overhead, or adjacent to some perishable product.

Where the lubricating requirements of a driving chain installation are to be studied, the conditions of operation such as the load, speed, clearances existing between the wearing parts, and the extent of articulation or bending prevalent must all be taken into account. All these factors will have a certain effect upon the ultimate service which any lubricant will be able to give in actual operation. An example of this is the fact that a relatively fluid oil which would be admirable for the lubrication of a silent chain installed in an oil-tight casing, would probably be entirely too light for a detachable chain due to its inability to adequately fill up the clearance spaces.

In considering the load that is to be carried we must also look into the extent to which the chain will be started or stopped suddenly. Heavy loads which must be taken up more or less suddenly will naturally impose a certain amount of shock upon the chain links. The lubricant must, therefore, be able to counteract this by virtue of its viscosity. Use of a product that is too thick, however, might prevent its penetration to the wearing parts of the chain, depending, of course, upon the type of chain involved. Speed, in turn, enters into the problem in that it involves the frequency at which the chain will revolve, or, in other words, the number of times per minute that the links will come in contact with the teeth of the gears or sprockets. Each time this takes place a certain amount of shock will occur with the resultant tendency for rupture of the lubricating film. This can be minimized, however, to a certain extent through the occurrence of capillary action or back suction, which is exerted upon the lubricant. Where effort is made to meet the shocks which are involved under

(*Continued on page* 40)

Materials Handling Forum

Conducted by Matthew W. Potts

IN announcing the "Materials Handling Forum" INDUSTRY ILLUSTRATED again takes a progressive step in its educational program on the subject of materials handling. For two years this magazine has led the field of technical and industrial journals in presenting editorial material on this important subject. Now, because of the many letters received asking for additional, or detailed information, we have decided to open a department wherein our readers may participate; an open forum for discussion of some of the problems that are now retarding the growth of this important branch of practical industrial management.

In April, 1924, this magazine deemed it advisable to add to its editorial staff a man thoroughly conversant with the design and application of materials handling equipment. The following brief biography is presented in order to acquaint our readers with the background which Mr. Potts brings to bear upon his conduct of this department.

* * *

Mr. Matthew William Potts has had many years' experience in the installation, design and maintenance of materials handling equipment; starting in 1913, while employed with the American Cyanamide Company as layout draftsman on new installations.

In 1917, he took charge of the Engineering Department of the H. W. Caldwell & Sons Company (this company is now a unit of the Link-Belt Company) in the Eastern Division, designing new equipment and planning installations, among which were the elevating and conveying systems of the Air-Nitrate Plant of Muscle Shoals. From 1920, to April, 1922, he was in charge of materials handling for the National Aniline & Chemical Company at their Buffalo Works and New York Office. In May, 1922, Mr. Potts opened a consulting office in New York, specializing in reports and investigations on the installation of materials handling equipment.

Mr. Potts joined the editorial staff of INDUSTRY ILLUSTRATED in April, 1924, as Associate Editor. Since serving in this capacity he has investigated a number of industrial plants to obtain first hand information concerning their handling methods and problems. In the August issue of this magazine he presented the entire story of materials handling methods at the Ford Motor Company's River Rouge Plant, an outstanding example of proper coordination of various types of materials handling machinery.

The future value of this department will depend in large measure upon our readers. If they continue to make inquiries as they have in the past, much valuable information will be collected and dispensed in these pages.

This Forum provides a place for the discussion of materials handling problems of general interest. Questions regarding the best *type* of equipment for handling specific commodities are pertinent; as are questions regarding the *adaptability* of various types of equipment for a specific problem or installation.

Each question published will be answered on the basis of our experience and available information. Further discussion of these problems will be welcome, and we will publish such letters as, in our estimation, contribute to a clearer understanding.

The service will consist of only that information which can be embodied in a letter. Obviously, we cannot undertake to make extensive layouts or elaborate reports, except where the problem is of sufficiently wide interest. When the information desired involves engineering work, reports, drawing layouts, or calculations of a technical nature, the person or company making the request will be advised of the proper source for this type of service. Needless to say, this department will be conducted without prejudice for or against any type or make of equipment.

If readers have original ideas as to the proper use of equipment, or any other constructive suggestions falling within this field, such letters will be published, under the limitations set forth above.

The Forum will also provide a place where the manufacturer or user may set forth opinions regarding practices now in use in the Materials Handling Industry. Suggested improvements in present equipment, providing only that they are logical, may be discussed here, with the idea of placing the manufacturer in closer touch with the user, and vice versa.

The Editors reserve the right to publish any or all letters received. We also reserve the right to omit from publication those which in our estimation should not be placed in an open Forum for discussion. Letters giving savings made by materials handling equipment are particularly requested.

We depend upon the cooperation and interest of our readers to make this Department of greatest value to them.

The Editors.

(*Continued from page 38*)

higher speed conditions by increasing the body or viscosity of the chain lubricant, it must be borne in mind that under no condition should the latter be too heavy, otherwise its ability to penetrate to the wearing parts might be decidedly reduced. Therefore, only lubricants which are recommended by the oil companies or chain builders should be used. Hit or miss experimentation on the part of the chain user may often result in more damage than benefit to the chain.

The bending or articulation to which a driving chain is usually subjected in its course of passage over the gears or sprocket wheels, imposes wear not only on the points of actual contact between the teeth and chain links, but also on the link connections. Wear of this nature cannot be entirely eliminated, though it can be materially reduced by the use of a suitable lubricant capable not only of penetrating to the interior wearing surfaces of the link connections, but also of forming an adequate lubricating film on the external surfaces of contact. In further connection with this matter of bending the question of clearances between the link connections must also be considered. Essentially the lubricant must have sufficient fluidity to penetrate within the links regardless of the construction. It must also have sufficient stickiness to adhere to the chain surfaces and sprocket teeth in the face of the action of centrifugal force. Even where a high speed chain is bath lubricated this point must be given consideration. On the other hand, the lubricant should not be considered from the viewpoint of its adhesive nature only, as is often done with gear compounds, for it might easily be chosen so thick and viscous as to be absolutely unable to serve the inner wearing parts of the chain.

Dust, dirt, water and perhaps chemicals, etc., constitute the final operating conditions which should be studied when selecting a chain lubricant. Naturally, when a chain is called upon to operate in the presence of any of the above, the lubricant must serve not only as an actual lubricant to prevent wear, but also as a protective agent to insure that the chain does not become abnormally scored or corroded. In other words, the lubricant serves as a guard to prevent the entry of foreign matter into the internal clearance spaces.

In the case of the simpler types of chains such as the detachable and pintle devices, frequently the nature of their construction will lead the user to believe that they do not really require lubrication. This, however, will all be according to the nature of their service. It is not so much that they do not need lubrication, but in certain instances, under detrimental operating conditions it will be impossible to bring this about. It is safe to say that wherever possible even the simplest type of chain should be lubricated, if it is to do its best work.

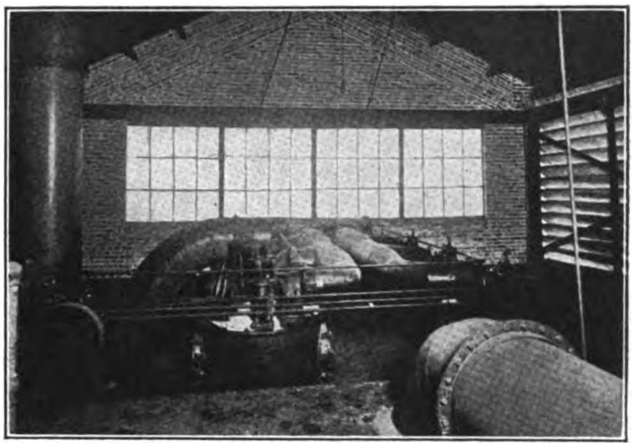
With the more carefully designed and constructed chains of the roller and silent types, every effort should be made to lubricate them regardless of the operating conditions. Some operators will be tempted to give these latter too much consideration, especially where dealing with roller chains, feeling that inasmuch as these are not as intricate as the silent type, in view of operating conditions which are especially detrimental to lubrication, it will not pay to even attempt this latter. Other users perhaps may relent and favor their roller chains with a daub of waste engine oil now and then. Of

(*Continued on page 42*)

DRACCO SYSTEM of DUST RECOVERY

EFFECTS a COMPLETE SAVING of MATERIAL in GRINDING MILLS

These illustrations on this page show part of a Dracco installation in the mill of a large western mining company. It is a good example of what Dracco methods are doing for a variety of grinding operations and can do for a still greater variety.



FREES the AIR, FLOOR and EQUIPMENT from DUST—and ITS HARM

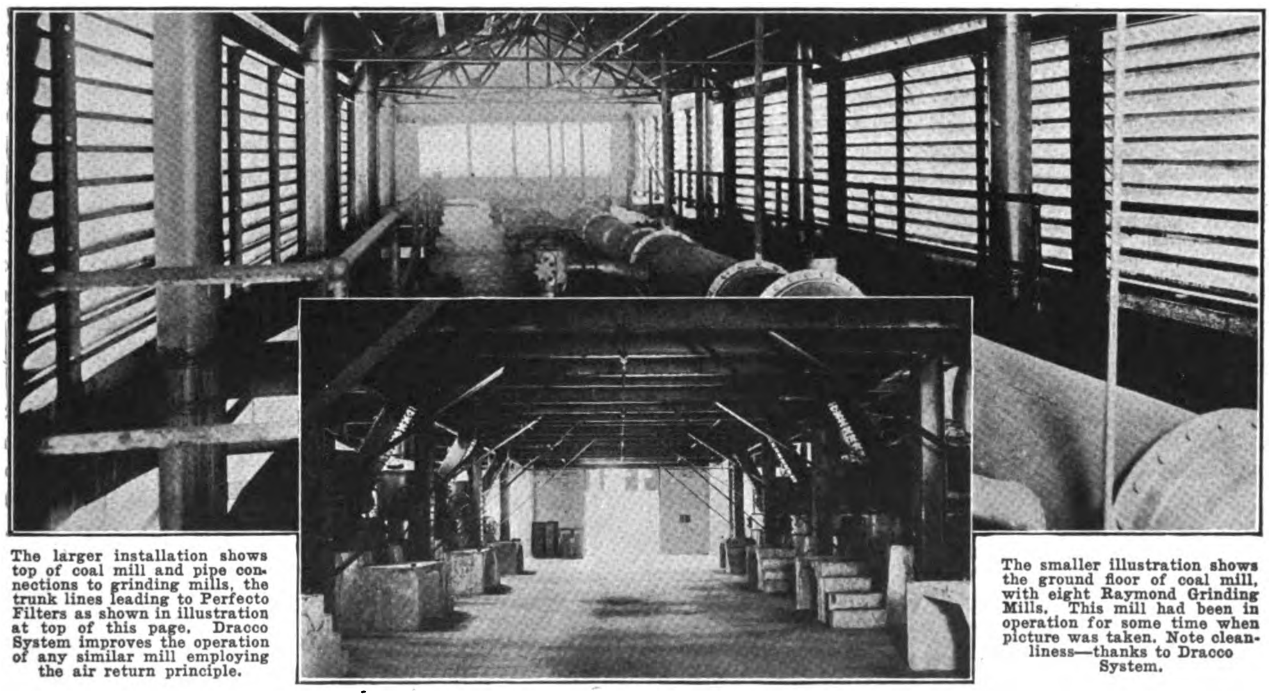
This particular illustration shows the top of six Perfecto Filters. Through pipe at right they are connected with eight Raymond Grinding Mills that grind coal.

Here is just one instance of the efficiency of the Dracco System of dust recovery. In this coal mill, where the material is ground to extreme fineness, the cyclone would not be satisfactory, owing to its inability to collect fine dust efficiently. Bag filters, on the other hand, are subject to clogging, owing to a certain amount of back pressure that is always present.

Materials, such as lead oxide, lime or phosphate rock (particularly if a certain amount of moisture is present) are especially liable to clog. The excess air, unable to find its regular outlet, escapes through any opening that it can find, *contaminating the surroundings with dust.*

The Dracco System remedies this difficulty by drawing the excess air completely out of the system and filtering out the last particle from same through Perfecto Filters connected to the vent pipe.

Whatever your particular dust collection or fume recovery problem may be, our engineers can solve it. A request from you will bring prompt response and full particulars.



The larger installation shows top of coal mill and pipe connections to grinding mills, the trunk lines leading to Perfecto Filters as shown in illustration at top of this page. Dracco System improves the operation of any similar mill employing the air return principle.

The smaller illustration shows the ground floor of coal mill, with eight Raymond Grinding Mills. This mill had been in operation for some time when picture was taken. Note cleanliness—thanks to Dracco System.

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

(Continued from page 40)

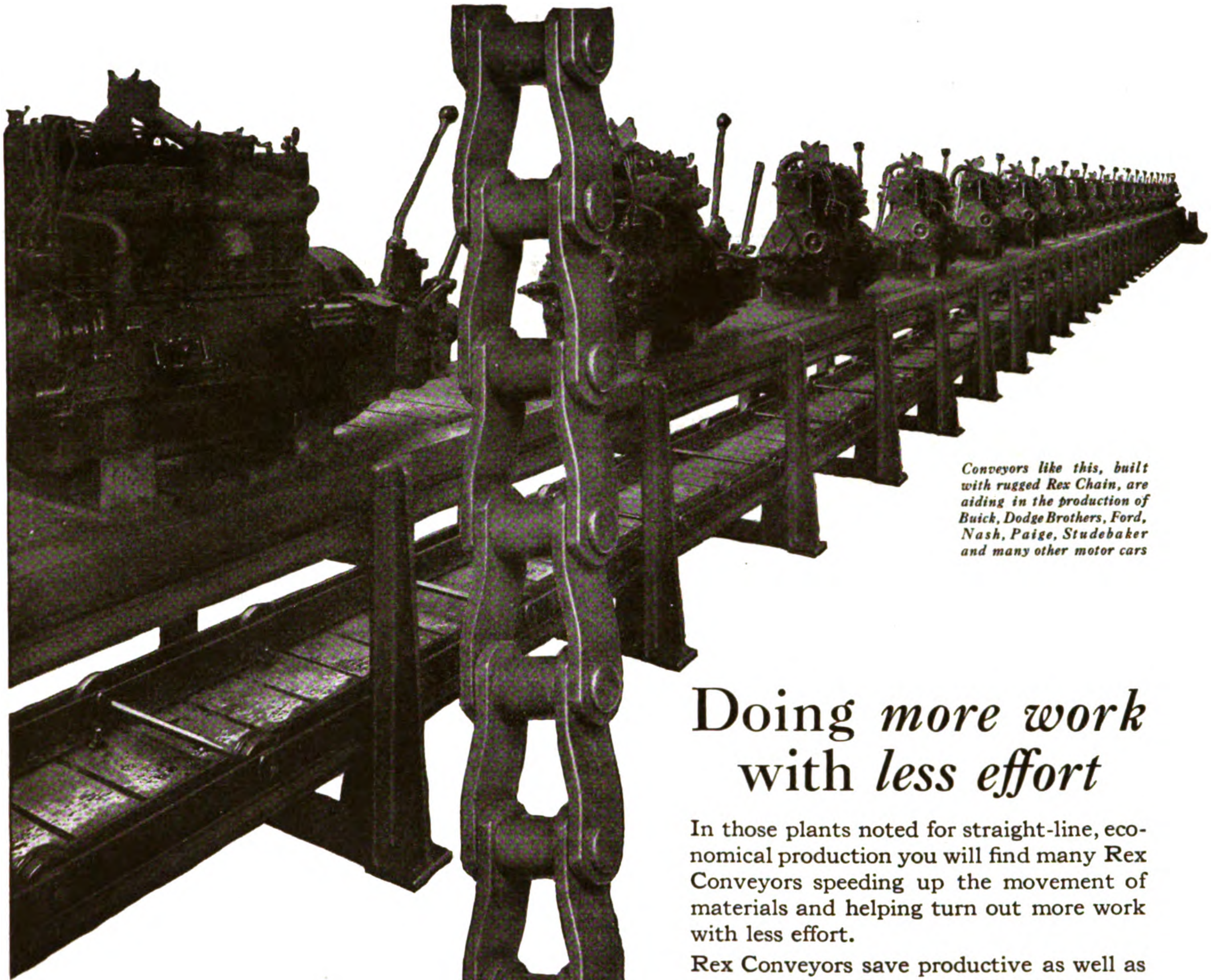
course, waste oils will lubricate to a certain extent, but usually they will contain such a high percentage of foreign matter that the abnormal wear which would result makes it advisable to use new lubricant. For roller chain lubrication a relatively heavy product of the nature of a medium bodied gear compound, or a semi-solid grease is most suitable. Roller chains can either be soaked in a bath of heated lubricant, or this latter can be painted onto the surfaces, preferably after heating somewhat to facilitate spreading.

Silent chains, in turn, being the most carefully built of any of the usual forms of chain drives, should of course receive the most careful attention from the viewpoint of lubrication. Silent chains may either operate exposed or in an oil-tight casing. The speed of operation and nature of the service is often taken as indications as to whether such a casing will be necessary or not. Generally speaking, more satisfactory service will be obtained where a casing is used, inasmuch as it will prevent the entry of dust, and the possibility of other foreign matter coming in contact with the chain. Furthermore, a chain which is operated in a dust-proof, oil-tight casing, and subject to automatic means of lubrication will operate most efficiently and require the least attention. Chains which are installed in such casings may or may not be immersed in oil; it will all depend upon the manner in which the lubricant is distributed to the surfaces. Where chains of this type are installed exposed or located in a case which is not oil-tight, it will be necessary, as a rule, to lubricate them as a roller chain, i. e., by brushing or painting a somewhat heavier grade of lubricant over the wearing surfaces. Or, in lieu of this they can be removed and soaked in a bath of oil at frequent intervals. A soaking bath of this nature is naturally the best method as it insures the penetration of lubricant to the innermost wearing parts of the chain. For this purpose a straight mineral lubricant of about the same body as a light steam cylinder oil is preferred by many, due to its lubricating ability and its faculty for "staying put."

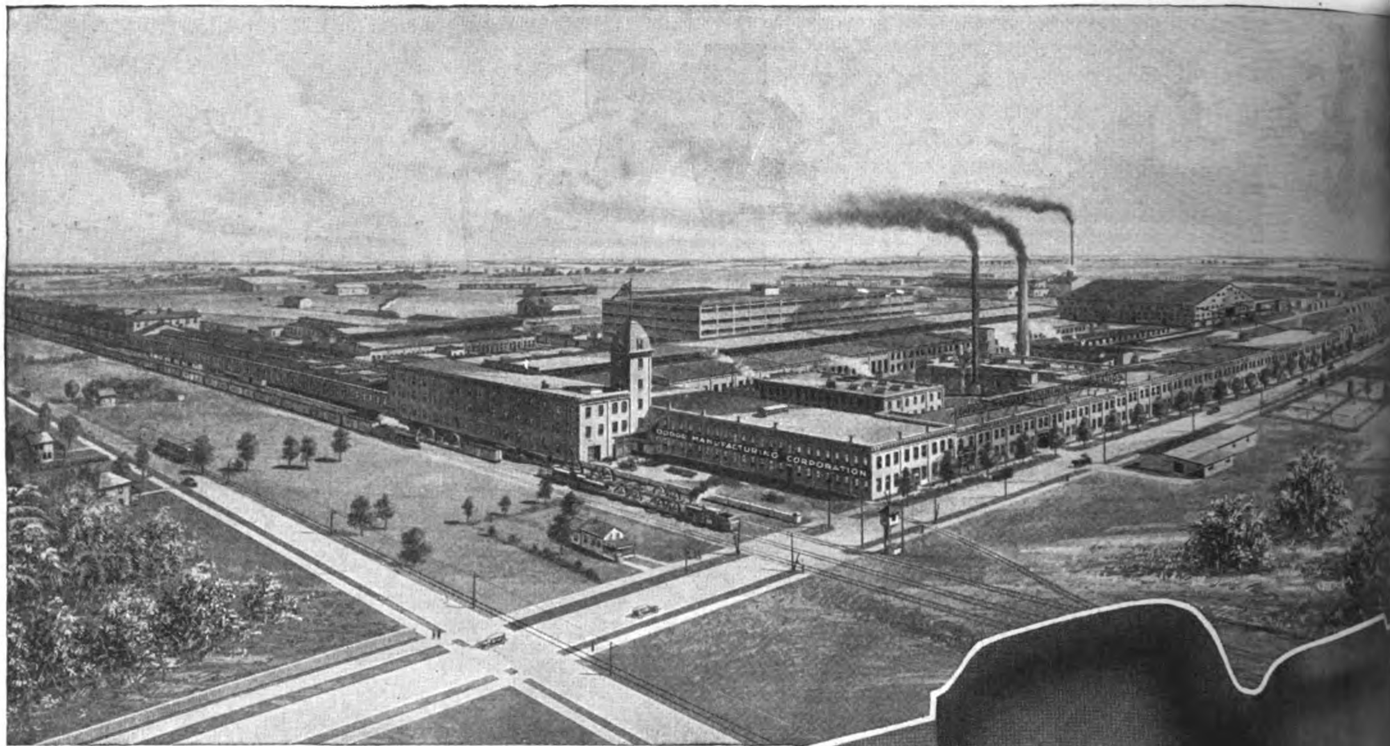
But the selection and application of the lubricant are not the only necessary factors in the lubrication of a chain drive installation. It is quite as important to clean our chains at periodic intervals, especially where they operate exposed and in contact with an excess of foreign matter, as on the motor truck. This is best carried out by rinsing them periodically in a bath of kerosene. If this is carefully carried out, and if our lubricant is suited for the type of chain involved, and properly applied, the operation of a chain drive should become one of the pleasures of the day's work.

THE past month has brought an abundance of evidence that the iron and steel industry is passing through the early stages of recovery from extreme stagnation. Improvement has been neither swift nor sweeping, but it has been substantial despite the traditional industrial inertia of the midsummer period.

Incoming orders for steel in August were from 10 per cent. to 15 per cent. greater than for July and shipments gained from 15 per cent. to 20 per cent. Despite this increase in shipments, unfilled orders of the United States Steel Corporation increased 102,000 tons during August, the first increase since February.



A NEW POWER SAVING APPLIANCE BACKED



DODGE MANUFACTURING CORPORATION

The New Power Saving Roller Hanger Bearing—

Interchangeable in all Standard Frames

INTERCHANGEABILITY is always an identifying characteristic of any Dodge product.

Forty-two years ago the first Dodge Wood Split Pulley with interchangeable bushings paved the way for the complete Dodge line of power transmitting appliances.

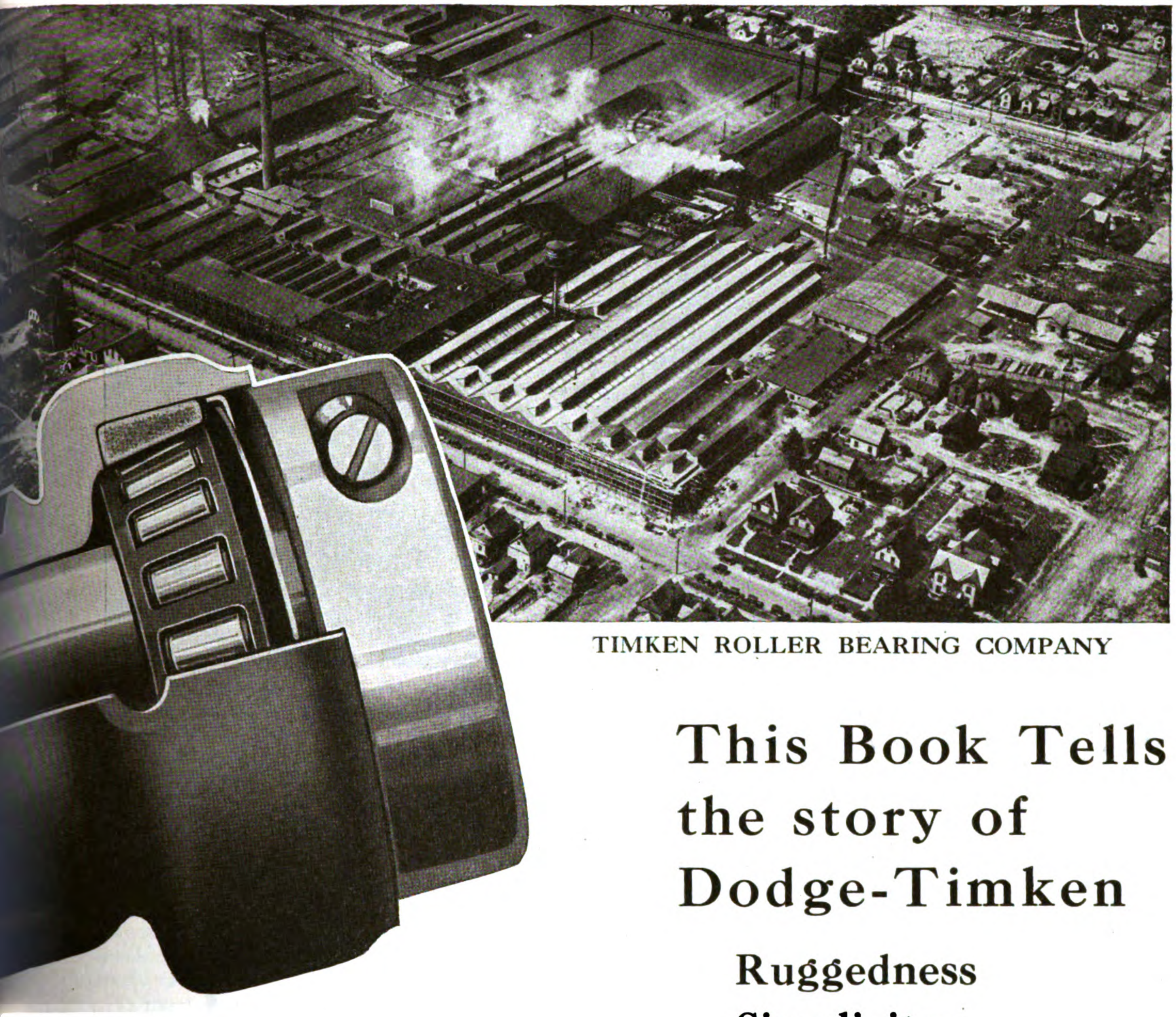
Now, the Dodge-Timken Roller Hanger Bearing appears, to carry still farther the Dodge idea of interchangeability which facilitates both layout and installations as well as extending the use of the appliance beyond the service for which it was originally purchased.

The Dodge-Timken Roller Hanger Bearing is interchangeable in any Dodge Ball and Socket, Four-Point or Pressed Steel Drop, Post or Bracket Hanger as well as in practically all frames of other manufacture.

DODGE MANUFACTURING CORPORATION *General Offices:* Mishawaka, Indiana *Works:* Mishawaka, Ind., and Oneida, N. Y.

Branches: New York, Atlanta, Philadelphia, Minneapolis, Pittsburgh, St. Louis, Boston, Houston, Cincinnati, Seattle, Newark, San Francisco, Chicago

BY TWO NATIONALLY RECOGNIZED LEADERS



TIMKEN ROLLER BEARING COMPANY

This Book Tells the story of Dodge-Timken

Ruggedness
Simplicity
Lubrication
Interchangeability
Economy

Sign and Mail the Coupon—Now

Dodge Manufacturing Corporation,
Mishawaka, Indiana.

Gentlemen:—

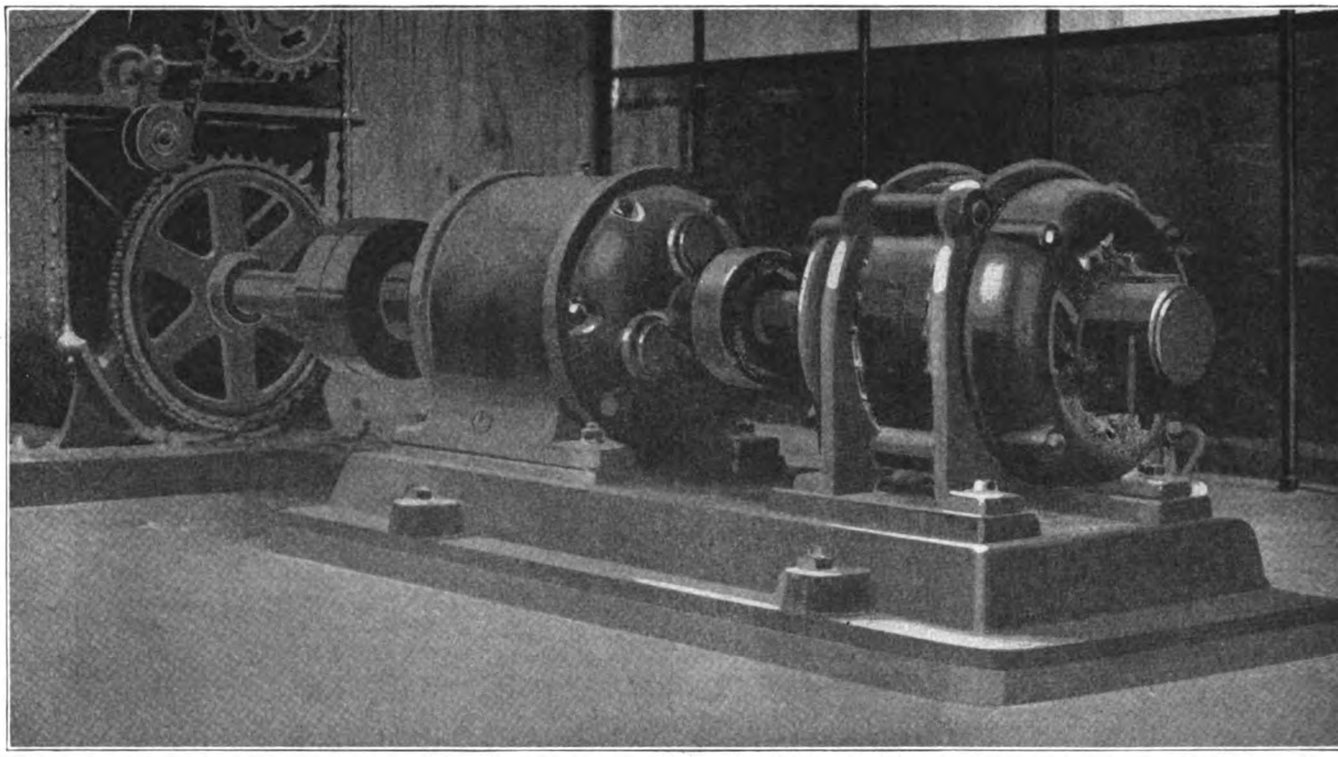
Please send "Facts about the Dodge-Timken Roller Hanger Bearing" and other particulars.

Firm ....

Address ....

Individual ....

Position ....



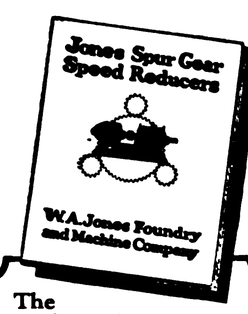
3 H. P. Jones Speed Reducer driving Chemical Mixers. Motor Speed 1140 R. P. M. Final Speed 31.6 R. P. M.—Ratio, 36 to 1.

Using the Unit Drive for Low Speeds

The many known economies and advantages of the unit drive for conveyors, elevators and the like have long been known. The only question has been how to "step down" the comparatively high motor speed to the slow moving machinery.

Belts and pulleys? Sprockets and chains? Ordinary gears? These take up too much space, make for complex exposed drives that are potential sources of trouble, a hazard to workmen, hard on bearings, with a constant power drain and threat of shut downs.

Jones Speed Reducers have none of these failings. They are neat and compact. Splash lubricated in a fully enclosed housing, they keep out all dirt and moisture, remove the accident problem, are rugged yet precise in construction. Write for Catalog No. 26, the authoritative guide to the solution of speed reduction problems. It will prove both interesting—and useful.



The Only Book of Its Kind

CATALOGUE No. 26—a clear, unbiased exposition of present day speed reduction practices. Endorsed by leading engineers and technical schools. Fifty-six installation views alone of the more than 140 illustrations. Useful tables and formulae on speed reduction. Write for it.

W. A. Jones Foundry & Machine Company

Main Office and Works: 4412 West Roosevelt Road, Chicago

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New York	Pittsburgh	Cleveland	Buffalo
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	Milwaukee	Detroit	
	425 E. Water St.	137 E. Woodbridge St.	

Jones Speed Reducers

and Power Transmitting Machinery

Helping to Conserve Our Lumber Supply

(*Continued from page 19*)

yielded 204, a gain of 77 board feet. The limbs and top, hitherto considered worthless except for distillation or fuel, gave 163 board feet additional, making a total of 367 board feet of parts as against the 127 board feet obtainable under the old method.

From now on all hardwood limbs and tops not under four inches in diameter will be brought to the Ford mills. Another saving possible under the new system is in the logging operations. Much timber has been sacrificed in an effort to get straight logs of standard length. Trees have been cut off at a height of from two to three feet in order to avoid the swell at the butt. They now may be sawn six inches from the ground. It is no longer necessary to avoid the crotch of a tree. The shape of the planks is of no consequence.

The body parts produced under this method are superior to those sawn out of edged and trimmed boards as the grain may be followed more advantageously. This is especially true of curved parts, a large number of which are found in body construction. Much of the youngest and best wood in the tree was wasted under the edging method, but this is now completely salvaged. Not only are more parts obtainable from a tree but better parts as well.

This practice of cutting the parts to rough shape while the wood is still green has also simplified the whole process of kiln drying, reducing the spoilage to a noticeable degree and shortening the time required by approximately 10 days. The old time lumbermen and wood workers who freely predicted that the new system would break down at the kilns were rather chagrined to find that the parts came through with less warping and end-checking than the boards from which parts were formerly sawed.

It has been estimated that this new system will make the Ford forests last one third longer, possibly indefinitely, if proper methods of reforestation are followed. A young and vigorous growth of timber is constantly coming up and these trees will not have to reach full maturity before they become available for body parts manufacture.

In the interests of forest conservation the Ford Motor Company makes public the new method, and it is hoped that other companies will take advantage of the economies offered. It would be a conservational measure of national importance if saw mill operators instead of sawing boards would saw complete parts or dimensional stock. Automobile body companies, furniture factories and other wood working industries could have their parts made right at the mill, thus making an enormous saving in lumber, in addition to which they would profit by lower freight rates. The general scheme of the system is universal in its application.

Handling a Yearly Production of 1,200,000 Tons

(*Continued from page* 35)

tory of the earth. They consider that, vast ages ago, the sun was a spinning, flaring mass of matter, not yet concentrated into a center of heat and light. It was considerably larger than it is now; it spun much faster, and as it whirled a series of fragments detached themselves from it and became planets. Our earth is suspected of being one of these. But this was aeons before life began. The tides of those swift days spread and receded over the steaming beaches of mud and sand.

In those distant shadowy times, so far back as to tax the imagination of man, the deposits are believed by scientists to have developed. Learned geologists tell us that the entire district was then the shores of a vast ocean. For ages the strong sea currents lashed onto these shores billions upon billions of minute shell-bearing animals, shell fragments, and other marine substances. At length this formation expanded, hardened, petrified and became largely uniform in substance and color as it is found today.

The stone is similar to that used by ancient Egyptians in the building of sepulchers which have endured the centuries free from any mark of time. In fact, expert analyses have proved that it is even more durable, for certain slightly unfavorable contents found in the Egyptian stone is wholly absent in these deposits.

Thousands of visitors, architects, contractors, public works officials and sight-seers, journey to the district every year. Those in the building industry go there in the late winter and the spring months to formulate future construction schedules.

In the springtime when operations are in full swing the countryside becomes a stupendous stage whereon is enacted a thrilling spectacle of engineering skill. Everything moves with clock-like precision, from the first stripping operation to the final whir of the milling machine.

At the quarries, stripping the top earth is the initial step. In the old days this was a slow, costly operation which naturally had to be added to the price of the product. Now it is done quickly and economically by means of hydraulic stripping machines. Powerful streams of water are forced through from specially constructed pumping stations. The pipes leaving the mains are tapped by smaller pipes until finally the water is rushed through a four-inch pipe, to which the nozzle is attached, at a rate of 900 gallons a minute. This terrific pressure rips off the top earth like autumn leaves before a gale.

After the removal of this first layer comes the more difficult task of disposing of the refuse rock. This lies between the top soil and the merchantable stone. Holes are drilled into the rock about three feet apart the entire length of a ledge. A heavy charge of powder is placed in these holes and tamped solid with fine stone dust. A thin copper wire links the holes together. When all is in readiness and everyone safely sheltered, a signal is wigwagged to the electrician far back of the "front lines." There is a tense moment, and then the hills tremble as a section of the earth seems to rise in a unit.

As much as 10,000 pounds of powder are required to remove this stripping in a single operation.

(*Continued on page* 50)

(*Continued from page* 48)

After steam shovels have cleared away the refuse rock, the brave little channelling machine with its mighty thrust sets to work. Throughout the eight months' quarrying season batteries of these ingenious machines march back and forth with almost human precision. The machine, operating under its own steam, has a capacity of sixty thousand cubic feet of stone a year. The machines are served by thirty-ton derricks, fifty-ton locomotive cranes and fleets of switch engines.

Each machine, a small locomotive, carries a gang of steel chisels on one side of the engine. As it moves back and forth along a temporary track built on the ledge, the chisels cut grooves in the stone. On each trip the channel is deepened until the great block is finally ready for turning.

To simplify the quarrying process, a ledge is divided into what are known as "floors." A floor is the depth of a channel cut, which is eight to twelve feet. After a machine has cut to the depth of a floor, the stone is split loose at the bottom by means of wedges. When the block is turned from its age-old resting place it is far too large for loading on a railroad car. Another drilling process splits it into suitable proportions for the mill machinery. Each block is given a number and then loaded on cars and shipped to the stacking yards.

The blocks are handled at the quarries by huge steel derricks and traveling cranes operated by electricity. There is five thousand feet of rope cable to one of these derricks. In a single quarry there is as much as forty miles of wire strung through the machinery from the hill-tops to the pit depths.

Not long ago the governors of thirty States visited the quarries. For an hour they stood on a flat car in a beating rain fascinated by the spectacular demonstration. They watched the channelling machines cut through 200-ton blocks of solid stone. They cheered as these massive blocks were drawn from their places and turned over by the powerful machinery as a child would turn toy blocks of wood.

"It is almost beyond imagination," said a western governor.

"At least," replied Governor Gifford Pinchot of Pennsylvania, "a stone building will mean far more to us in the future than it has in the past."

Genius is no more apparent in the quarry operations than in the score or more of mills situated in the limestone district. There are curious machines for almost every conceivable purpose. They fashion tiny bits of artistic trimming. They plane and split huge blocks. They hollow out great columns for public buildings. They produce elaborate gothic tracery.

All are labor savers. Take the gang saws, for instance. In the old days they were suspended by ropes and the sand and water used in cutting the stone were fed to the saws separately and by hand. The ropes, too, were lowered by hand as the saws ate their way into the stone. Later, rigid swinging arms replaced the ropes, with four feed screws controlling the feed of the saws. Still later the feed was made automatic.

But the crowning success came when the automatic sand feed was evolved. On the saws using sand with automatic feed and circulating pump, the sand and water return to the pump pit after passing over the stone. Then by a simple treatment the particles of sand which

(*Continued on page* 52)

The Trackless Train

Mercury
A-310
Trailer

Low First Cost or Ultimate Economy

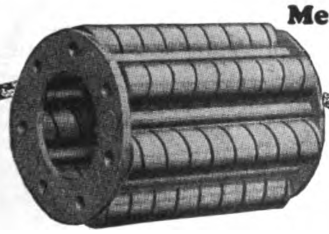
—If low first cost alone decides your purchase, we cannot expect your trailer order. The Mercury A-310 is not built to sell on price.

—but if Ultimate Economy, (brought about by elimination of maintenance, a positive guarantee of longevity, and maximum conservation of man and machine power)—is your controlling buying motive, we are confident that after investigation, Mercury Trailers will be your choice.

A strong statement, assuredly, and one that requires proof. Unfortunately space will not permit us to give the "reasons why" but they are all contained in our Bulletin A-100. Whether or not you are in the market for trailers you will want a copy for your files. Use the coupon and send for one today.

Mercury Manufacturing Company
4112 South Halsted Street
Chicago

To Milwaukee — Foundrymen's Week
AMERICAN FOUNDRYMEN'S ASSOCIATION ANNUAL CONVENTION AND EXHIBITS
OCT. 11-17
Meet Us There!



Bearings Hyatt roller bearings are used in all wheel hubs. Bearing application as approved by Hyatt Engineers. Both grease retaining and thrust washers provided. Actual tests have proven that Hyatt bearings save from 50 to 75 per cent of pulling effort required with ordinary bearings.

Mercury Manufacturing Company, 4112 So. Halsted St., Chicago
Send Bulletin A-100 and the "Mercury Six Reasons Why."

Name.................................
Firm.................................
Address.................................
City.................................
State.................................

(*Continued from page* 50)

have become too fine to be longer effective are washed out through an overflow. All other means of sawing stone have been supplanted by this skillful and economical method.

Either a pendulum or parallel motion is used on all saws operating in the mills. The pendulum motion saw lifts at the end of each stroke and thus forces the sand into the stone. The sand does the cutting. The saw with the parallel motion has no lift. It is generally employed where crushed steel is used instead of sand.

Sawing with diamonds, another operation extensively used in the mills, has greatly speeded up production. The diamond saw has a circular blade of steel with teeth, or steel castings, about an inch and a half square, set in grooves and fastened with a copper rivet. Into each tooth from four to eight genuine rough black diamonds

High-pressure stream used to remove the top surface for quarrying.

are moulded. A thirty-two inch saw blade has fifty teeth, and the larger blades, some running to seventy-eight inches, have a proportionately greater number of the precious gems.

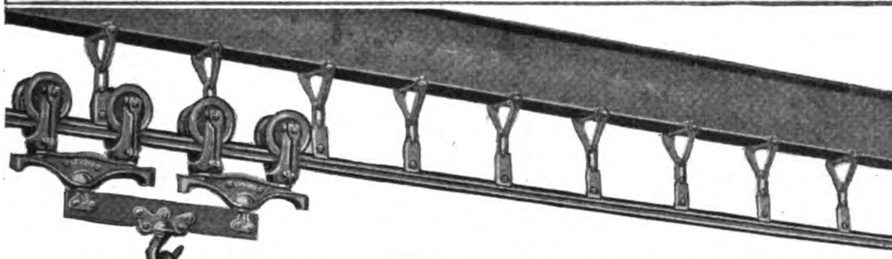
While this method involves a heavy cost, it also proves highly economical, for a sawing rate of sixty inches an hour has been attained. Such a goal was hardly dreamed of a decade ago.

Modern planing machines are another big forward step. Large sections of sawed stone are lifted by electric traveling cranes and placed on the bed of the planers where they are dressed into ashlar or moulded for cornices or sills. The machines operate at a cutting speed of 42 feet a minute. Stone cutters with mallet and chisel did the work in the old days and the operation was painfully slow and far more expensive.

Stone cutters also fashioned balusters by hand before the advent of the carborundum baluster and planer machine. To cut a two-foot baluster a competent stone cutter labored twelve hours. Today there is a carborundum wheel that is cut to the pattern of the baluster. It moves at the terrific speed of 1,375 revolutions a minute. It grinds into a piece of stone sawed on all six sides and turns out the finished baluster in fifteen minutes.

So, too, is the milling machine a great time and labor saver. It cuts tracery work, dentils and sunken panels with amazing precision, and will flute columns ten times

(*Continued on page* 54)



"Cuts Two-Thirds of Factory Handling Costs"

This is the actual saving reported by one factory as a result of installing a Louden System.

Creating greater production per man employed, at less cost, is the one outstanding means of increasing profits in practically every present day industry. This is being accomplished in hundreds of plants by handling materials in a far more orderly manner, in less time and with less common labor, through the use of a

LOUDEN

OVERHEAD CARRYING SYSTEM

Other reports, selected at random: "It is reducing our labor cost on material handling 30%"; "It saves over 100% on the investment every year"; "It has already saved us a great many times what it cost us"; "It reduced our pouring gang from 20 to 6 men."

In conveying material in loads up to 2000 lbs., Louden equipment saves wages, time, breakage, floor space and floor wear. It is in use in practically every industry, making substantial savings in small plants as well as in large ones. Moderate in cost. Installed by local labor.

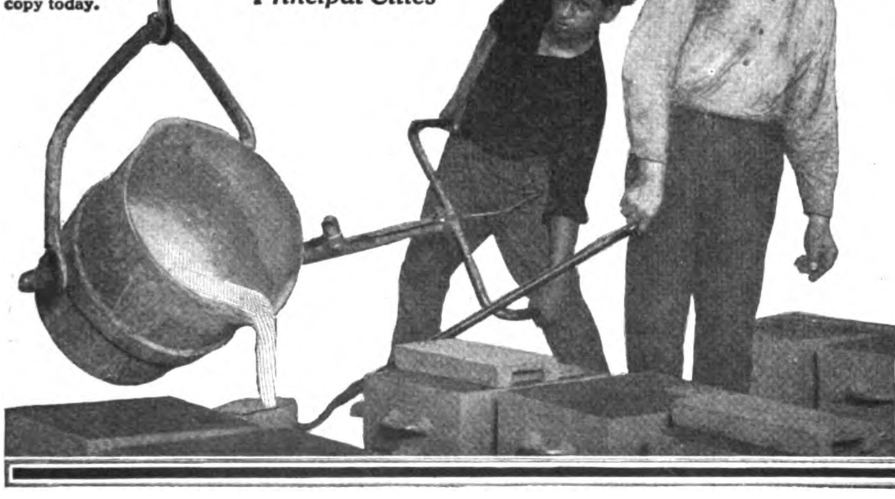
The opportunity to see what the Louden System would do for you is all that we desire. Without committing you to anything we will have one of our engineers in your vicinity make a survey and report. You'll find his ideas helpful. Drop us a line today.

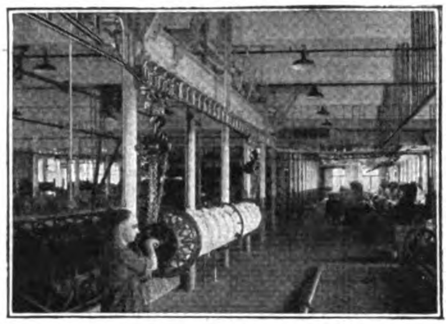
The Louden Machinery Company
582 West Ave., (Est. 1867) Fairfield, Iowa

Branches in all Principal Cities

Send for Louden Overhead Book

It pictures many installations in various industries—installations varying in size from a few feet of track to several miles. Tells an interesting story of how other concerns have cut manufacturing costs. Send for your copy today.



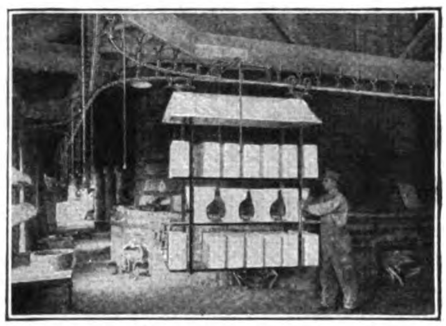


Many Uses in Textile Mills

Weighing 2,000-lb. beam on track scale. One man does work of four in putting beam in machine. No danger to men. Less breakage of beam heads. F. C. Huyck and Sons Company, Rensselaer, N.Y.

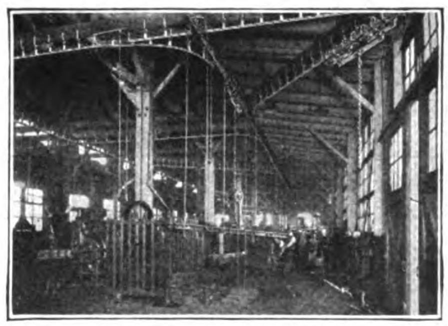
Handling Grand Pianos

Saves time and handling during varnishing. Storage tracks save space and rehandling between coats. Scratches avoided. Costs cut one-third in this department of Apollo Piano Company, DeKalb, Ill.



For All Departments in Potteries

"Our entire plant is equipped with the Louden System. It saves one-third the help—eliminates breakage of wares—has cost less than $5.00 in two years for maintenance." B. O. T. Mfg. Co., Trenton, N. J.



Switchyard on the Ceiling

In the M. K. & T. General Reclamation Shops, Parsons, Kas., all material for reclamation and reconditioning is handled from the receiving platform and through shops and auto cars by Louden Overhead.

(*Continued from page* 52)

more rapidly than was possible by obsolete methods. The lathe, another most important machine, varies in size and is capable of turning all types of stone work, from small balusters to monolithic columns 40 feet long, and has established the record of a 28-foot column in three days. It used to take six weeks when done by hand. The shaper, the header and the pneumatic air hammer, now used by stone cutters, are other inventions that have greatly reduced production costs because of the big saving in time and labor.

I left the mills, and with the whir and roar of machinery still in my ears, was driven to the quiet seclusion of the Stone Club of Bedford. There before the great stone fireplace which is topped by a stone clock, I heard more of the Story of Stone from men who have devoted their lives to the industry, who have watched thousands of buildings rise of material drawn from the stubborn hills. There I met Thomas J. Vernia and A E. Dickinson, R. M. Richter, W. B. McMillan, S. C. Freeze, I. Matthews and others connected with the industry.

They did not talk much of what had already been attained. The phenomenal progress and the present high efficiency are as they should be. These leaders in the industry talked of the future. They are planning and dreaming of still bigger things, innovations that are as certain as the rising of the sun; progress from which the entire country will benefit.

And as I sat listening to these men, with the picture of the roaring quarries and mills still fresh in my mind, I was reminded of Berton Braley's verses:

> Back of the beating hammer
>   By which the steel is wrought,
> Back of the workshop's clamor
>   The Seeker may find the Thought
>   Of Iron and steam and steel,
> That rises above disaster
>   And tramples it under heel!
>
> Might of the roaring boiler,
>   Force of the engine's thrust,
> Strength of the sweating toiler,
>   Greatly in these we trust.
> But back of them stands the Schemer,
>   The Thinker who drives things through;
> Back of the job—the Dreamer
>   Who's making the dream come true!

Yankee ingenuity and vision were never more poignantly demonstrated than in the quarries and mills of southern Indiana.

THE combination of the special buying in the West on account of agricultural improvement, the increased buying from abroad on account of foreign loans and the ordinary consumption requirements of the American people will be the basis of business revival in 1925.

In this connection, however, we would remark that people are usually willing to spend freely if they can buy on credit. In the past one hundred years a condition of easy money and liberal lending of bank credit has always found the American public willing to spend freely. In 1925 it is likely that the demand for goods in many lines will surpass expectations. Credit will be plentiful.—*Alexander Hamilton Institute.*

The Economic Aspect of the Plant Restaurant

(*Continued from page* 36)

the meals were not properly served and were often uninviting. Of course, many of the complaints there were no grounds for; nevertheless many of the workers refused to eat in the company's dining room.

In one year this company showed a deficit of $9,000 on its dining room.

As a last resort the manager decided to change the table service to the cafeteria type of restaurant. In a comparatively short time the whole attitude of the workers changed with reference to the company's dining room, and in three months eighty per cent. of the workers were patronizing the restaurant. In one year this manager saved $6,000 in wages for dining room help, as compared with what it was costing him for wages under the old system. The cost of making the structural changes to the restaurant was $5,000.

The breakage of china has been reduced fifty per cent. and food wastage is at a minimum since the workers take only what they will eat. The employees are thoroughly satisfied with the restaurant now, though they pay on an average of twelve cents more for their meals than they paid under the old system.

Another concern that was experiencing some difficulty with its restaurant installed a conveyor system in its dining room. This system does much to speed up the service and lessen the unit cost of the meal. The most important factor in the success of the plant restaurant is rapidity of service. The conveyor system of this plant restaurant serves from thirty to forty persons per minute. This company was able to reduce its dining room personnel fifty per cent., after the conveyor was installed.

The conveyor system is absurdly simple. Belts are placed along the side of the counters. Each belt is stretched from one end of the counter to the other. While lunch is being served the belts are put into motion by small electric motors and kept moving at the speed one would ordinarily walk. The diner places his tray on the belt as he enters. He then follows his tray, as it moves along and is filled with various dishes by the attendants on the other side of the belt. Belt conveyors running along the outside rear walls of the dining room facilitate the work of getting soiled dishes back to the dishwashing room.

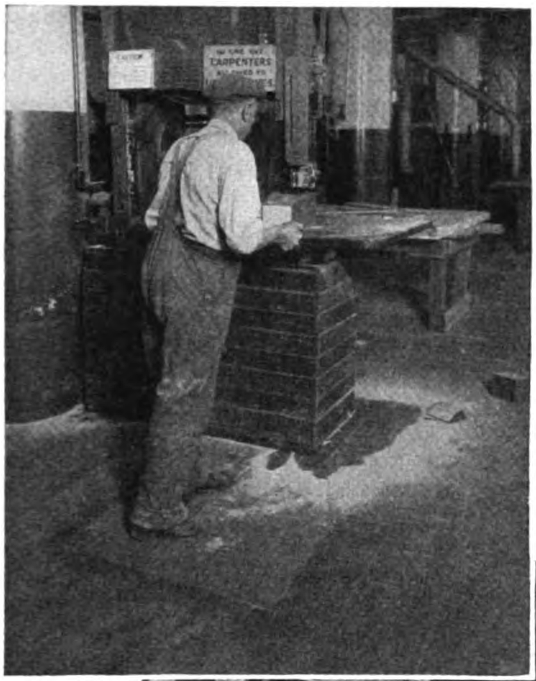
The conveyor systems possess many advantages over other systems in plant restaurants. They are time and labor saving. They require a small amount of power for their operation and if properly designed require practically no attention.

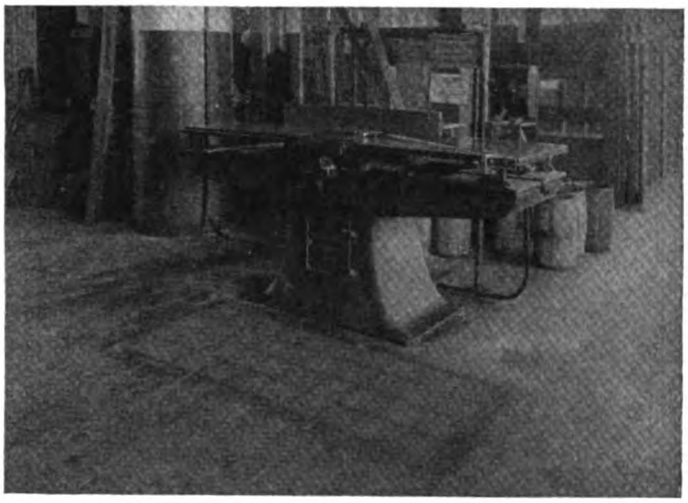
Another plant manager who thought his shop restaurant was not functioning properly made some changes in the personnel and put a middle-aged German-American woman in charge. In one month this woman was able to cut the meat bill alone $200.00 a month by eliminating waste. This was considered a worth while saving as this plant was employing less than a thousand persons.

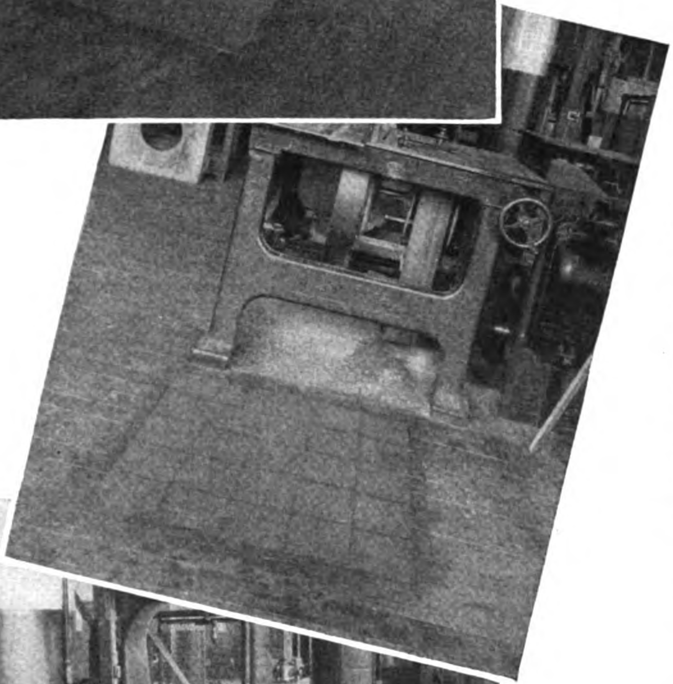
The management of a plant employing less than two hundred persons was desirous of installing a plant restaurant, in view of the fact that they were situated

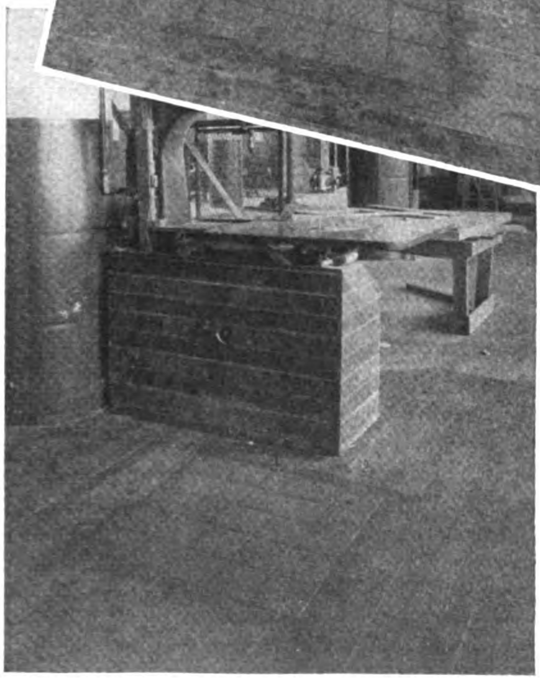
(*Continued on page* 58)

NORTON FLOORS









SAFE—Never get slippery
DURABLE—Shoe leather doesn't wear them out

Norton Floors are exactly suited to bear the unusual wear and to eliminate the slipping hazard in front of much-used or dangerous machinery.

Alundum abrasive, the toughest of all known abrasives and used for years as the cutting material in grinding wheels, gives Norton Floors a slip-proof surface and the ability to stand up under the severest conditions.

Neither grease, oil nor water will destroy their slip-proof effectiveness.

Laid flush with the rest of the floor there is nothing to trip on and they will always remain flush.

There are Norton Floors suitable for use in the most magnificent of modern buildings or for industrial purposes—Alundum Stair and Floor Tile, Treads, Platforms, and Aggregates.

NORTON COMPANY
WORCESTER, MASS.
New York Chicago Detroit Philadelphia
Hamilton, Ontario

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(*Continued from page 56*)

about nine miles from the city, and there were no desirable places for the workers to get a hot noonday meal in the vicinity of the factory.

The company was reluctant to install the restaurant as they were of the opinion that since there were so few men employed the restaurant would show too great a deficit. Finally, someone suggested running a commissary in connection with the restaurant, where employees could make purchases of eggs, coffee, meats, butter, gloves, shoes, etc. The profits from the commissary and the assistance the mutual aid was able to render, has made this restaurant one of the most successful.

A large organization has placed the financing and management of their restaurant in the hands of a voluntary employees' association. The equipment of the lunchroom was purchased by the employer. The kitchen is electrically equipped throughout. During the first year the gross receipts amounted to about $200,000. For one month the average receipts per meal were 19.8 cents and the average cost per meal 18.9, leaving an average profit per meal of 0.9 cent. For another month the profit was 0.7 cent per meal.

From the foregoing, it may be gathered that the plant restaurant can be made to pay its way if proper methods are instituted.

There are several cogent reasons for the industrial restaurant in any plant, whether large or small. Where workmen are some distance from their homes, the industrial restaurant is an important factor in keeping employees well, especially in the cold season and on wet days.

The unwholesome conditions of eating the noonday meal outside of the shop are strikingly illustrated when men are seen rushing from the plant to the saloon and hurriedly swallowing an unsanitary lunch and drinking a quantity of indigestible drinks. In view of the fact that many of the men are unable to find boarding houses in the vicinity of the factory, they are obliged either to eat the food purchased from hucksters outside the gate or at the saloon. These places are under no supervision and some of the food is not fit for human consumption.

Is it any wonder that there is a noticeable loss of "pep" among these workers after the noonday meal?

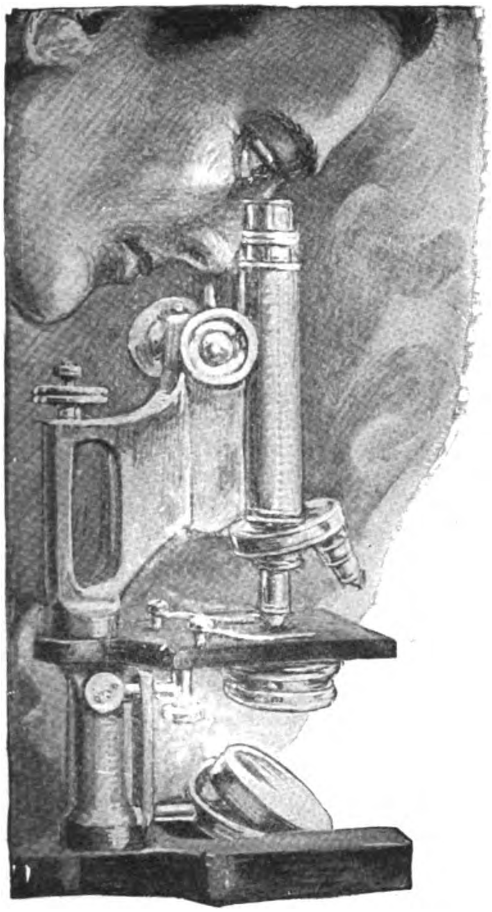
One investigator found that thirty-six and eight-tenths per cent. of the workers examined by the company's physician showed some degree of difficult digestion, which was due to the workers eating unsubstantial lunches and was responsible for a lessening of the worker's output.

Modern prandial chemistry has done much to improve the plant restaurant.

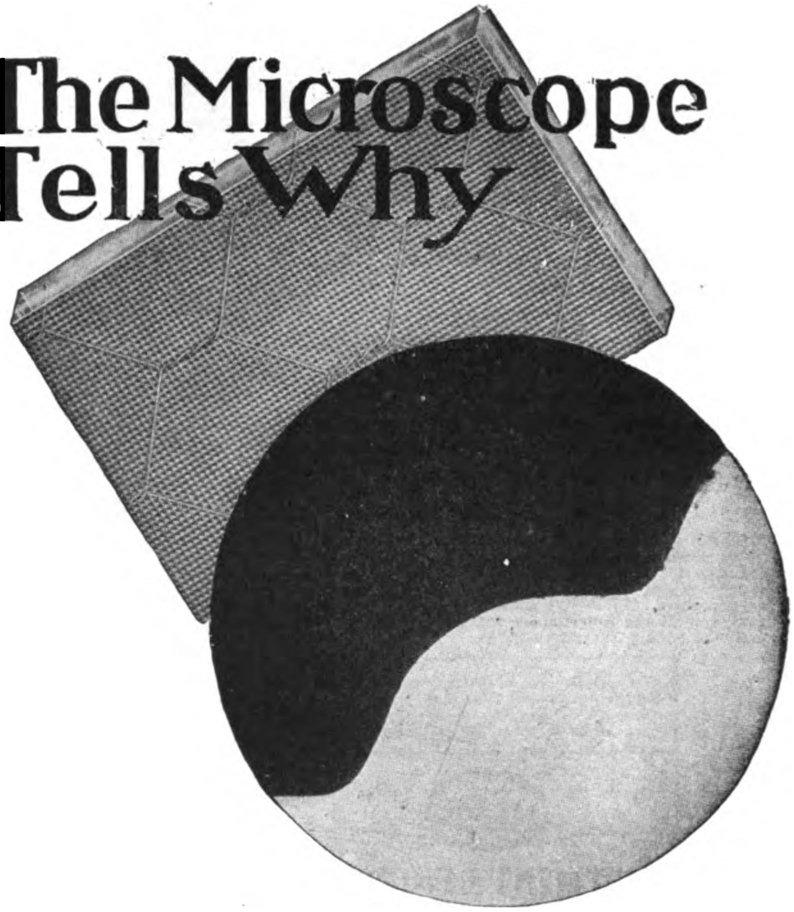
The meals furnished in industrial restaurants are based upon proper food economics and proper food values. There is a moderate range of selection of food, but no food that is wasteful economically or unnutritious or which is difficult of digestion is served. The men in charge of these restaurants know that the dyspeptic is only half a man.

In this connection it is interesting to know that a large automobile concern finds that the accidents among the employees are much less numerous in the afternoon than in the morning. They attribute this reduction to the

(*Continued on page 60*)



The Microscope Tells Why



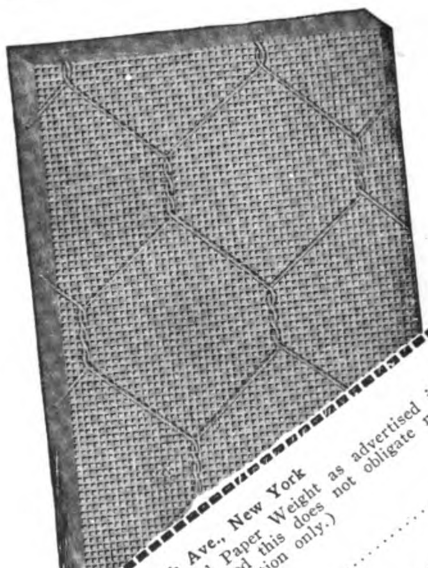
FACTROLITE

Diffuses Daylight

Each little pyramid has **plane** sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes.

At the same time the maximum degree of **diffusion** is attained. Large and small industrial plants have used thousands of feet of this improved daylighting glass.



At a time when conservation of resources is a paramount need, why not consider the conservation of daylight?

A sample of FACTROLITE sent on request to any engineer. Simply fill out and mail the attached coupon.

The Mississippi Wire Glass Co.

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Gentlemen: Send me a Catalog and Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way. (For American distribution only.)

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(*Continued from page* 58)

change of environment occasioned by the employees going to the lunchroom to eat their noonday lunch.

Among the women workers in a plant in the Middle West a smaller proportion of fainting cases was observed after the plant restaurant was installed. This was largely due to the workers getting a good dinner, in contrast with an inadequate breakfast, and a dietary of too many delicacies and unsubstantial food.

Good nutriment depends not alone on the amount of food eaten, but on the kinds of food eaten. An excess of sweets, meats, bread, and other starchy foods are responsible for incapacitating the worker more than any other cause.

The Greeks and Romans did not know what sugar was, and unless one is a marathon runner, a prize fighter, or a wrestler, he can get along very well without a great deal of sugar. The Esquimaux have long proved this. They eat no sweets, and as a result they are a hardy race and have no word for "toothache."

The great standby in the industrial restaurant is milk. Milk is a universal food containing that very elusive substance now very much discussed, vitamine. Last year the Metropolitan Life Insurance Company used in its home office 3,649 quarts of cream, 357,056 quarts of milk and 19,200 quarts of evaporated milk. This company employs more than 7,000 persons in its home office.

There is as much phosphorous or nerve building material in a glass of milk as there is in any medicinal nerve tonic.

A pint of milk will furnish as much food value as a pound of round steak. In this connection I might add that milk is a heat producer, and may be objected to on this ground by some workers during the hot months. This objection can be overcome by using skim milk. Dr. Evans says: "A pint of skim milk will repair more tissue, furnish a little more energy and make about half as much heat as a pint of whole milk—and it will cost less."

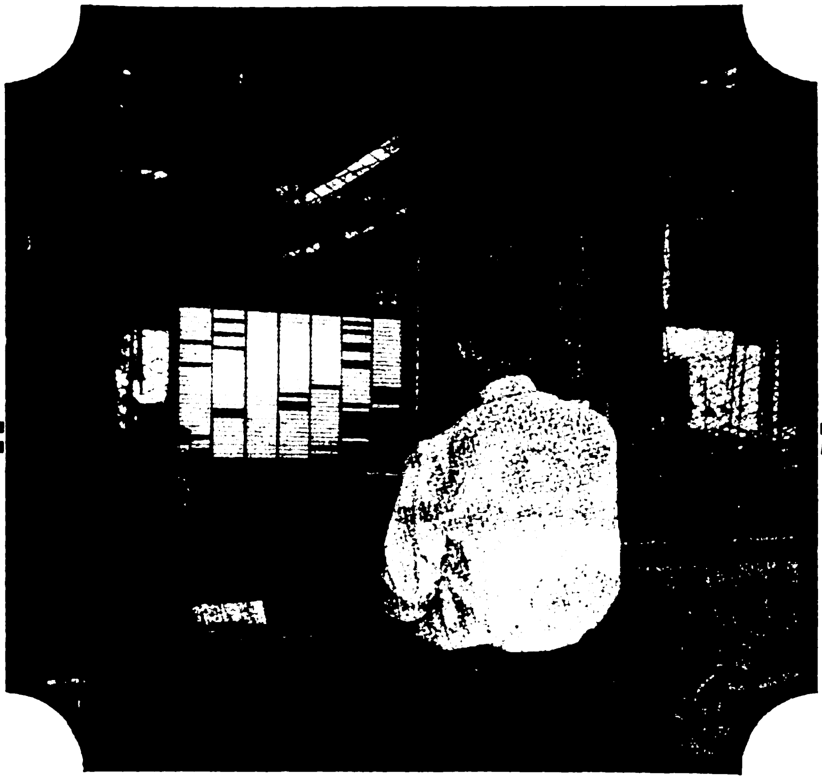
To demonstrate the energy contained in milk, Dr. Herman Bundensen, Health Commissioner, Chicago, used dry milk in place of coal to run a train a distance of more than ten miles. The locomotive pulled a train of ten cars and carried more than a hundred passengers. Dried milk that was moistened and made into lumps was used in place of coal.

A large company in the Middle West starts work in the morning one half hour later than usual time, in order to give the workers time to get a good breakfast, well cooked and to eat it without hurry. The investigators for this company found that some of the workers' output was below average, which they attributed to the workers going without breakfast. When time was allowed for a properly cooked breakfast, fatigue was greatly diminished and production increased 10.6 per cent.

There is no doubt but that fatigue finds a formidable opponent in the dining room, and fatigue and morale make poor bed fellows.

Napoleon declared that "an army marched on its belly." If this is true of war, why isn't it true of work?

In conclusion, I wish to say that no restaurant and particularly no industrial restaurant can be a success if it is not kept clean and wholesome, and regardless of culinary accomplishments if the proper hospitable impulses are lacking the plant restaurant is a failure.



This McCaskey System Stopped Tool Loss

AN inaccurate tool checking system was costing the Arrow Electric Company, Hartford, Conn., thousands of dollars loss each year. Now a McCaskey System not only has eliminated this loss but provides an accurate, efficient record for each tool and the workman that has it. Read the letter of Mr. S. P. Wyrfel, who tells how this functions in their plant.

"We never knew what convenience in the tool room meant until we installed a McCaskey Tool Check System 2 years ago. A glance at the McCaskey now tells us just which tools are out and just which workmen have them.

An Accurate Check on Every Tool

"Our old method was to give each man a number of brass checks stamped with his number. He turned in a check for each tool he took from the crib, and got his check back when he returned the tool. But any check was good for any tool, so that a man might return an inexpensive tool in the place of an expensive one; and there was no way of telling how long a tool had been out. Also, the checks were always being misplaced or lost, and sometimes forged.

"With the McCaskey System we know that every tool is either in its place in the crib or in the hands of a certain workman. We also know how many tools each man has out and how long he has had them. If a certain tool that is wanted for a particular job is out of the crib, we know just who has it—there is no holding up a job while we hunt for the right tool.

Makes Workmen More Careful

"Knowing that we have an accurate check on them, the workmen are much more careful with their tools and much more prompt about returning them. As a result it requires a smaller investment in tools to keep our stock complete, and less labor and maintenance in the tool room.

"Probably thousands of other factories are still using the old brass check system, and wasting hundreds of thousands of dollars every year in tools misplaced, lost or stolen. But we wouldn't think of doing without our convenient and efficient McCaskey System."

Could a McCaskey System Save in Your Plant?

McCaskey systems are bringing huge savings to hundreds of manufacturers. They are checking tool loss, controlling delivery, production, perpetual inventory—in fact, they are used wherever detail records are involved. Could a McCaskey system applied to your plant bring you similar savings? We will be glad to consult with you—to show facts and figures of McCaskey operations in plants approximating yours. There is no obligation. Write us today.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division ***Alliance — Ohio***

CANADIAN PLANT *GALT, ONTARIO*

The Guide Post of Industry—

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The Subscriber Service Editor

Industry Illustrated
120 West 32nd Street
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One Handling or Many?

(*Continued from page* 25)

convert unproductive labor into savings, is of extreme importance wherever material has to be moved from point to point in factories, warehouses, or other similar enterprises. With a hand lift truck to lift and carry the load, easily and quickly, one man can equal the work of from two to six men. This statement seems unbelievable and yet by a careful analysis of a hand lift truck system, operating under satisfactory condition, one will find that the large figure is not at all exaggerated. The variation is due to the many conditions under which lift trucks are employed.

The various illustrations show that a hand lift truck system is made up of two parts, a master lift truck and a number of load platforms or skids. Let us consider, as a comparison, operating conditions using ordinary platform hand trucks for the handling of the various materials shown in Figs. 8, 9, 10, 11, 12, 13, and 14. With the old method of handling or trucking, the various units would most likely have been placed on the floor and when ready to be moved would have been placed piece by piece on a comparatively expensive hand truck. At destination, these units would have been unloaded by hand, piece by piece, or else dumped, which in the case of fragile material would result in breakage. Some plants have tried to leave the load on the hand trucks but this usually led to a big investment in equipment and large expense in maintenance of a number of trucks.

With a hand lift truck system, the various units are placed direct on an inexpensive skid, which can be built in the shop, or purchased, and by simply running the master lift truck under the load, it is lifted by one stroke of the handle and is ready for transportation. At destination, the release on a hydraulic plunger by means of a foot pedal lowers the load and skid to the floor in a very few seconds and the master truck is immediately ready for the next loading. There is no rehandling and no expensive tie-up. Such a system provides a capacity of a fleet of separate trucks at the comparatively small cost of one master truck and a fleet of inexpensive load skids of any design or style required for the material being handled. With such a system, hand loading and unloading is almost entirely eliminated. One man with a lift truck can pick up or deposit a skidded load in a minute or two. Because of this saving in time, his load handling capacity is greatly increased and alone he can accomplish the work of two or more men. Very heavy, or awkward load (Figs. 14, 21, 23, 26, and 29), ordinarily handled by several men or a gang, can be handled by one man with a lift truck almost as quickly and easily as smaller loads or those weighing only a few pounds. When using this system of transportation, the trucker is never tied up or idle, waiting to be loaded or unloaded, and it only requires a moment to pick up or deposit the skid.

It has been pointed out that the lift truck is an accessory to the platform or skid, for the reason that one lift truck is used where hundreds of skids, in various forms and sizes, are employed. While this particular point is open for debate, it is a well-known fact that neither one can operate without the other and it is also agreed that the proper type of skid has much to do with the ultimate success of the system. Skids have been more or less standardized but we find them made up of different materials. Some systems employ all wood skids which are usually made in the plant carpenter shop. This practice is now being done away with as it has been found that where these skids are employed, the carpenter shop always has a large number being repaired. Several factors cause the wooden skids to deteriorate quickly, such as nails loosen, boards loosen and splinter; and as these catch and damage the goods, also give employees minor injuries that frequently require time off for attention, the cheapness of the wooden skid has been found an expense. To meet the need of a better skid, truck manufacturers, and others, are now producing a combination steel and wood skid, which consists generally of steel legs and frame with a hard wood platform or top to resist the wear caused by hard material. Pressed steel skids are also being produced and these skids are particularly advantageous where heavy loads are to be handled. Special skids to perform special operations are generally built of structural steel shapes. Practically all the types of skids mentioned are shown in the various illustrations in this artcile.

Providing the capacity required for the plant system or selecting the type of equipment to be employed, is simply a matter of deciding on the type and size of skid which your specific needs make necessary. It may be a rack, or a bin, or box, or it may be some specially adapted form of any of these, but no matter what the condition, the solution is generally a simple matter. In providing for lifting and carrying capacity, it is only necessary to select from the many available standard models now produced by various manufacturers, a truck to fit the skid decided upon. There are standard trucks of every size with a lifting and carrying capacity to handle from 1,000 to 20,000 pounds. Platform capacity and truck capacity are two of the most important factors to be considered. The third is the type of truck to be used and the fourth is the proper layout, or operation, of the truck in the production schedule.

When we consider that all the products of American industries can be segregated into about six similar classes, it is easy to see that the lift truck system of transportation will fit into almost any plant. Under these classifications would come:

1. Castings or finished parts in production in machine shops or machine industries.
2. Boxed, packaged, bottled and canned goods, which would include those products produced by canners, packers, bakers, confectioners, etc.
3. Bundled, rolled, sheet and bagged goods, such as are required in leather, paper, rubber, textile, clothing, printing and publishing industries, chemical plants, etc.
4. Flat units, sheet metal, lumber, etc., as required in sheet metal works and lumber mills.
5. Fragile material that has to be racked or segregated in processes such as cores in foundries.
6. Special, long, large or unwieldy articles in various industries.

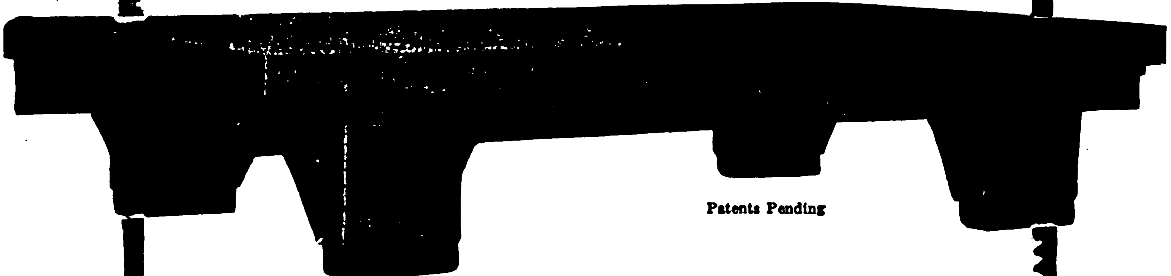
It is interesting to note that all these classifications, shown above, are clearly illustrated by the accompanying photographs. Materials under classification No. 1 are shown being handled in Figs. 1, 2, 9, 15, all under varying conditions and in different industries. Those under classification No. 2 are shown in Figs. 10, 11, 16, 22, 25, 27, 33, and 34, while classification No. 3 are shown in Figs. 3, 13, 14, 17, 20, 24, 28, 31, 32, and classification No. 4 are shown in Figs. 8, 12, and 19, and classification No. 5 are shown in Figs. 21 and 22, while classification No. 6 are shown in Figs. 4, 5, 6, 7, 18, 23, 29, and 30.

(Continued on page 66)

HALLOWELL

STEEL LIFT TRUCK PLATFORMS

Why not Standardize on "Hallowells"?



Patents Pending

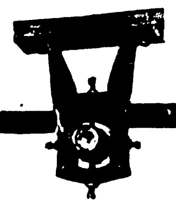
"Hallowell" parts are manufactured in large quantities, but they are assembled into complete platforms only as orders are received; for the reason that conditions of each individual installation are taken into consideration and a suitably constructed platform recommended.

The same specially designed steel leg holders, and the same method of attaching them to the runners—both of which are outstanding "Hallowell" features—are employed in all of our platforms, but as the size, load to be carried, and severity of conditions increase, so the sections are made heavier and larger.

Thus, every "Hallowell" is built exactly to your requirements and in accordance with the conditions in your plant. Yet, because of quantity production, the price of a "Hallowell" is comparatively low.

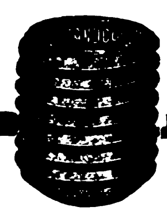
Give the "Hallowell" a trial—you'll then know why so many large and prominent concerns throughout the country have adopted it as their standard.

A Few of Our Other Specialties



"PIONEER" STEEL HANGERS. Specify and insist upon the "Pioneer"—the original steel hanger—the leading steel hanger of the day because of its demonstrated qualities through many years of actual and extensive use.

"HALLOWELL" STEEL BENCH AND TABLE LEGS. Be economical and don't make another bench, assembling stand or table without getting our Bench Leg data—it will pay you. They are indestructible, never become wobbly, and are inexpensive.



"UNBRAKO." A product absolutely unexcelled and sold at attractive prices.
Ask for samples and test them in comparison with any other make.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PA.

(*Continued from page* 64)

With this array of evidence, there is no longer need to doubt that the hand lift truck system of transportation is applicable to various handling operations in practically every industry.

A saving which is effected by lift trucks, but which is frequently not calculated, is the loss of goods in transit. Thousands of dollars are wasted annually through spoilage and breakage. Goods and materials are soiled and mutilated by rehandling, are dropped and broken through transfer, or damaged and destroyed by coming in contact with damp, wet and dirty floors, in storerooms and warehouses. Easily soiled and damaged loads, such as paper or textile, when handled on skids, are kept off the floor and in this manner remain clean and dry. They can be quickly picked up and deposited without rehandling. Heavy loads of castings or machinery are also easily handled without danger of being dropped and broken. Fragile materials, such as pottery, and glassware, are moved quickly and gently without shock or jar.

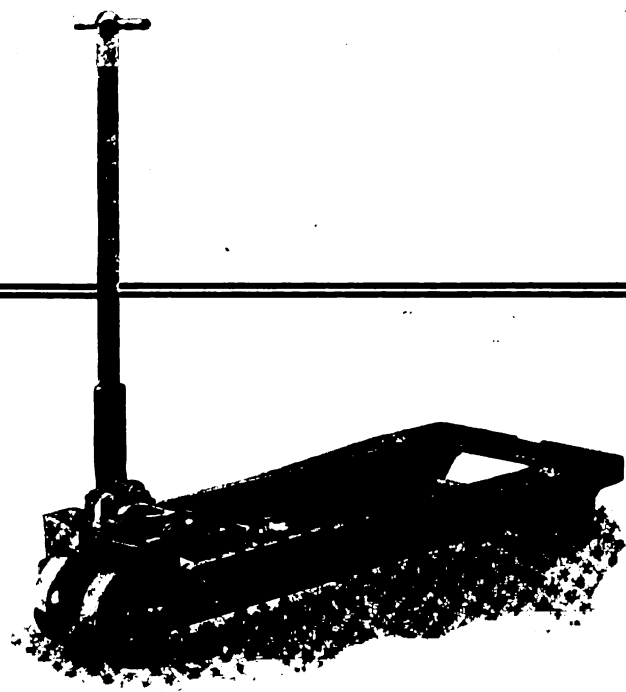
There is one large branch of industry that has profited largely by the use of hand lift trucks: the printing trade and the paper industry. Power presses of today, with their enormous hourly capacity, demand the use of a quick, clean, economical method of delivering paper to the presses and carrying away the printed sheets. This

Fig. 33. A convenient method of unloading or loading from trucks and wagons which are at different levels.

operation is shown in Fig. 24. Here every pound of paper conserved is profit. Rehandling soils and damages paper. Paper transferred by the hand lift truck system is handled but once. Damaged paper in storage from bursting water pipes, careless janitors with mops, and other causes, is discounted when stock is piled off the floor on skids. With this method of transportation it is always clean dry, flat and ready for the press and can be moved at a moment's notice. Time is always an important item in the printing and publishing trades and it has been found that the hand lift truck system of transportation permits stock to be unloaded from trucks to skids, as soon as received; rapidly and neatly stored and quickly moved to and from the presses without any rehandle. This proves the statement, previously made, that the highest type of conservation is the utilization of present resources and supplementing same with the most modern methods.

The original lift trucks were crude affairs but today

(*Continued on page* 68)



STUEBING MODEL—LIFT TRUCK

Lift More on Ball Bearings

If you can carry a greater load on each of your lift trucks than you are carrying now, your transportation problems are nearer solution. Where three men were necessary for a certain department before, two men can do the same work now if your lift trucks are Fafnir Equipped.

The amount of load that a hand lift truck can carry is limited by what a man can pull—and the more he can pull the more he can carry. The ease with which a truck pulls is up to the bearings in the wheels—for if the wheels revolve with difficulty when the truck is empty, they won't run any better when it's loaded.

The Stuebing Model Lift Truck has the maximum load capacity because it moves on *Fafnir Ball Bearings*. Its wheels are as carefully mounted as those of the most expensive automobile. The Stuebing Truck Company has found that where load capacity and ease of handling are first considerations it pays to use the best. It will pay you, too, if you have *Fafnir Ball Bearings* in your lift trucks.

Do Your Lifting on Fafnirs

The FAFNIR BALL BEARING CO.

NEW BRITAIN — *Main Office and Factory* — CONN.

(*Continued from page 66*)

these trucks are highly finished machine products. Attention has been paid to every detail which will assist in their giving satisfactory service at all time, for instance, most manufacturers have equipped their trucks with roller or ball bearings in all the wheels and these are considered standard equipment. This one feature alone makes for easy operation. In addition, they have equipped all points which require lubrication with grease gun lubricating attachments which insures the proper lubrication for the bearings at all times.

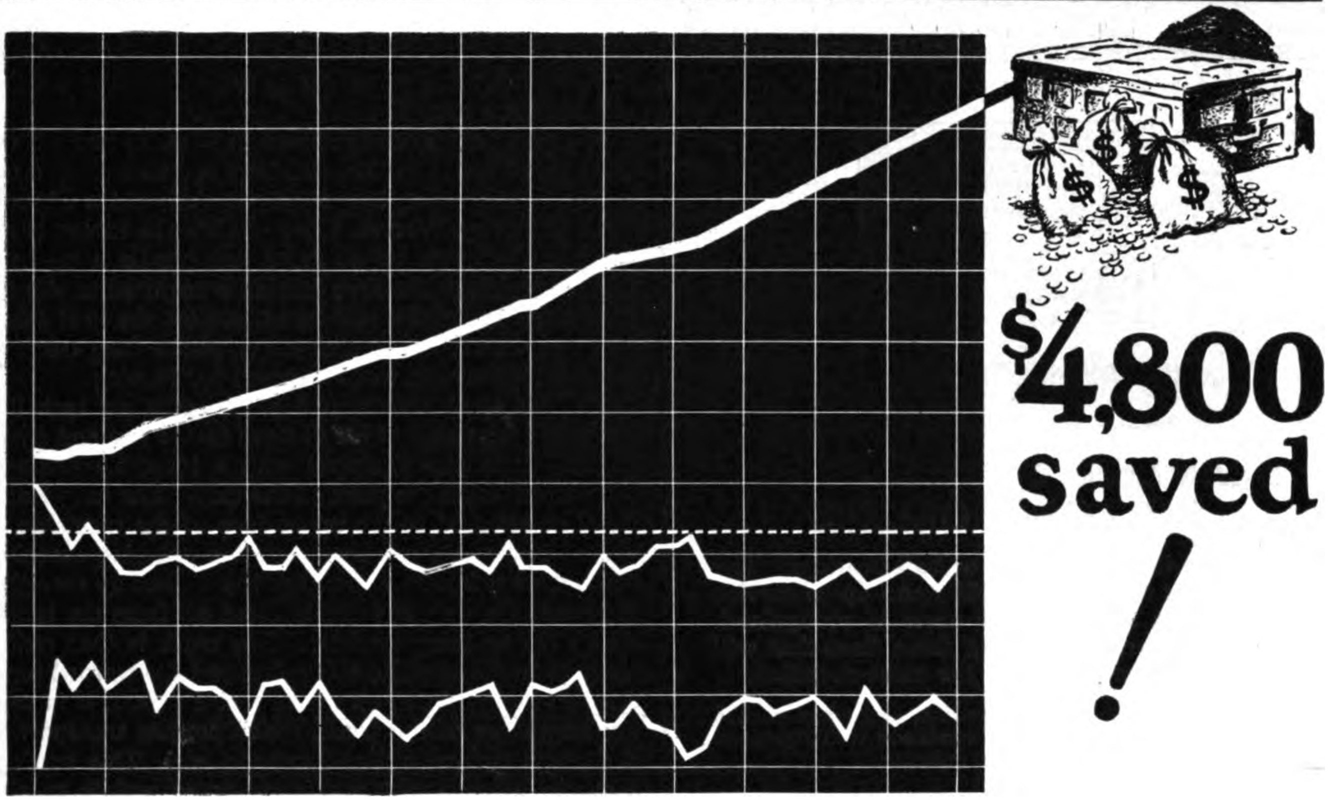
It does not seem possible that the small item of wheels should have an important bearing on this type of transportation system but it has been found of extreme importance. So much so, that the standard trucks are equipped with various sizes of wheels, ranging from six to twelve inches in diameter. It has been found that where good floors exist that a six inch or seven inch diameter wheel is entirely satisfactory, but in the case of rough floors a nine inch diameter, or larger wheel, is required for easy movement of the load. It will, therefore, be well for the executive when selecting his truck requirements to consider the diameter of the wheel in connection with the floor conditions. It is also well to consider the type of wheel for the reason that where floor conditions require a protective tread, various types of rubber-tire wheels, special wooden wheels and fabric-cushioned wheels can be obtained. The wheels, however, which in this case would be considered as additional or special equipment, are only applied by the truck manufacturer when requested by the user.

Fig. 34. Note the brake on the front wheels to hold the load on the incline.

When considering a special wheel, it is well to remember that rubber-tired wheels and fabric-cushioned wheels are resilient and afford increased protection to the floor, but the pulling effort required for a given load is also greater in proportion. In selecting a built-up wooden wheel, the increased frictional resistance between truck and floor need not be taken into consideration. In most cases, standard cast wheels, furnished by the truck manufacturers are satisfactory.

Special trucks, equipped with springs, for cushioning the floor shock can be obtained. These trucks are particularly recommended for the handling of green concrete blocks, green or baked cores, unannealed glass, crockery ware, or any similar fragile material. The trucks shown in Figs. 21 and 26 are spring equipped, the one in Fig.

(*Continued on page 70*)



How a Branch House reduced handling costs 13c per ton

A source of profit overlooked by most manufacturers

FROM April 1923 to April 1924, a saving of $4,800. was made through the installation of the Cowan System of reducing handling costs.

The lower line of the above chart shows the tons handled per week; the next line above it shows the handling cost per ton by the Cowan System; the broken line shows the estimated handling cost per ton had the old platform trucking system been used; and the top line of all shows the progressive saving in dollars.

Similar easy opportunities for more net profit exist in practically every manufacturing plant, although extensive investigation shows that very few take advantage of them.

If you would like to find out whether such a saving or profit is possible for you, we will, at no cost or obligation to you, make a survey and plan of your present handling methods and costs.

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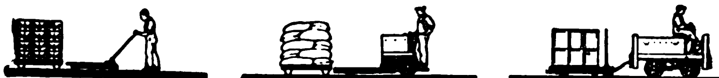
Send today for complete information

FOR complete information, without obligation, simply send us the coupon below, Cowan Truck Company, Dept. A-5, Holyoke, Mass.



COWAN

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HAND AND ELECTRIC LIFT AND CARRY TRUCKS

MEMO

Secretary: Please fill out coupon below and mail today to Cowan Truck Co., Holyoke, Mass.

COWAN TRUCK CO., Dept. A-5, Holyoke, Mass.
Gentlemen; Please send full information about the Cowan System of Reducing Handling Costs to:

Name of Individual..................................

Name of Company..................................

Street..................................

City...................... *State*............

(*Continued from page* 68)

21 having a special leaf spring, built into the main frame of the truck and over the rear wheel, while that shown in Fig. 26 has several springs placed in the lifting frame of the truck, thereby making a cushion between the skid and the truck proper.

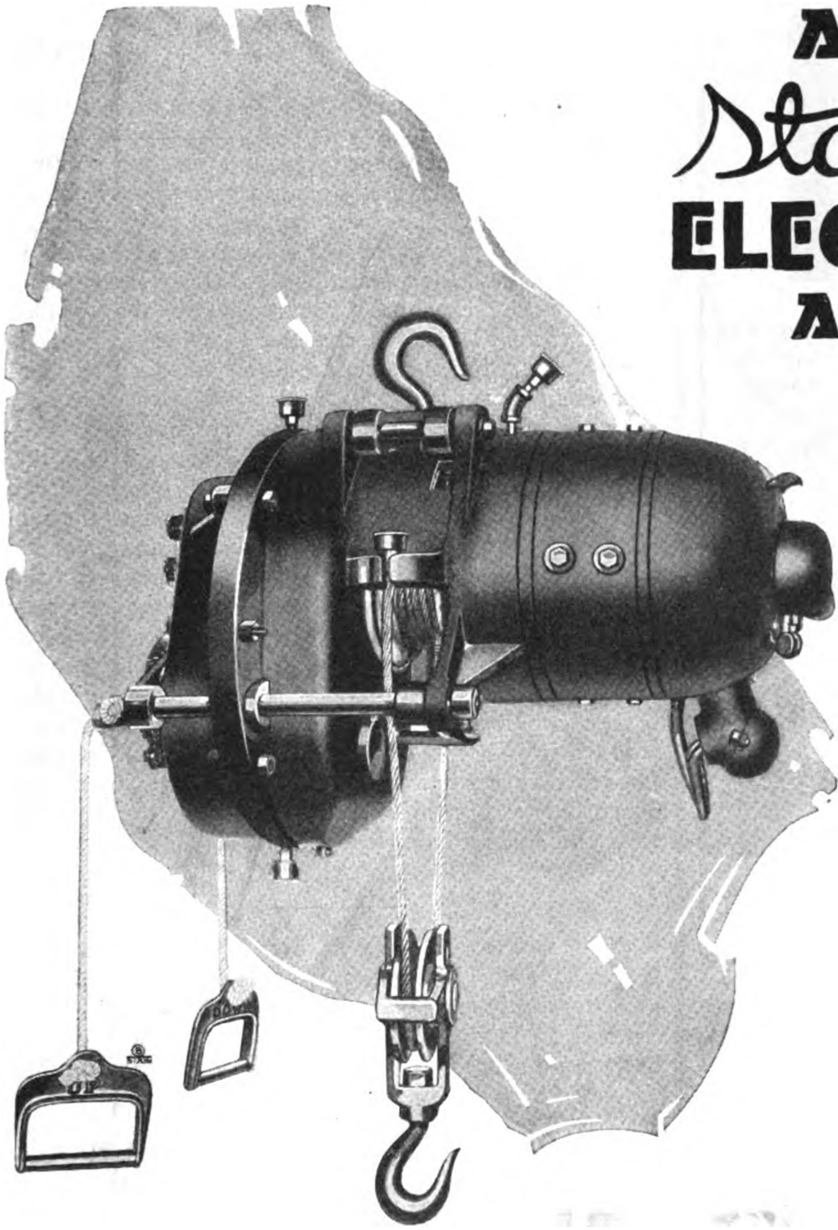
Special trucks, such as shown in Figs. 23 and 30, can be obtained for individual handling operations. The one in Fig. 23 is handling long tubing on skids at the Phoenix Tube Company, Warren, Ohio. While the tubing is not particularly heavy, yet to move and handle it by hand takes many times the time and labor required to slip the hand truck under the skid and transport the load away. The main limitation in connection with a long truck of this type is the aisle room required for turning.

The lift truck shown in Fig. 30 has a six inch lift, instead of the standard lift of from two to two and a half inches. It is also equipped with a turntable arrangement which takes the place of the skid. The long frame member, attached to the upper face of the turntable, is backed under warped beams on the spinning machine, while the truck is in a low position. Then by elevating the truck, the warped beam is lifted off from the brackets on the spinning machine. The truck is then pulled away from the machine a few feet and the warped beam can be swung around on the turntable so that it is resting lengthwise of the truck, which permits transporting it through narrow aisles, doorways, etc. This truck is a special arrangement and is presented mainly to give the executive an idea of what can be accomplished by using one principle to solve many problems.

In speaking of aisles, we touch upon an important point, which is frequently overlooked in the installation of lift truck systems. It is better to have the aisles at least two feet wider than the overall length of the load than to have them only slightly longer than the length of the load. A spacious aisle permits the trucker to remove a loaded skid without a lot of jockeying and this results in a saving of time. It is easy to see that the man working in Fig. 12 would have difficulty in the moving of one of the loaded skids in the background of the picture, where the aisle narrows down and even with the aisle as wide as that shown in Fig. 32, the man is operating in more or less cramped quarters. It must be remembered that plenty of aisle space can be allowed without waste of storage space, for the reason that the load can be piled higher at less expense.

Another item in favor of the hand lift truck system of transportation is the fact that when production requirements are low the empty skids can be stacked up out of the way, and, in this manner, from ten to twenty skids, require no more storage space than one ordinary hand truck. Thousands of industrial plants, warehouses, wholesalers and retailers are cramping their efforts, losing floor space and have more men than they need because of the lack of consideration of modern handling equipment. Most floor space is in the "high-rent" district which makes it requisite to reduce the amount of floor space to a minimum and utilize every square foot, both for trucking and storage. The use of a hand lift truck and skids generally increases storage capacity and permits free trucking and quick release of stock and materials in process. Also it is possible to handle the same amount of stock with about one fourth the number of hands required with other trucking systems, thereby ef-

(*Continued on page* 72)



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(*Continued from page 70*)

fecting a 75% reduction in labor costs. Moreover, the men are spared the strains incident to constant lifting of heavy weights by hand, which is the case when the goods are rehandled many times.

It takes but a very short study of the time required for moving materials in any plant, to see that by eliminating unnecessary piling and unpiling of merchandise a definite money savings results. The time consumed in loading and unloading—handling, where ordinary hand trucks are used, constitutes a major part of the so-called hauling costs. When we consider that incoming goods and materials, for instance, are often unloaded by hand from freight cars or trucks, and piled on the receiving platform, are then loaded onto platform trucks, or similar conveyances, hauled to the store-room and unloaded once more, we begin to see what handling means. Even after these operations the same materials passing through manufacturing operations are often loaded and unloaded by hand a dozen, or more times, in their progress from stockroom on to assembly. These goods are generally again placed in storage and when requisitioned for shipment are often loaded, hauled to the shipping department, unloaded, boxed or crated, loaded again and hauled to the shipping platform, to be placed in the freight car or to the waiting motor truck. It is this rehandling, ofttimes involving extensive trucking equipment, and always extremely wasteful in time and labor, that the hand lift truck and skid system greatly reduces.

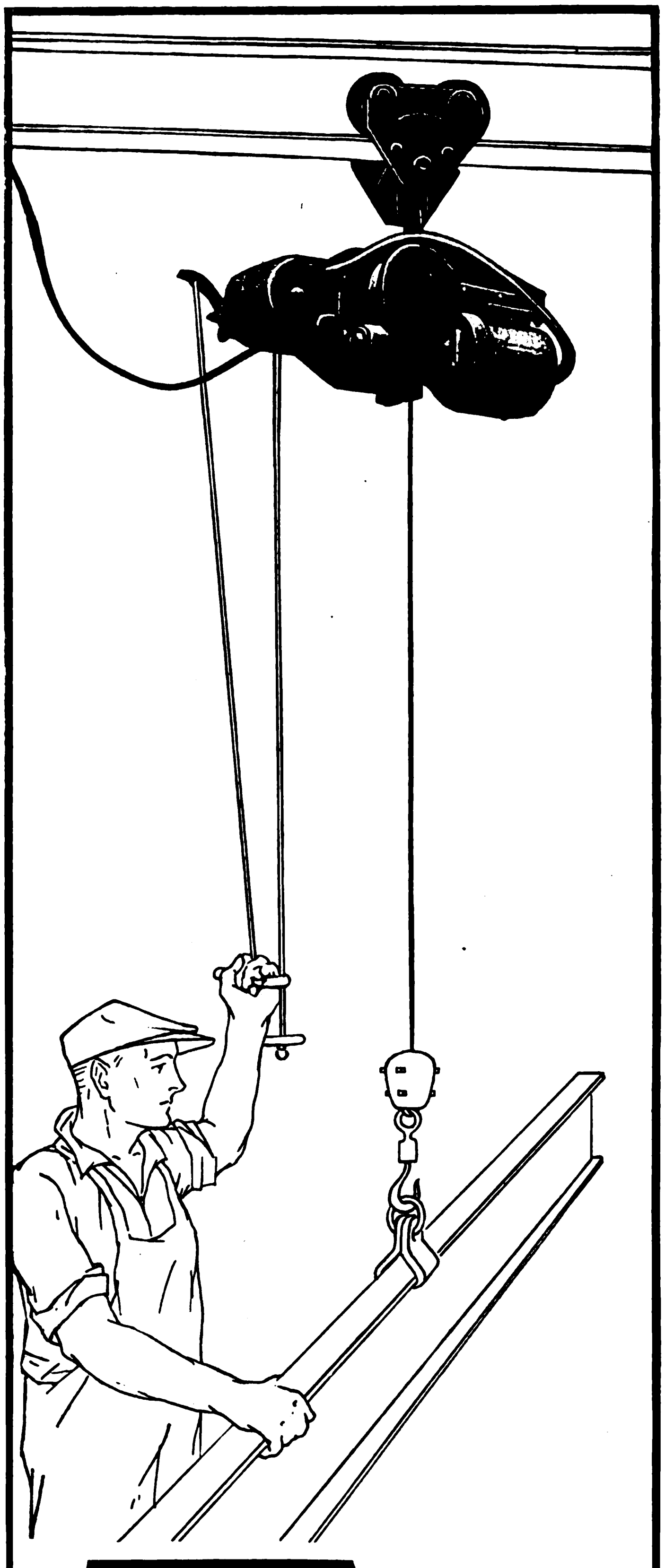
MANUFACTURERS in every American industry will be interested in the Exposition of Inventions to be held December 8th to 13th, inclusive, 1924, in the famous Engineering Societies Building, New York City. The American Institute of the City of New York is handling this display through its Inventors' Section, with behind it an experience of ninety-six years in fostering and portraying American industrial life.

A feature of the Exposition will be exhibits from the leading American industries showing developments of various machines, utilities and processing methods.

In this display of American inventions the American Institute will be continuing with a new emphasis almost a century's encouragement of inventors and introduction of their works to the public.

The American Institute also established the first permanent exhibit—an idea later adopted in various industries—where "machines, models, specimens and drawings" were displayed to the public. Great annual fairs of the Institute, begun in 1828 and held at such widely known places in their times as Niblo's Garden, Castle Garden, Crystal Palace, Palace Garden, the Academy of Music and Madison Square Garden, in New York City, portrayed year after year the advancements in agriculture, commerce, manufactures, science and the arts, until, with the expansion of the country's business in the last quarter century, the idea developed into the more famous world fairs and national and international industrial expositions under various auspices and managements.

Arrangements for the display of working models or actual devices at the Exposition of Inventions can be arranged through a Committee of the American Institute at 47 West 34th Street, New York City.



Combating Rust and Corrosion

(*Continued from page 26*)

erected, the proper shop and field coats were used to satisfy the surface. With a good rust-inhibitive coat applied next to the metal, followed by a high quality linseed-oil paint, the only requirement is a renewal of the surface with sufficient frequency to keep it in good condition. So many industrial processes, however, bring with them their train of destructive influences, that it is imperative that they be given very careful consideration and the proper treatment be given the surface to enable it to withstand these conditions a maximum length of time.

One of the most common conditions to be met is that of intense or excessive heat. Commonsense should teach one that a surface that becomes red hot cannot afford a very satisfactory foundation for a successful paint coat. Yet times without number, inquiries are received from companies wanting to know what might be recommended to successfully meet conditions of that kind. It simply can't be done! *You* would let go of such a surface, too. It is true that there are certain paint or varnish products that will withstand heat as high as 500° for a period of time; but eventually they will fall down and require renewal. Most industrial plants, except those having brick stacks, are constantly seeking metal protective paints for steel stacks to withstand relatively high degrees of heat. Coal tar and naphtha is frequently used for the purpose and gives fairly good results. It, however, must be frequently renewed. When once a product of this character is applied, it is necessary, unless it be entirely removed, to continue with its use. It has the tendency to bleed or show itself through the next coat, if it be of a different character. In stack painting the most important consideration is to see that the surface is dry and clean. Wash it down with a rag moistened with turpentine to remove all surface rust. Badly rusted spots should be wire brushed or cleaned out down to the bare metal. Immediately after washing apply the new coat. Every three or six months look it over, and if it begins to show the need of a new coat, do not delay, but give it immediate attention.

The presence of heat alone, unless it be excessive, is not sufficient to cause deterioration of the paint coat, if it be of a suitable character for the surface. The gases thrown off by heat, combined with condensation due to inequalities between the inside and outside temperature, are the factors which must be guarded against. They are the cause of rapid rusting and corrosion of metal roofs in many industrial plants. In fact even tile roofs, generally looked upon as the next thing to everlasting, are not immune to these destructive influences. Quite recently my attention was drawn to the experience of a large steel and iron foundry, part of whose buildings were roofed with galvanized iron and part with large slabs of tiling. In both cases, the inequalities of temperature, especially during the winter months, caused excess condensation, which, combined with sulphurous gas and soot, caused a dilute solution of sulphuric acid on the under surface. In this case the corrosion started within and worked through both the metal and the tile. This may be an extreme case, but it nevertheless illustrates the exceedingly destructive forces that are constantly at work on many metal surfaces of industrial

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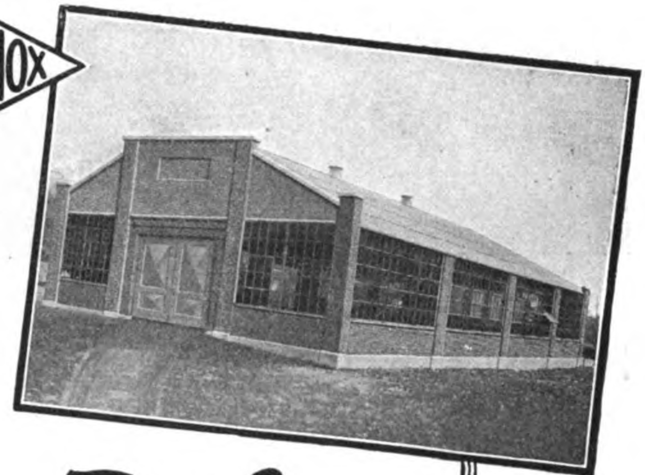

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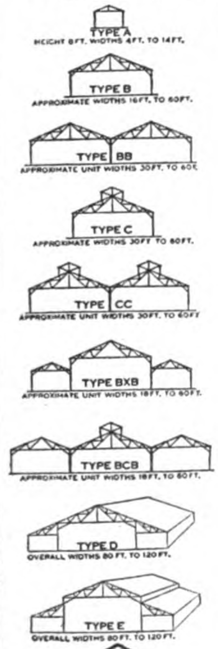

The pictures tell the story—how Blaw-Knox Better Buildings meet the different requirements of various industries.

One of these buildings is all steel construction, having Blaw-Knox leakless, rust-proof roof, galvanized copper-bearing steel walls and front, Blaw-Knox fabricated trusses, standard steel sash, doors, ventilators, etc.

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Quickly and easily erected.

Firesafe and weatherproof.

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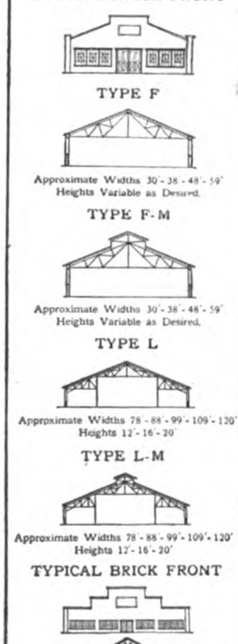

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(Continued from page 74)

plants. In reaching a solution of the roofing problem in this case, it was the writer's recommendation that galvanized iron be purchased, given a wash (as directed in a previous article) of copper acetate or copper sulphate and water; then a coat of a rust-inhibitive primer in which Basic Chromate of Lead is the main ingredient. Follow with two coats of white undercoat and a finishing coat of a well-known "Mill White," in the gloss finish. This would offer minimum contact for soot and sulphurous gas and withstand the conditions better than anything else that might be recommended. The outside surface of the roof to receive a finishing coat of a varnish-vehicle metal-protective paint, offering maximum resistance to escaping sulphurous or gaseous fumes. The white gloss finish was recommended for the interior even though it would not retain its whiteness indefinitely. It is the characteristic of all interior whites made with an oil or varnish vehicle to discolor or turn slightly yellow under contact with the conditions cited above. This discoloration, however, is of less consequence in a structure of this kind than it might be under other circumstances. The main point to be considered here is that of a smooth, readily-cleaned surface, one offering minimum lodgment to dust, soot, dirt and the like. Granted that it would not remain white long, the temporary advantage of whiteness when first applied, and subsequent ease of cleaning, makes its selection a satisfactory one.

Certain manufacturing processes cause conditions that are exceedingly difficult to meet as far as protection to metal surfaces is concerned. For instance, one could not expect a paint to give much service in contact with caustic soda, alkalies, or direct contact with acids. While certain paint compositions are "acid-resisting," there has yet to be found a formula for a paint or varnish that is "acid-proof." Certain iron-oxide and varnish combinations, or a high grade asphaltum or carbon and varnish mixtures give excellent results where any other product would entirely fail.

Where conditions of any kind out of the ordinary exist, it has been found that in most instances a metal-protective paint composed of more or less permanent pigments combined with a varnish vehicle will offer greater resistance than a linseed oil paint. Where high degrees of heat, extremes of moisture, acid or gaseous fumes exist,—then the varnish-vehicle paint is preferable. The most important consideration is to see that plenty of time is allowed between coats, so that each coat becomes thoroughly dry. These finishes do not dry with an absolutely hard-dry surface. They must still remain sufficiently elastic to expand and contract with the metal beneath without cracking or peeling. Furthermore, manufacturing processes should be delayed sufficiently long to permit of thorough drying the last coat. This will permit the film of paint to offer maximum resistance to the conditions it must meet in actual practice. Under certain circumstances it would be a profitable move to shut down operations long enough to permit surfaces to be painted a thorough drying out. It is worse than useless to apply paint to any surface containing moisture or dampness. Then allow sufficient time between coats for each coat to dry hard. By not attempting to rush the process, except where artificial heat of not too strong a degree is available, it is possible to accomplish a great deal in the fight against the corrosive action

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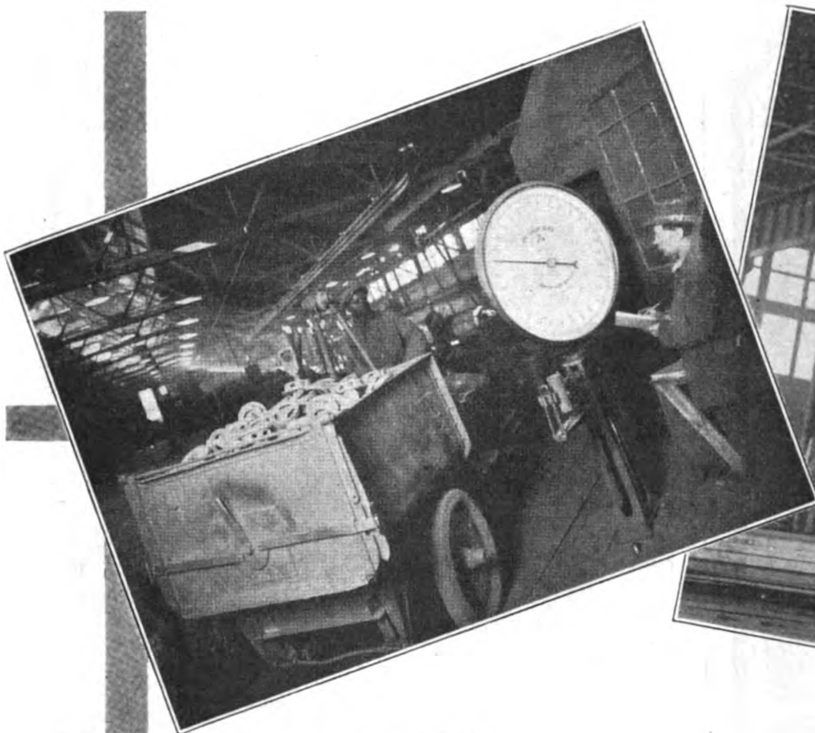

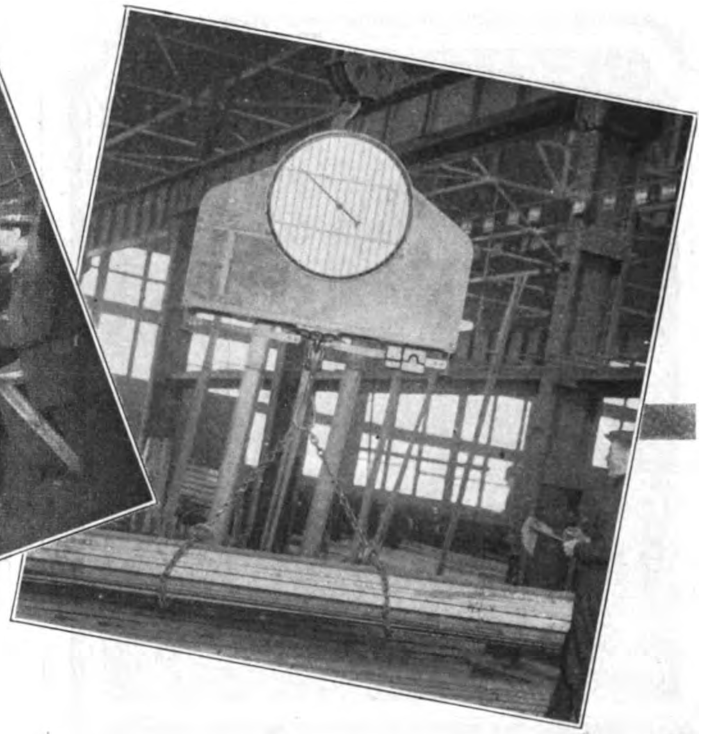

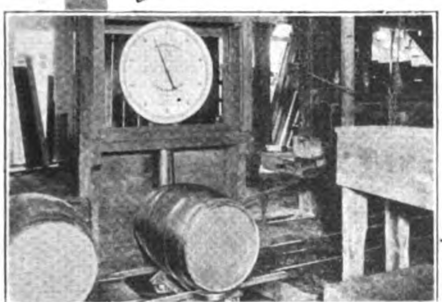

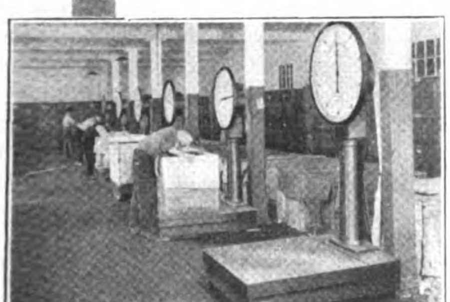

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KRON SCALES

(*Continued from page 76*)

of manufacturing processes on your plant and equipment.

In the construction of factory buildings, the structural steel work is invariably given a coat of red lead or of some good rust-inhibitive paint, by the company furnishing the steel work. This serves to protect the metal while in transit, and under erection. Frequently, however, during construction serious abrasions are made in the surface, offering a lodgment of the corrosion "germ." These must be watched for and given attention prior to the use of the finishing coat, if rust is to be overcome. Such spots should be thoroughly cleaned out with scrapers or wire brushes and touched up with the same kind of priming coat; then allowed to dry prior to the application of the field coat. For, should the field coat be of a graphite character, it might have a tendency to set up electrolysis at these points and actually *start* the corrosion instead of stopping it. Care should be taken also to see that all parts of the steel that come in contact with each other are well insulated with paint before riveting. Right at these joints are possibilities of serious weakness in the completed structure. Moisture and dampness may work its way into them and be the forerunner of trouble.

The field coat or finishing coat or coats may be of a number of compositions, either linseed oil, varnish-vehicle paints combined with iron oxides, graphite, carbon, etc. There are a wide range of paints for metal surfaces on the market, any one of which will ordinarily give good service. In buying paint, it must be remembered that one gets just about what one pays for. So that from the standpoint of the best protection offered the surface, the highest quality material is the cheapest in the long run. The manner of application has a great deal to do with the results secured. If applied with the brush, care should be taken to see that all parts of the surface are well covered. Frequently this is somewhat difficult to do where the structure is of an intricate character. Application by mechanical means is preferred in certain classes of work, due to the possibility of forcing the paint into joints, cracks and crevices that could not be reached by any other means. The growing use of the spray machine in maintenance work is a very important subject—but that is another story.

Tank Painting.

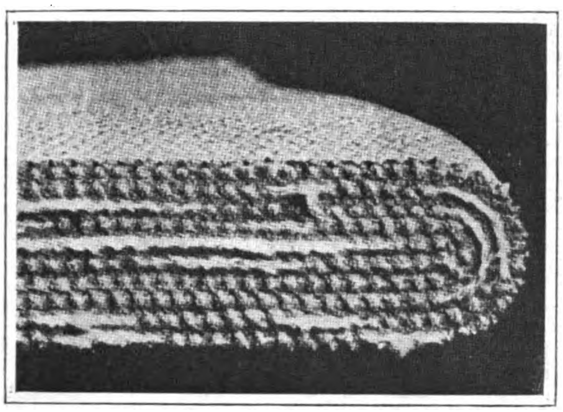
While the corrosion problem with respect to tanks is similar to that affecting other metal surfaces, they present in addition the question of interior temperatures. Particularly where highly volatile liquids are stored, it is imperative that the interior of the tank be kept at a minimum temperature. Otherwise there is apt to be considerable evaporation and increased danger of explosion. Then, too, the contents of the tanks frequently have a disastrous effect upon the wearing and protective qualities of the paints applied to them. This is especially true where tanks contain acids or other mixtures, which, coming frequently in direct contact with the surface, destroy the paint coat and cause accelerated corrosion.

The color of the paint used on the exterior of tanks containing highly volatile liquids is a very important consideration. Dark-colored paints absorb heat rays and cause the interior temperature of the tank to rise rapidly. Gloss finishes absorb less heat than flat paints, for

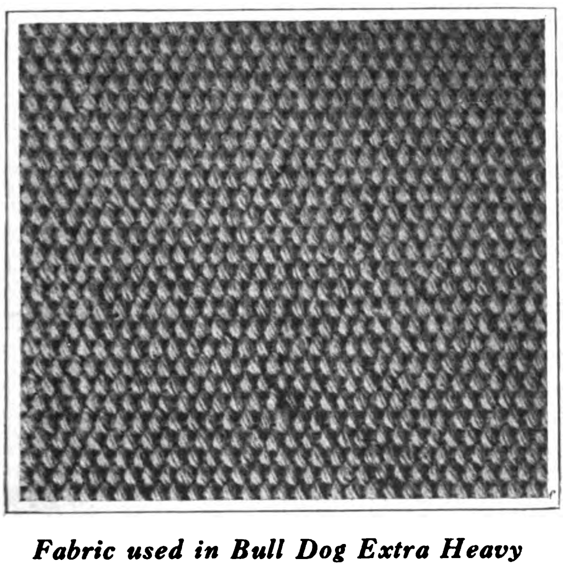
(*Continued on page 81*)

BRIEF TALKS ON RUBBER BELTING

Different Fabric Construction for Different Types of Drive



Bull Dog belt showing ply formation. Note the rugged type of construction thickness at every point.



Fabric used in Bull Dog Extra Heavy belt shown actual size.

THERE are two kinds of power impulse—a steady pull and a jerky or interrupted pull. A belt for a strong steady pull must have a straight warp formation to resist strain and avoid stretching, while a belt for a jerky pull must have a spring-like warp to allow for stretch and recovery.

Our Bull Dog belting whether regular or extra heavy is intended for a steady drive and heavy loads. The fabric for it is woven with a strong warp thread of hard twisted strands with a filler spaced to let the warp run nearly straight. Our Perfection belting on the other hand, has a spring-like construction of the warp threads which enables it to re-act after a jerky pull without permanent lengthening.

This spring-like construction enables the belt to run on a small pulley without too great stretching of the outer plies or too much cramping of those next the pulley surface. It gives the high flexibility required for a belt of this type.

No one kind or type of belting will serve all purposes with equal satisfaction so it is necessary to select intelligently the proper belt for maximum efficiency in accordance with the work to be done.

Use Bull Dog for hard drives and general service; Perfection for high speeds and small pulleys.

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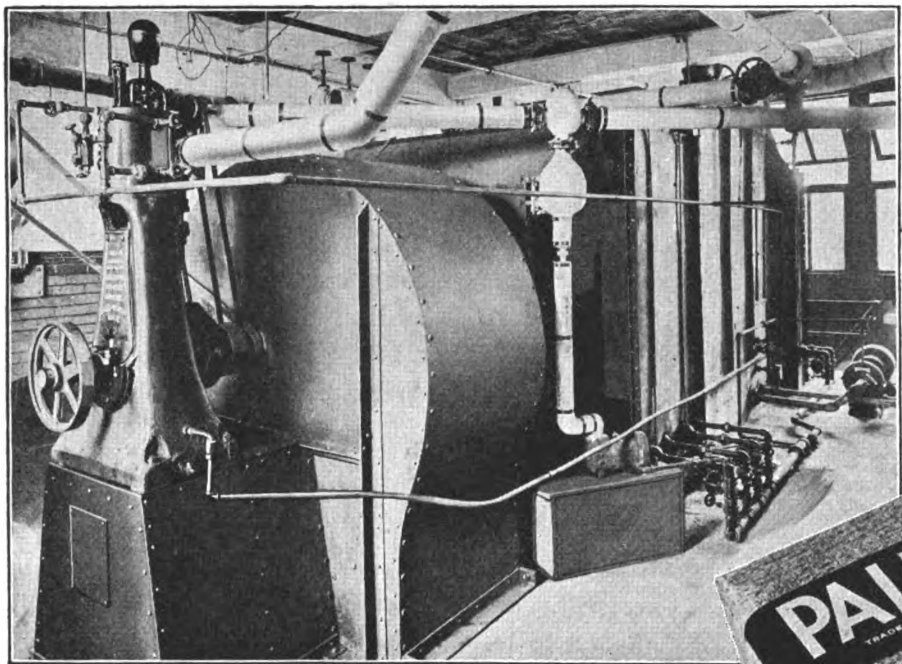

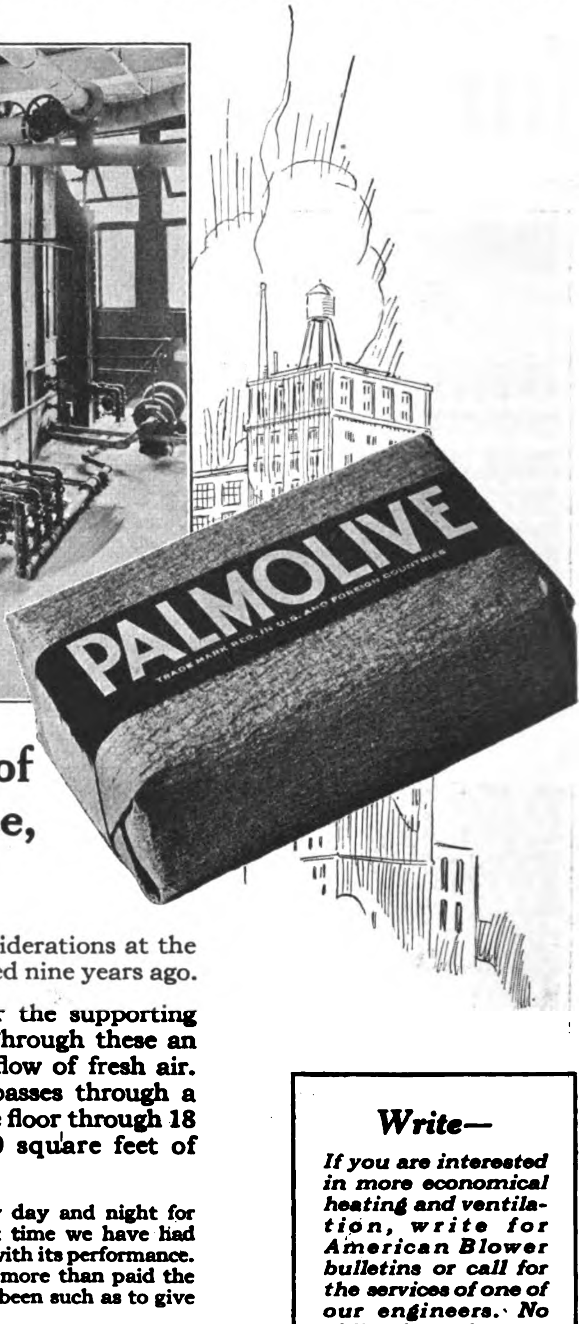

J. A. Schwenkes, Master Mechanic of The Palmolive Company, Milwaukee, Wis., says:

"The health of our office workers was one of our first considerations at the time we planned our new office building which was completed nine years ago.

"In order that they might have an abundance of pure air the supporting columns of the office floor were of hollow construction. Through these an American Blower 72" ventilator type fan keeps a steady flow of fresh air. The air is first thoroughly washed and then, in winter, passes through a series of steam coils which heat it after it reaches the office floor through 18 openings in the supporting columns. Altogether 13,000 square feet of floor space are ventilated in this manner.

"The American Blower fan, operated by steam, has run constantly day and night for nine years at an almost inconsiderable maintenance cost. During that time we have had no mechanical trouble with it in any way. We are more than satisfied with its performance. Keeping the workers from fatigue so attendant on foul, impure air has more than paid the cost of the installation. Our experience with the American Blower has been such as to give us the utmost confidence in it."

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

Write—

If you are interested in more economical heating and ventilation, write for American Blower bulletins or call for the services of one of our engineers. No obligation—but an opportunity to save money.

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American Blower

"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
Manufacturers of all Types of Air-Handling Equipment —— Since 1881

(*Continued from page 78*)

the reason that they reflect more of the light coming in contact with them. Dr. H. A. Gardner, Director of the Institute of Paint and Varnish Research, Washington, D. C., has conducted extensive experiments with various colored paints on small tanks containing benzine. The following table shows the variation in the rise of temperature between the different colors, all of the gloss finish, when subjected to the rays of a carbon arc light for 15 minutes:

	Rise in Degrees F.
Tin Plate	19.8
Aluminum Paint	20.5
White Paint	22.5
Light Cream Paint	23.0
Light Pink "	23.7
Light Blue "	24.3
Light Gray "	26.3
Light Green "	26.6
Red Iron Oxide Paint	29.7
Dark Prussian Blue Paint	36.7
Dark Chrome Green "	39.9
Black Paint	54.0

From the foregoing it will be readily seen that in addition to preserving the surface, the use of paint on the exterior of a metal tank serves an extremely important purpose. Many companies having to solve the problem of the proper storage of highly volatile liquids should profit by this experiment and see to it that the color of the paint used be given very careful thought. Wherever conditions permit, white or light shades should be used, even though it might be necessary to paint these surfaces more frequently than the remainder of the plant. The saving effected by less evaporation of the contents would more than pay for the slight added attention given these surfaces.

It will be noted that aluminum paint stands at the top of the list of paint products, as far as heat and light reflection is concerned. This product will give very satisfactory protection to an exterior metal surface, provided the liquid portion of the mixture is of the right character. For most durable results it should be a varnish made for exterior use. Most any aluminum mixture will serve well for an interior coat, but it would not resist rust and corrosion very long outside. But whether used inside or outside, aluminum finishes have the property of reducing heat emissivity, and for that reason should not be used on radiation in factory buildings or offices, if maximum results are desired from the heating system. The Bureau of Standards, Washington, D. C., in their Technologic Paper No. 254, states,—"aluminum and copper bronze coverings . . . diminished the heat dissipated by 17 to 20% below that of non-metallic paints. Merely covering the aluminum paint with a coat of terra-cotta enamel increased the heat dissipated by about 28%." They further state that "it is unnecessary to remove the old coat of aluminum paint before applying the coat of non-metallic paint. This is owing to the fact that the aluminum paint, which has a high thermal conductivity, becomes simply part of the metal wall of the radiator."

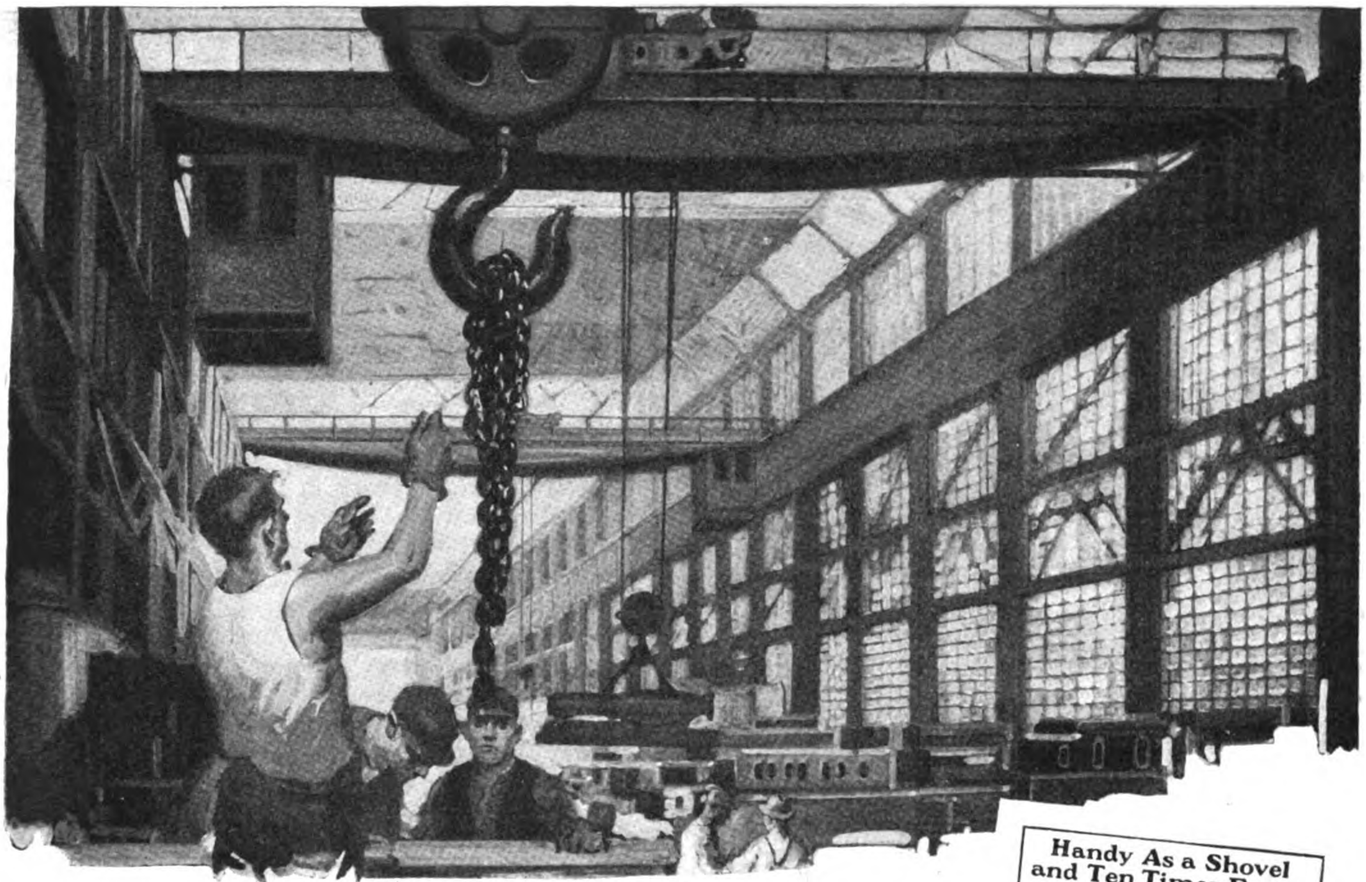
Permit me to suggest, therefore, that any company that desires to increase the efficiency of its heating system, either in plant or office and who has been painting the radiation with aluminum paint, can readily obtain the desired result by applying *over* the aluminum a coat of most any other kind of paint, just so that it does not contain flakes of metal. Flat wall paints, enamels, floor paints or ordinary linseed oil paints may be successfully used for this purpose, with every assurance of adhering to the surface and giving satisfactory results.

Aluminum paints also serve a very excellent purpose by acting as a sealer over any finish that has a tendency to "bleed" through subsequent paint coats. Certain grades of asphaltum, if applied to a metal surface, almost compel their continued use, due to the disfigurement and unsightly appearance that results if other paints are applied over them. This objection will be overcome, however, by the use of one coat of aluminum paint applied to the surface and permitted to dry. Then proceed with the paint, as selected for the finishing coat, and no further trouble will result.

The Boiler Room.—The use of the automatic stoker or the oil burning system in the boiler room makes it possible to keep this part of the plant in a much more presentable condition than formerly was the case. Even in those plants where stoking is done by hand, a great improvement may be effected by the use of certain finishes and a little time and attention given to their frequent replacement. Here is a room where the use of aluminum paint on the boiler front serves a distinctly useful purpose. It keeps down heat radiation and makes the atmosphere much more comfortable. A certain plant now burning oil has adopted this idea, together with a high grade white enamel for other portions of the room. The effect is very unusual and exceedingly attractive. Everything is kept spick and span and the chief engineer takes great pride in keeping the room in that shape. Woe betide the man that forgets himself and disfigures the surface.

In conclusion, many industrial plants having maintenance problems to consider would do well to take the paint and varnish manufacturer into their confidence. Frequently suggestions and ideas can be given that would do a great deal toward arresting rust, corrosion and decay with consequent replacement of expensive parts, all of which might have been prevented by the use of a little paint or varnish of the *right* type.

INCREASED international competition implies a large increase in the volume of production, as well as in its types and forms, but it is only under such stress of competition that progress in efficiency and economy has best been made. In all likelihood, we shall readily readjust our producing and trading methods and processes to meet changing conditions as they come, including, perhaps, such basic matters as our attitude toward protective tariffs. Adaptability to changing conditions has always been an outstanding American characteristic. Whatever the emergency that may arise, there can be no doubt of our ability to meet it on the way.—*La Salle Extension University Business Bulletin.*



No Production Delays with P&H Cranes

Foundry men with long years of experience—know that the dependability, ruggedness, and quality are built into P & H Cranes for a purpose—because of the big part that reliable material handling plays in profitable production.

The P & H provides low-cost crane operating service over a long period of years. Extreme care is used in selection of material, extra time is taken to test and know that every piece is according to our rigid requirements.

This thoroughness, experience gained in building over 7300 cranes and hoists, standardization, and our renewal-from-stock service, are all factors in giving you dependable crane service every day in the year.

Crane and Hoist Division

Pawling & Harnischfeger Co.

Established in 1884

3850 National Avenue, Milwaukee, Wis.

Offices and Agents in Principal Cities

P&H CRANES and HOISTS

Aerial Transportation

(*Continued from page 27*)

Colonel Vincent may be romantic, but if so, he doesn't reveal the fact in talking of the future of aerial transportation. He is a flier, but when it comes to discussing the immediate future of flying machines, he believes in "keeping his feet on the ground."

To be sure, he expects rapid development within the next few years. He not only expects it, he is contributing to it.

"We may confidently look forward to transcontinental air travel in the next ten years," he says. "There will be planes for private use, too, planes that very likely will compare favorably with the motor car in carrying capacity, durability, economy, and safety and that will, of course, excel the motor car in speed. There is every reason to believe that development will be rapid, but there are equally good reasons to believe that this development will be along the usual lines of slow, painstaking endeavor rather than as a result of any spectacular discovery or invention. The main thing right now is to avoid a reaction from the intense activity of 1917-18 and to contribute all we possibly can toward the furtherance of sensible experimentation and experience.

"We can't expect a great deal of help from the government, because this country is not and never will be a militaristic power, nor is it accustomed to grant subsidies to any industry, as are some of the European governments. The different departments are doing all they can, however, and the work of the army, navy, and post office departments is going to be very helpful. America will never build large fleets of aeroplanes for the army or navy, though, and our chief hope for development in this country must lie in the commercial field. We must make commercial aviation sufficiently profitable to encourage experimentation and development.

"The principles underlying the construction of satisfactory planes are already thoroughly understood and will require but little development to apply them practically—so little, in fact, that we may expect immense development in a short time, if we only give our attention to them.

"Immediate future development will center around plane structure rather than the engine. We are already second to none in the perfection of aerial power plants, except, possibly, in air-cooled fixed radials. Our engines are light, powerful, durable, fireproof, trustworthy, and economical. Our great opportunity just now lies in the plane structure; in reducing head resistance by the use of metals, enclosing framework in the wings, using new materials as wing coverings, and so on. The Germans are able to get speed and carrying capacity with smaller engines than ours, because they have perfected plane structure to a greater extent than we have. We must not continue to lag behind in this phase of progress.

"Developments of the next few years will be along two lines. First, there will be the large-capacity machines operating on regular schedule between the larger cities, and later between smaller ones as well, just as trains now do. Such aircraft will doubtless cross the ocean and will replace steamships to a certain extent.

"Second, there will be the smaller and faster craft for mail, rapid transit, and private use. Such machines will accommodate anywhere from one to 40 or 50 people

(*Continued on page 86*)

(*Continued from page* 84)

and will travel at a speed ranging from 100 to possibly 200 or 300 miles an hour.

The first class mentioned will be the dirigible. Development of power plants and control systems already have made craft of this type safe against ordinary storms and it will not be difficult to provide enough landing places to make them quite safe. Indicative of the tendencies along this line is the fact that a mooring mast will be erected on an Aviation Country Club building that is now in course of construction in the downtown district of Detroit. We are now at a stage in the development of lighter-than-air machines where just a little more will make them quite practical for regular and economical transportation of large numbers of people.

"The heavier-than-air machine is at present limited by our incomplete knowledge of plane structure. In any type yet devised, there comes a point where the increased weight of the plane must be out of all proportion to its increased carrying capacity and until this handicap is overcome, aeroplanes cannot exceed a very limited capacity. At present, this capacity is limited to about 40 or 50 persons, but we may expect to see planes carrying this number economically in a short time.

"Development of small planes along the lines of the automobile is a comparatively simple matter. We are already assured of a speed of around 200 miles an hour with a plane of small capacity. My opinion is that planes for private use will have about the same capacity as a touring car and will operate quite as economically. We already have planes that will carry six passengers at a speed of 100 miles an hour and make ten miles to the gallon of gas, and this is more than any automobile of equal capacity will make if driven at the same speed.

"The initial cost of an aeroplane is beyond the reach of the average person, but standardization and quantity production will soon reduce this to a point where a plane will cost little if any more than an automobile and will bring the aeroplane into common use for time saving and ordinary transportation. Planes already are quite as durable as the automobile, being capable of flying 500 to 1,000 hours, which means traveling 25,000 to 50,000 miles. The army world fliers changed engines in England, but they did so merely as a precaution and not because their engines were worn out. Their engines would have brought them on across the Atlantic and to their starting point, but they might have needed some repairs and overhauling. Remember, too, that these were Liberty engines and there are better engines to be had now.

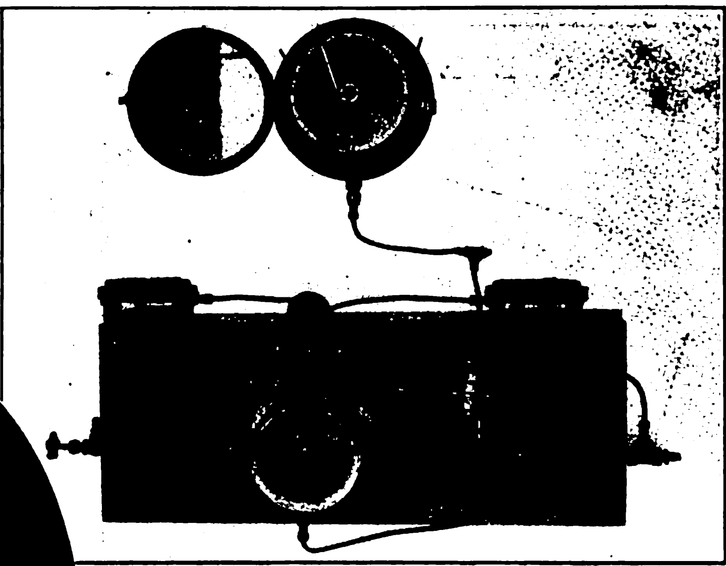
"Landing fields must, of course, be provided, but these are multiplying rapidly throughout the country. No statistics for the United States are available, but a recent survey revealed that there are 117 in Michigan alone.

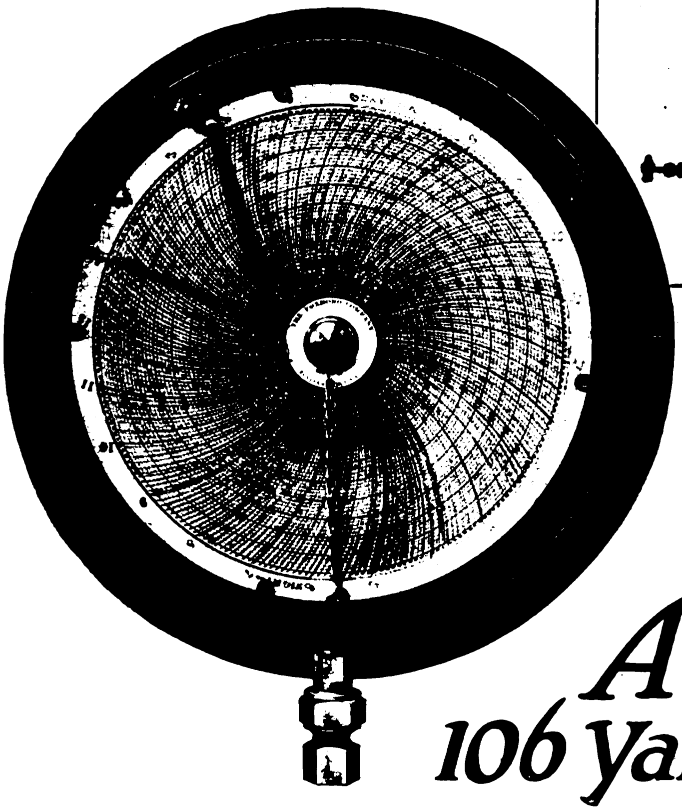
"The advantages of aerial transportation, from an economic standpoint, are obvious and should be sufficiently great to attract unlimited capital for its development. Think of the hundreds of millions of dollars that are required to build a railroad before a single passenger or pound of freight can be transported over it, or of the other hundreds of millions that we are investing in highways for the automobile. No rails or road are required for air travel, thus eliminating a tremendous initial investment and later maintenance cost. Not only so, but there is a new level of transportation every few hundred

(*Continued on page* 89)

THE TEST

An 8-inch Foxboro Recording Pressure Gauge taken from stock, range 0 to 100 lbs. per sq. in., is connected between two motor valves operated by a pressure-time control mechanism which operates the valves alternately causing the pressure to rise from 0 to 100 lbs. per sq. in. and fall to 0 again in a definite cycle. The Foxboro Improved Helical Tube Movement produced a perfect record of these hundreds of extreme pressure changes and shows no sign of fatigue or "set" at the conclusion of the test.





A Record!
106 Yards In 24 Hours

This was the record pen-travel of the 8-inch Foxboro Recording Pressure Gauge photographed above. From 0 to 100 lbs. pressure per sq. in. (maximum range) and back 240 times—480 distinct movements or a total distance of 106 2/3 yards in 24 hours.

Ordinary gauges could have stood but a few hours of such treatment.

This test proves conclusively that the Foxboro Improved Helical Tube Movement is permanent in calibration. It does not weaken under the most severe service.

Your recording pressure gauges may never meet such a drastic test. But the ability to produce accurate records during long years of hard service calls for a standard of strength and resiliency found only in Foxboro Pressure Gauges and Thermometers. Foxboro temperature, pressure and humidity instruments are of the highest quality and are worthy of your confidence. For complete information write for Bulletin A 98-2.

THE FOXBORO CO., Inc.
Neponset Avenue, Foxboro, Mass., U. S. A.

New York Chicago Boston Philadelphia Pittsburgh Cleveland Rochester
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Peacock Brothers, Limited, 179 Delorimier Avenue, Montreal, Canada

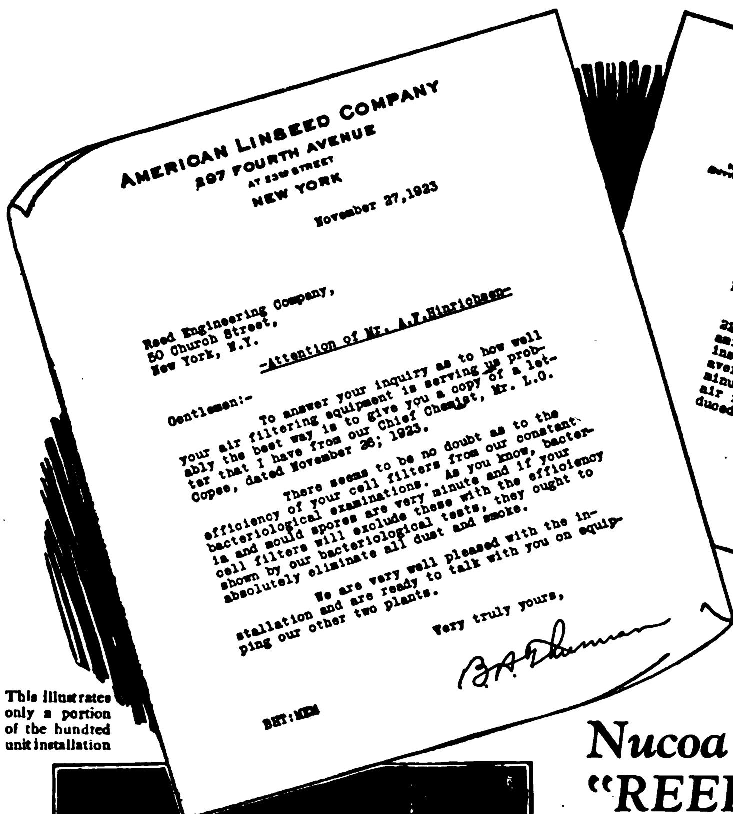
FOXBORO

REG. U. S. PAT. OFF.

THE COMPASS OF INDUSTRY

6867

REED AIR *IS* CLEAN AIR



AMERICAN LINSEED COMPANY
207 FOURTH AVENUE
AT 23RD STREET
NEW YORK

November 27,1923

Reed Engineering Company,
50 Church Street,
New York, N.Y.

-Attention of Mr. A.F.Hinrichsen-

Gentlemen:-

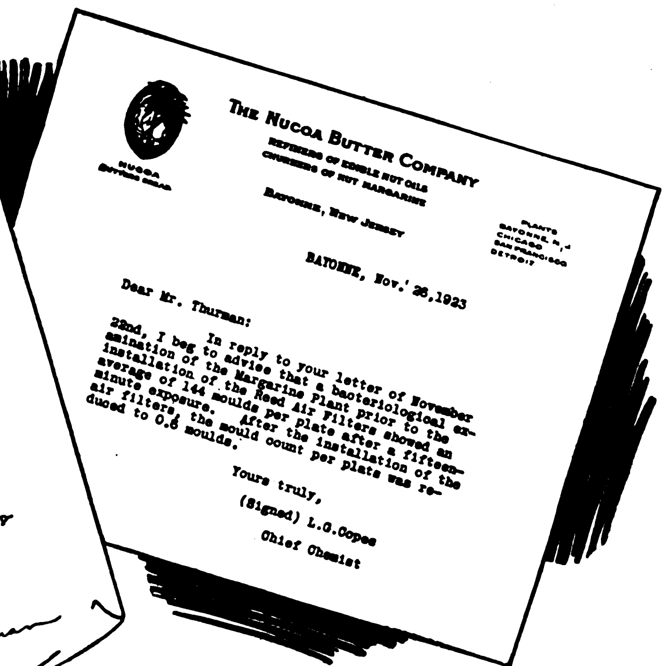
To answer your inquiry as to how well your air filtering equipment is serving us probably the best way is to give you a copy of a letter that I have from our Chief Chemist, Mr. L.G. Copes, dated November 26, 1923.

There seems to be no doubt as to the efficiency of your cell filters from our constant bacteriological examinations. As you know, bacteria and mould spores are very minute and if your cell filters will exclude these with the efficiency shown by our bacteriological tests, they ought to absolutely eliminate all dust and smoke.

We are very well pleased with the installation and are ready to talk with you on equipping our other two plants.

Very truly yours,

BHT:MEM



THE NUCOA BUTTER COMPANY
REFINERS OF EDIBLE NUT OILS
CHURNERS OF NUT MARGARINE
BAYONNE, NEW JERSEY

PLANTS
BAYONNE, N.J.
CHICAGO
SAN FRANCISCO
DETROIT

BAYONNE, Nov. 26,1923

Dear Mr. Thurman:

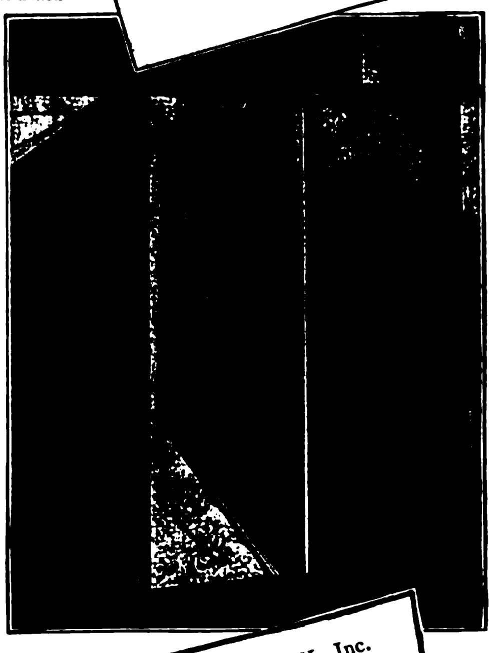
In reply to your letter of November 22nd, I beg to advise that a bacteriological examination of the Margarine Plant prior to the installation of the Reed Air Filters showed an average of 144 moulds per plate after a fifteen-minute exposure. After the installation of the air filters, the mould count per plate was reduced to 0.6 moulds.

Yours truly,

(Signed) L.G.Copes

Chief Chemist

This illustrates only a portion of the hundred unit installation



Nucoa Butter Co's Tests Show "REED AIR—99.6% Clean"

The Nucoa Butter Co. had more than a dust problem—bacteria and mold spores had to be eliminated from the air to insure the highest quality of product.

Reed Air Filters were installed and bacterialogical tests now show the air in their plant to be free from dust, dirt and bacteria—99.6% clean.

Reed Air Filters are being used by many of the largest industrials. Repeat orders total more than 7,000,000 C.F.M.—evidence of satisfactory service.

If you have a dust problem our Engineering Department is at your service without cost or obligation.

REED AIR FILTER COMPANY, Inc.
211 Central Ave., Louisville, Ky. 50 Church St., New York
Offices in principal cities

REED AIR FILTER COMPANY, Inc.
Engineering Department
211 Central Avenue, Louisville, Ky.

Gentlemen: Please send me without obligation your informative folder, "Are You Interested in Clean Air?"

Application..C.F.M.

....

Name..

Address...

Note: SIGN ON THE "REED AIR" DOTTED LINE............FOR CLEAN AIR AT MINIMUM COST

(*Continued from page 86*)

feet in the air, making congestion forever impossible. The railroads and highways have been taxed just about to capacity; we'll soon have to take to the air in order to find room.

"If we make only as much improvement in the next ten years as we have made in the past decade, aerial transportation will be definitely established on a sound commercial basis. During the past ten years speed has been increased from 100 to 270 miles an hour, the non-stop flight has been lengthened from 24 to 37 hours, the altitude record has been set above 36,000 feet instead of 20,000, the horsepower of aerial motors has been increased from 200 to 1,000, weight per horsepower has been materially reduced, and carrying capacity has been greatly increased. At the same time, many remarkable flights have been made and planes have been put to practical use such as carrying mail, patrolling large areas of territory, and carrying passengers on limited flights.

"Development of the dirigible has not been so pronounced, due to the fact that little effort has yet been made to put craft of this type to commercial use. The chief improvements have been made in the engines, the control system, and mooring masts, while the length has been increased from 500 to 750 feet. Various projects for commercial development of the dirigible are broached from time to time, however, and it is to be expected that something definite along this line will be done in the near future."

"Will the aeroplane replace the automobile?" Colonel Vincent was asked.

"No, it will merely supplement the automobile. No means of transportation once developed is ever entirely discarded. Many individuals will doubtless own both automobiles and planes, while others will find one or the other best suited to their personal use."

"Will the development of aerial transportation greatly affect rail and ocean travel?"

"It will affect rail and ocean travel considerably, yes, but will probably have little effect on freight transportation, at least for some time."

"It has been suggested that huge air liners will sail around the world without stopping, that they will remain in the air for months or even indefinitely, that heavier-than-air machines will light on the liners for the purpose of discharging and taking off passengers and discharging provisions and supplies, while the liners keep on going. What do you think of the possibility of such development?"

"If an aeroplane should light on a dirigible as it is at present balanced, it would sink the airship. Some development that will make such a scheme feasible may, of course, be made, but just at present, it sounds very impractical. Aeroplanes have been re-fueled while in flight and some plan may be worked out whereby dirigibles can be kept in the air for long periods of time, but it is doubtful whether such a plan will provide for aeroplanes lighting on the ship."

"What can the general public do to hasten development of aerial transportation?"

"Use the air mail, for one thing. The practical, day-to-day (and night-to-night) use of aeroplanes in the mail service is going to prove a very important factor in working out some of the problems that confront us, as well as in establishing aerial transportation as a safe, speedy, practical, and reasonably economical means of travel and communication. It may lead to carrying light parcels and even passengers before long. At any rate, it is teaching us a great deal about air routes, night flying, meeting weather conditions, schedules, durability of planes and motors, and other important problems. In the meantime, it is accustoming us to the thought of practical air travel and transportation and is keeping a number of fliers in training. The air mail service should be extended and the only way to have it extended is for all of us to encourage it in every way we can.

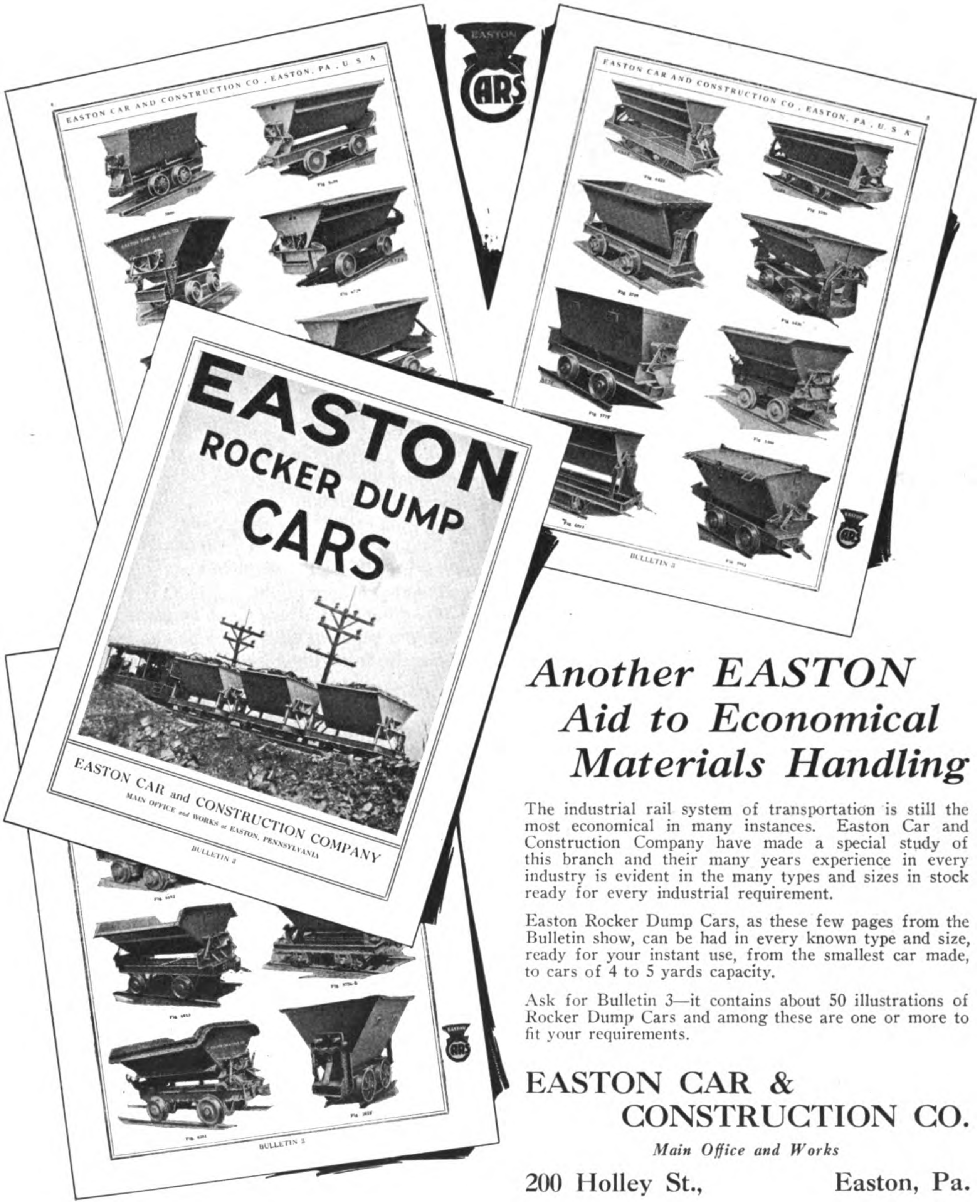
"Commercial aviation should be made profitable for the purpose of encouraging experimentation and development. The individual layman who takes an air trip from here to Cleveland, New York to Atlantic City, Miami to the West Indies, or elsewhere, is doing something to encourage commercial aviation and make it profitable. Those who employ an aerial photographer or ship some rush order by air are contributing to the cause, and so on.

"Some who are able to do so will encourage development by taking stock in companies that are carrying out experiments. It is not for me to say whether they will realize any returns on their investment, so far as cash dividends are concerned, but they certainly are hastening the time when aerial transportation will be practical and economical.

"Keeping up interest in the subject is also helpful. When the public demands aerial transportation as a necessity, we will not be long in perfecting it. Such a demand, I believe, is rapidly taking form and I confidently expect immense development in the next few years, although, as I have already said, this development will come gradually and in the usual way, rather than as a result of any one startling discovery."

OF late, we have had many prophecies of the future based on passing "barometers" and equally transitory statistics. But never until now were we far enough along the road to readjustment to realize that our progress depends upon certain slow-but-sure acting economic laws. Gradually events have brought about the opportunity for coördination and equalization of prices of the different classes of commodities—and, at the same time, have offered the ways and means that promise to lead ultimately to the rehabilitation of Europe. It was no mere chance nor fortuitous concourse of events that the opportunity to solve those two fundamental problems came at the same time and that we now have put into our hands the possibility of still greater accomplishments and expansions in the future than we have ever known before. The real basis for permanent improvement inevitably had to come in the process of that evolution which marks every phase of human existence, and which certainly has not spent its force, nor reached the apex of its achievements.—*La Salle Extension University Business Bulletin.*

ROCKER DUMP CARS



Another EASTON Aid to Economical Materials Handling

The industrial rail system of transportation is still the most economical in many instances. Easton Car and Construction Company have made a special study of this branch and their many years experience in every industry is evident in the many types and sizes in stock ready for every industrial requirement.

Easton Rocker Dump Cars, as these few pages from the Bulletin show, can be had in every known type and size, ready for your instant use, from the smallest car made, to cars of 4 to 5 yards capacity.

Ask for Bulletin 3—it contains about 50 illustrations of Rocker Dump Cars and among these are one or more to fit your requirements.

EASTON CAR & CONSTRUCTION CO.

Main Office and Works

200 Holley St., Easton, Pa.

EASTON CARS

FOR EVERY INDUSTRIAL PURPOSE

Is Your Factory Location an Asset or a Liability?

(Continued from page 17)

The American Can Company completely and magnificently covers the country with tin can plants. Its avowed aim is "to be at every market for tin cans, to cut freight costs, to give service." The markets are everywhere, for everything from fruit to paints uses cans.

Markets may be a bugaboo, however. Magazine printers often think they must be where editors can run over every hour and edit proofs. Yet the Rumford Press up at Concord, N. H., prints thirty magazines, among the best, without any kicks, and increases its business. This capital city has a fine printing atmosphere and skilled and steady labor. Woolen mills are clustered in New England, the business market for all things wool. Clear across the country the Oregon City Woolen Mills produces fine products with the aid of nearby wool flocks and excellent waterpower. Good goods and national advertising do the rest.

Labor moves as many industries as does the need for markets, and more. The labor problem is tied up with the Right Town problem and will be discussed with that.

The third factor, materials, is always important, and takes in much of transportation where supplies are heavy or perishable. A very good example of the two is the new and mammoth lumber manufacturing plant of the Long-Bell Lumber Company at Longview, Wash., a town of 5,000 population built to order by the company. This is the largest lumber plant in the country, the most modern, and probably the best located from all standpoints.

The Chevrolet Motor Car Company of General Motors located a plant at Buffalo to get its bodies quickly and efficiently from the Fisher Body Company plant there. A well-known New York printer will soon locate in the woods and waterpower of Eastern Tennessee a large printing plant, in order to make his own paper very cheaply and print low-price books and pamphlets by the million at a profit.

Power and fuel, the fourth factor, is quite important to the electro-chemical industries. We find them clustered around Niagara Falls in this country and the Shawinigan Falls in Canada. One of them is very much interested in getting a foothold at Muscle Shoals, which will provide enormous power. Ford thinks well of waterpower, and has established a plant near Troy, N. Y., run by the river. He also is an admirer of the Shoals Colossus. The Aluminum Company of America is completing an extraordinary waterpower development in Tennessee. The glass industry, using natural gas as fuel, is locating in West Virginia as gas gives out in Pennsylvania, although there still is much left there.

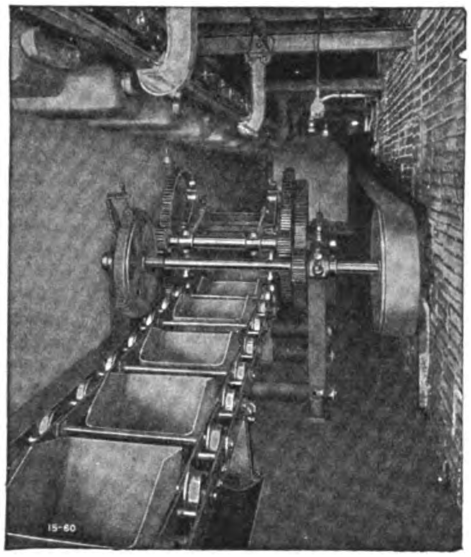
The rise of the industrial South is partly due to interconnection of hydro-electric power companies, making the precious juice available steadily in all sections, regardless of drought in any.

One of the reasons why the great Dunlop Rubber plant was located in Buffalo was the cheap electric power of Niagara, as well as proximity by rail and water to coal fields and natural gas. California's industrial rise has been helped immensely by her hydro-electric superpower system and fuel oil supply.

The labor problem is the leading one in our indus-

(Continued on page 96)

A Bold and Significant Prediction



The above illustration shows a Hunt Pivoted Bucket Conveyor handling coal in the power plant of a large manufacturing concern in New York City. An especial feature is the twist of about 30 degrees on the vertical run; made possible only by a pawl-driven chain of which the Hunt is the only type existent. This equipment has been in operation many years and continues to give excellent service.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

"Nearly three years ago,"—says an editorial in the August issue of this journal—"our editors made a very bold and significant prediction. It was as follows:

The biggest cost savings of today and tomorrow will come from moving rather than from making."

The editorial applies to the mechanical handling of raw and manufactured products, but it is also applicable to the mechanical handling of coal and ashes and similar bulk material.

For it is the unit cost of manufacture that determines the cost of the finished product; and it is but right that the movement of coal and the resultant ashes, should be taken into consideration in fixing the cost of production.

This operation can be made excessively costly by the continuance of apparatus for this purpose that should have, long ago, reposed in the scrap heap; which add unnecessary cost burdens by frequent repairs, often resulting in loss of time and expensive shut-downs. Inadequate machinery has a somewhat similar effect.

Therefore, to obtain the most favorable results and to reduce production costs, coal and ash handling apparatus should be of such character as to preclude the possibility of break-down, and render efficient and economical service over a long period of years.

For over half-a-century Hunt Cost Cutting Equipment has been noted for its ruggedness and reliability; handling coal, ashes and similar bulk material less expensively, less laboriously and with the greatest expedition and safety. Hunt Engineers with their half century experience will gladly help plan a suitable coal and ash handling system.

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc.,
431 South Dearborn St., Chicago, Ill.

ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.

It isn't the man so much as his pencil —but Calculagraph checks up on both!

WHEN you buy labor at so much per hour or per day, you buy something more than a given amount of training, skill and effort. Nine times out of ten, you buy also an uncertain amount of human nature! Does it pay to take the behavior of your workmen for granted?

Every factory executive asks this question, and most often decides, "Yes, my men are honest!" They are honest—yes, but negligence creeps into the actions of the truest men. And it is most apt to creep in at the close of the working day when time records are being made out by the old-fashioned method of card and pencil.

It isn't the man you have to watch so much as his pencil—and his pencil often slices away your plant profit. Calculagraph keeps a sharp eye on both man and pencil. Calculagraph does away with the pencil by ***printing the exact total of the time elapsed,*** recording the beginning and ending of each job. Calculagraph brings you a modern form of protection that is economical and indispensable.

Our Booklet, "Elapsed Time Records," Contains Interesting Data on Time-keeping Problems. Free on Request!

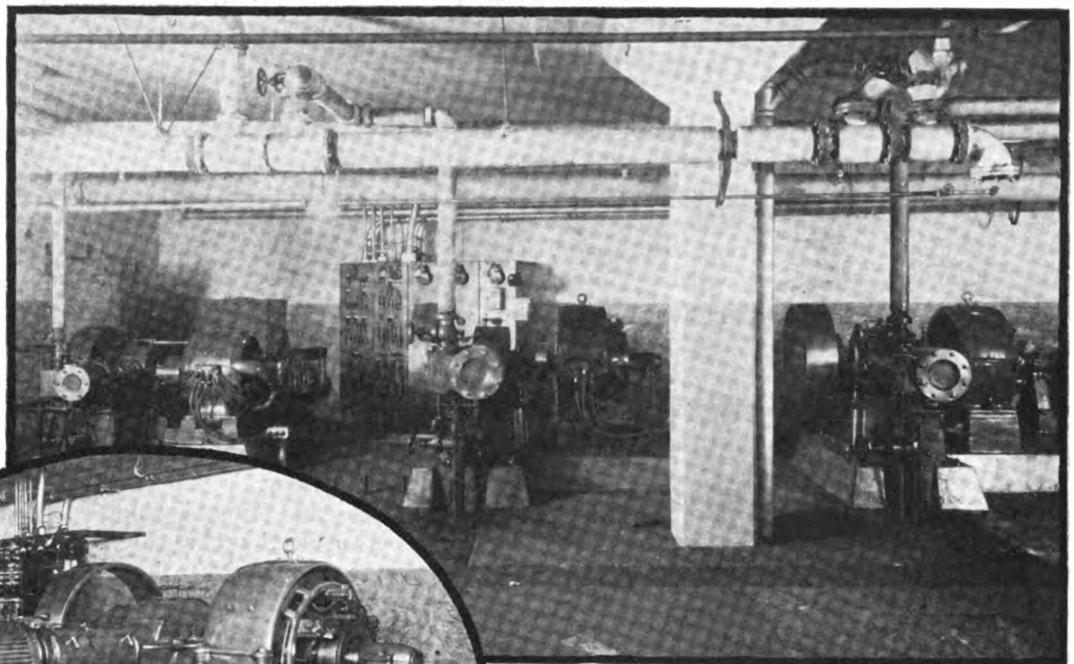
The Calculagraph Company

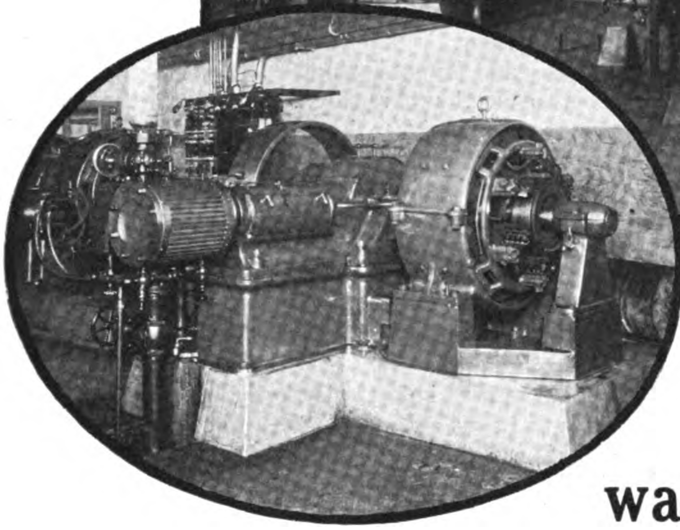
34 Church Street New York

THE

CALCULAGRAPH

THE ELAPSED TIME RECORDER





(*Continued from page 92*)

trial civilization, dealing as it does with the aspirations of the majority in industry. The solution is not high wages alone, for in the high wage trades we find the fiercest conflicts. It is rather in conditions that enable both workers and employers to act as human beings both inside and outside the factory, and to get acquainted with each other in both places. To act as human beings is to feel friendly toward each other, to serve each other, to build a home, to raise a family and have education and recreation for one's children, and to take pride in a common citizenship and social responsibility. The Right Town produces that condition. The Wrong Town has slums for labor, and palaces on the hill for capital. The right town takes thought for its housing and recreation.

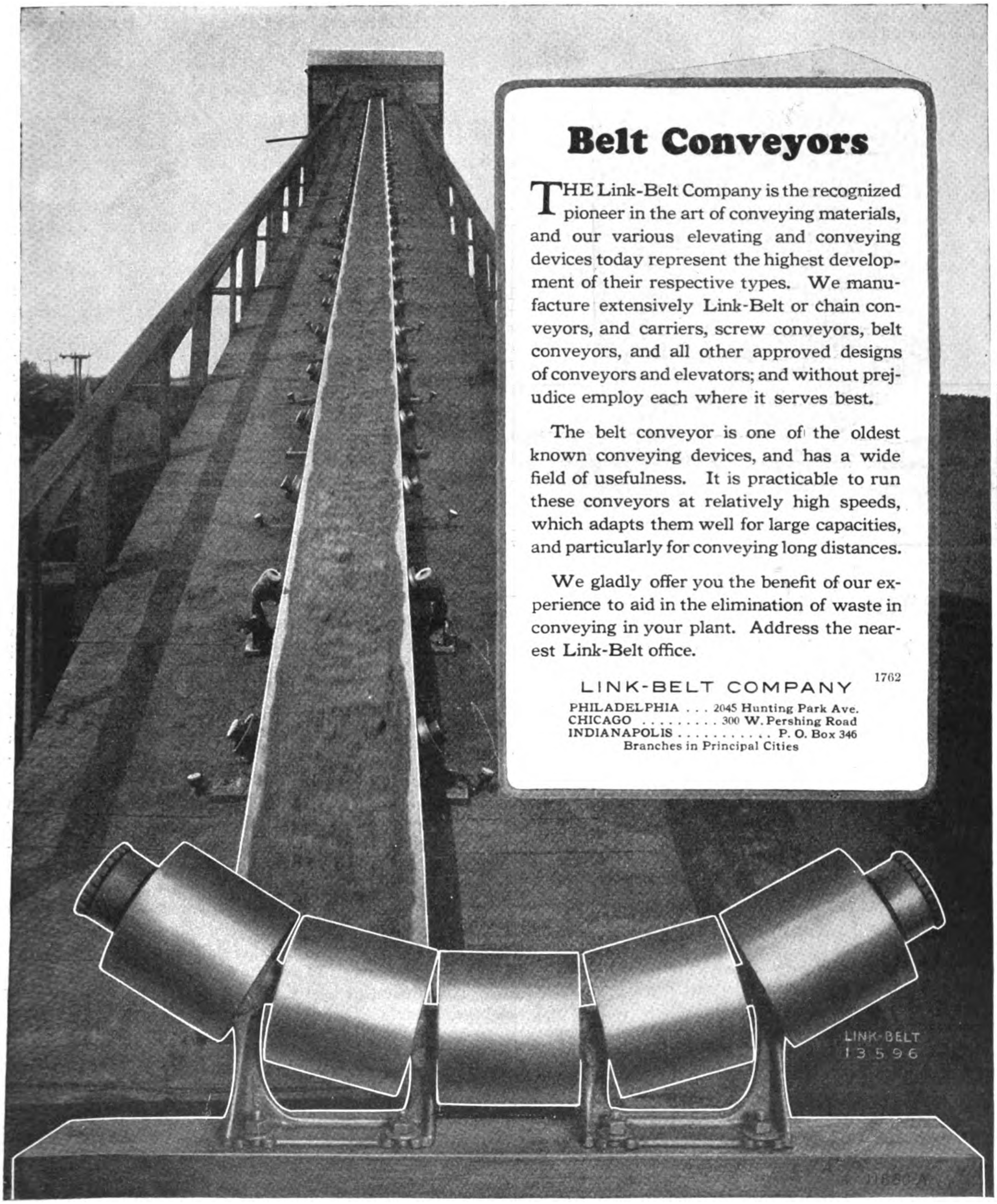
Take the textile industry. New England gained textile leadership, but labor remained poor, and it organized strongly and fought for power. The emigration of many mills to the South resulted. There the new mill-towns pay more thought to housing and recreation and have less trouble with labor. Conditions are not by any means perfect, but there is a new spirit. New England is getting that spirit now. The Dennison Manufacturing Co. near Boston, Cheney Brothers at South Manchester, Conn., the Shelton Looms at Shelton, Conn., the American Woolen Company at Shawsheen, Mass., and others elsewhere, are making progress in housing, safety work, and community conditions.

The clothing industry leaves labor turmoil in the great cities and goes elsewhere, often into the country. Rochester is a high-class clothing center, and a city of diversified industry and happy homes. Springfield, Mass., was chosen by the Rolls-Royce Company as an ideal city of skilled mechanics and adequate housing. The American Rolling Mill Company prospers in Middletown, Ohio, where employer and employee mix in community relationships. Racine, Wis., is attracting many shoe inindustries to add to its diversified concerns, quiet homes, and community advantages.

Personal happiness, pride in his community, and a scale of prices which fits his pocketbook, is what the worker wants. He then is ready to take some interest in his work.

Employers find they are happy themselves in such towns. Oakland, Cal., made itself so lovable to William Durant's son that when that genius established a Pacific coast plant he put it in the town which young Durant said was a good place for both capital and labor. Johnson & Johnson is the big surgical bandage plant in New Brunswick, N. J., and Charles McCormick of that firm is such a lover of his home city that he has gone out and brought industries to it to share with him its advantages. Los Angeles, the Dream City, has found itself with many new industries because humanity, rich and poor, like to live there, and happiness does cut costs.

Marshal Foch said that the Imponderables, the Things which are Unseen, won the day in France. In the gigantic scheme of locating industry for efficiency it is the intangibles of human happiness and satisfaction that are attracting industry from slums and smoke to the places of light and health; ultimately to make industry a living and human thing.



LINK-BELT

ELEVATING AND CONVEYING EQUIPMENT

Making Ready for Cold Weather

(*Continued from page* 33)

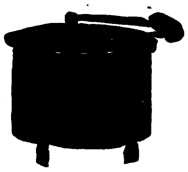
ered. Usually the wind velocity is small at very low temperatures and it is well that this is so, because a strong wind causes heat losses equivalent to the losses with no wind at a much lower temperature. The direction of the prevailing cold winter winds is an important point to be considered in rearranging or installing a heating system.

The usual temperatures maintained in industrial plants vary from 60° to 70° F., depending on the amount of physical exertion necessary for the employees. In sprinklered buildings it is best to keep the temperature above 40° F. at night to avoid any chance of freezing. Rooms having exhaust systems require large amounts of heat to warm the air that is drawn in to replace the heated air drawn from the room. The material stored in a room as well as the machinery must be heated during the warming-up period, and if large quantities of material are stored in a room this should be taken into account.

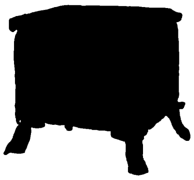
Direct steam heating is used in the majority of installations in plants and this will be considered first. There are two broad types of direct steam heating, one being the two pipe system with gravity return and the other the vacuum system. In the plant itself pipe coils are commonly used although cast iron wall radiation is becoming popular. With pipe coils the length of a coil should not be more than sixty feet and there should be a mitre piece at the supply end. The return header should be anchored to allow the expansion at the mitre end. In a gravity return system, a small pressure is carried in the radiators and the condensation flows by gravity back to a vented hot well or trap and the condensation is returned to the boiler. This system is usually used where the condensation will flow by gravity to the boiler. This is easily possible in one or two buildings nearby, but when buildings are separated it requires lifts for the condensation and these are not desirable. The vacuum system is better adapted to these conditions as the condensation is removed from the return pipes by vacuum pumps that maintain a pressure below atmosphere in the return piping.

The amount of heat that will be given off by a unit of heating surface varies with the temperature of the steam or hot water, the temperature of the air, and the velocity at which the air passes over it. With direct radiation as used in most plants, the velocity of the air is that at which the heated air is rising, as this draws in the cold air at the bottom. In order to get circulation in the back of a radiator next to the wall, there should be sufficient space. It has been found by experiment that at least two and a half inches are necessary between the wall and a radiator in order to get good results. In a room having fast moving machinery and belts, the heat transmission is slightly increased on account of the air currents increasing the velocity of the air passing over the radiators. Painting has some little effect on the radiating surface although it has no effect on the heat lost by convection. The last coat of paint is the only one that counts and it has been found that gloss paints allow a slightly higher percentage of radiation than the bare cast iron radiator,

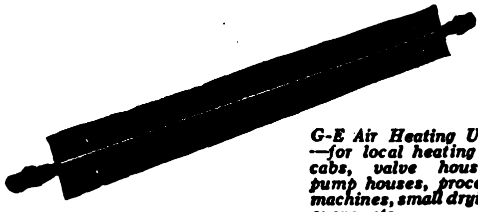
(*Continued on page* 102)



G-E Compound Melting Pot—melts battery compound, sealing wax and like materials.



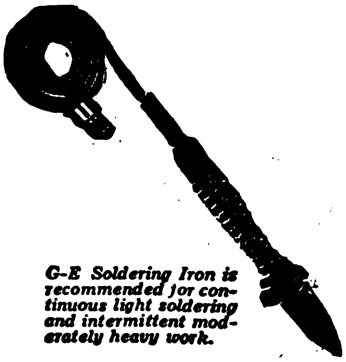
G-E Self-Regulating Solder Pot insures economy and convenience in melting solder.



G-E Air Heating Unit—for local heating in cabs, valve houses, pump houses, process machines, small drying ovens, etc.

Heat At Its Best

It is widely used in in-



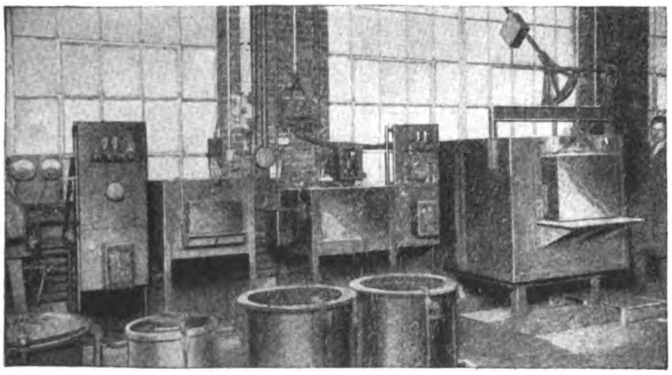
G-E Soldering Iron is recommended for continuous light soldering and intermittent moderately heavy work.

Carbon steel tools, parts and hardware drawn in the G-E Air Tempering Oven, come out clean; the temper is uniform, and the surface color of the right shade.

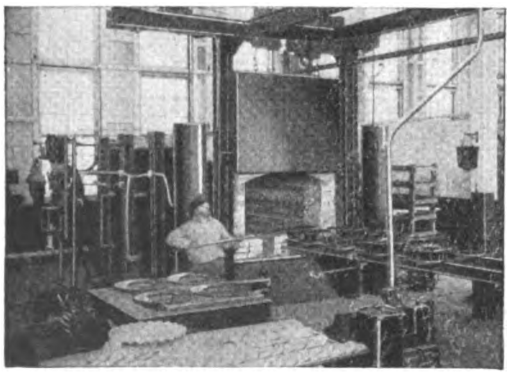
Electric Heat—quick, clean, safe, flexible, economical! Its advantages over other methods have so extended its use and development that it embraces applications that are vital in the heating processes of all kinds of industry.

It is readily adaptable to working conditions—can be used in any atmosphere—can be produced in just the exact amount and at the desired temperature. It is subject to accurate control both as to temperature, quantity, and distribution—which specific conditions can be duplicated at will.

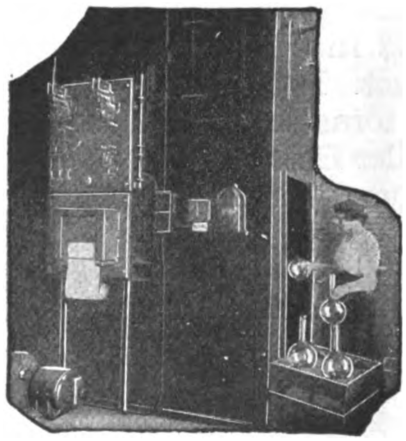
The General Electric Company builds heating units that are easily installed in the little box oven or the immense conveyor type ovens and furnaces. The G-E Direct-Heat Units with non-oxidizing ribbons are 100 per cent efficient in converting electric energy into heat that speeds production and reduces spoilage.



Installation in a heat treating shop of Direct-Heat Electric Furnaces manufactured by the General Electric Company.

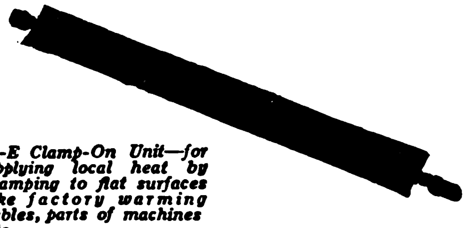


Electric vitreous enamel furnace equipped with G-E Direct-Heat Units and Automatic Temperature Control.

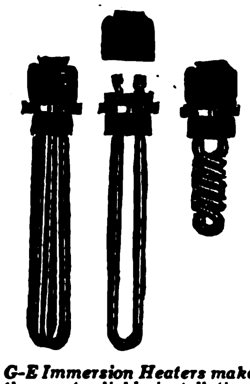


Electrically-heated glass annealing lehr equipped with G-E Direct-Heat Units and Automatic Temperature Control. The electric lehr gives just the right time-temperature cycle, and practically eliminates rejects.

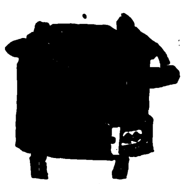
GENERAL



G-E Clamp-On Unit—for applying local heat by clamping to flat surfaces like factory warming tables, parts of machines etc.



G-E Immersion Heaters make the most reliable installations for electrically heating water and oils in industrial processes



G-E Jacketed Glue Pot effects big saving where glue is used only at intervals.

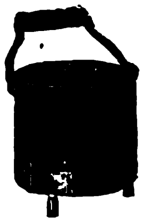
Is Electric Heat

dustrial heating processes

These units are compact, easily installed, and their flexibility makes possible the most desirable location of each individual heater. By combination of these units all requirements can be met for the utilization of heat over a wide and varying range in ovens and furnaces.

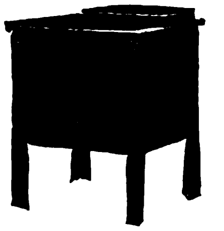
The General Electric Company also manufactures small industrial electric heating devices for handy use about the plant—giving to industry the broad use of electricity for practically every heating purpose. It is the originator of "Helicoil" Sheath Wire which has made possible the development of many of these devices.

Industrial Heating Specialists of the General Electric Company are ready to serve you in making recommendations covering the installations of electric heating equipment for many heating processes in your plant.



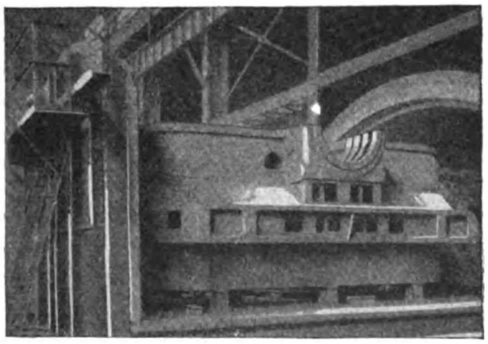
G-E Jacketless Glue Pot saves where glue is used continuously during the day. Maintains just the right temperature without attention.

Cartridge Unit, originated by General Electric Company, is unexcelled for concentrated local heating of tools and machine parts.

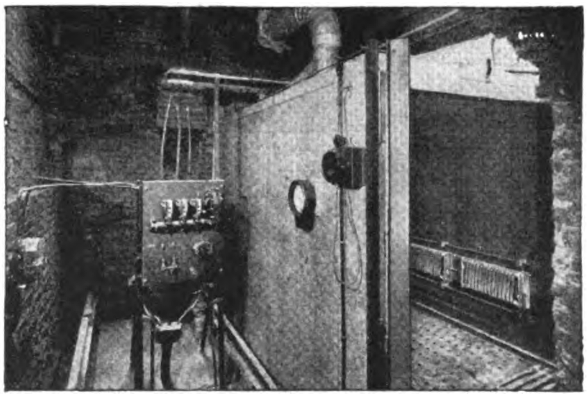


G-E Oil Tempering Bath—compact, self-contained electrically heated device for tempering carbon steels.

Baking, drying, and other oven processes are improved by the utilization of electric heat. G-E heating equipment with automatic control is used most extensively in this field.



Annealing 50-ton turbine casting in electric furnace 27 ft. long by 16 ft. wide by 9 ft. high equipped with G-E Heating Units and Automatic Temperature Control.



G-E Direct-Heat Units installed in electric oven. These units eliminate muffles and their maintenance.

30-114

ELECTRIC

(*Continued from page* 98)

and that bronze paints allow a slightly lower percentage of radiation.

The piping is very important in a steam heating system. The pipe, fittings and valves must all be carefully figured in order to have good distribution. The return of the condensation is just as important as the delivery of dry steam to the radiators, and the capacities and grades of return pipes must be correct for a system to work well.

With hot water heating as used in industrial plants, forced circulation is necessary, as the gravity systems are not capable of giving uniform heating over a large area. The main point to be taken care of in a forced circulation system is to have the pressure drop at each radiator the same. If the piping is designed correctly there will be uniform circulation without any valves. However, with standard pipe sizes it is not possible to have exactly the figured areas of pipes, and in many cases throttling valves are necessary to make the system work evenly. In old systems that do not operate evenly these valves may be installed to adjust the circulation. With a hot water system, the engineer in the boiler room can raise or lower the temperature of the water in accordance with the outside temperature. This gives one man control over the heating or it can be automatically controlled. With hot water heating, waste heat may be used in heating up the returns. In this way the boiler only has to make up the difference. Most plants have some waste heat and this makes the hot water heating economical if it can be used. The maintenance of a hot water heating system is not large, as it is very simple. The heater, pump, and the valves near it in the power house are about the only items needing attention. With turbine driven centrifugal pumps the maintenance is very small indeed, and it is not unusual to find them running night and day throughout the heating season without a shutdown. The heaters require little attention as there is not very much corrosion by the water, as the same water is used over and over and it does not contain much oxygen, which is the corrosive element. It must be remembered that hot water heating requires more square feet of radiation because hot water is usually run between 125 and 190 degrees, although it may be run up to the boiling point or a little above.

For large high ceilinged rooms such as erecting shops where only a comparatively few men are working, the heating can be economically done by space or unit heaters that heat the air over and over again. This system requires only a steam line and return line and is easily installed. These heaters have a motor driven fan to force the air through the heater coils and deliver it at fairly low velocity through an outlet at the top. These heaters may also be had as direct fired units when steam is not available. These operate on the same principle, the only difference being that the air is forced upward through a chamber around the fire pot instead of through steam heated coils.

The proper heating and ventilating of a plant is an important factor in the amount and quality of production. Men will work better when they are comfortable, and in order to make them comfortable in some plants a ventilating system is necessary. This may be run independently of the heating system or in connection with

(*Continued on page* 104)

(*Continued from page 102*)

it. The system largely used in plants is the combination heating and ventilating system in which most of the air in the plant can be recirculated and any amount of fresh air can be taken from outside. In this system the air is heated, usually by passing through steam coils, and then forced through the distributing ducts in the plant. The fans may be run to create a very slight pressure in the building so that there will not be any inward leakage of cold air which is so objectionable with direct heating. The design of the distributing ducts has a great deal to do with the operation of the system. A well designed system of ducts with outlets properly located will give equal distribution of heated air without annoying drafts. In most cases ducts are hung on the cealing and outlets are at the same height as the duct where this height is between eight and twelve feet. Due to the high velocity of the air passing over the heater coils in the fan system, the coils transmit about five times as many heat units to the air as with direct radiation. From the maintenance standpoint there are less repairs necessary on a compact heater coil on a fan system than on a large number of long coils around a building, and the returns are all at one place instead of at several places.

A fan system with reserve capacity is very flexible for changes in outside temperature. This is also very beneficial in the morning during the warming-up period as it gets the plant warm quickly so the men are comfortable. Exhaust steam is ordinarily used in fan systems, and as the fan requires power, it is customary to have a steam engine or turbine driving the fan, using the exhaust for the heater coils. The heat losses in plants are due first to direct transmission of heat through the walls and windows and second to air infiltration. Because of the fact that infiltration is hard to figure with, it is possible to keep a room warm more easily if infiltration does not have to be considered. This can be done by keeping a slight pressure on the building with a fan so that there is a very slight leakage outward but no leakage inward.

The common assumption that a room or plant should be heated to a certain temperature regardless of humidity is not correct. With a low humidity 70 degrees may be too cool for comfort. On the other hand, with a high humidity 70 degrees may be too warm. The point where each class of workmen are comfortable is the right point to maintain for highest production. With a fan system of heating and ventilating it is an easy matter to install an air washer and humidifier and automatically control the temperature and humidity between very close limits. There are several methods of controlling the relative humidity but most systems give very close control. In plants where steam or vapors are present in large quantities, a ventilating system is a necessity. In other plants it is not a necessity but it should pay for itself in greater output, due to the men being supplied with good clean air. Air filters are used on ventilating systems where no air washing or humidifying is needed. These are very good for removing dust and bacteria from the air. They may be cleaned and refilled quite easily and with a few spare units they can be used continuously. The maintenance of these filters is very small indeed.

Automatic temperature control often effects a saving in fuel of fifty per cent. of what would be used with no control. This is a large saving, but when one considers the usual method of cooling a room that is too warm it does not seem far off. When a room is too warm the usual way to cool it is to open the windows. This lets in a lot of cold air that has to be heated up again. In the meantime, the boiler has been generating as much or more steam as before the windows were opened. There are two kinds of temperature controllers, one the self-contained type that operates a valve without outside power, the other the air operated type using compressed air to operate valves or dampers. For remote control the air operated type is usually used. In order to control humidity a wet bulb is used in addition to the regular bulb. With fan operated heating and ventilating systems automatic control is almost a necessity and when a humidifier is added this too should be controlled.

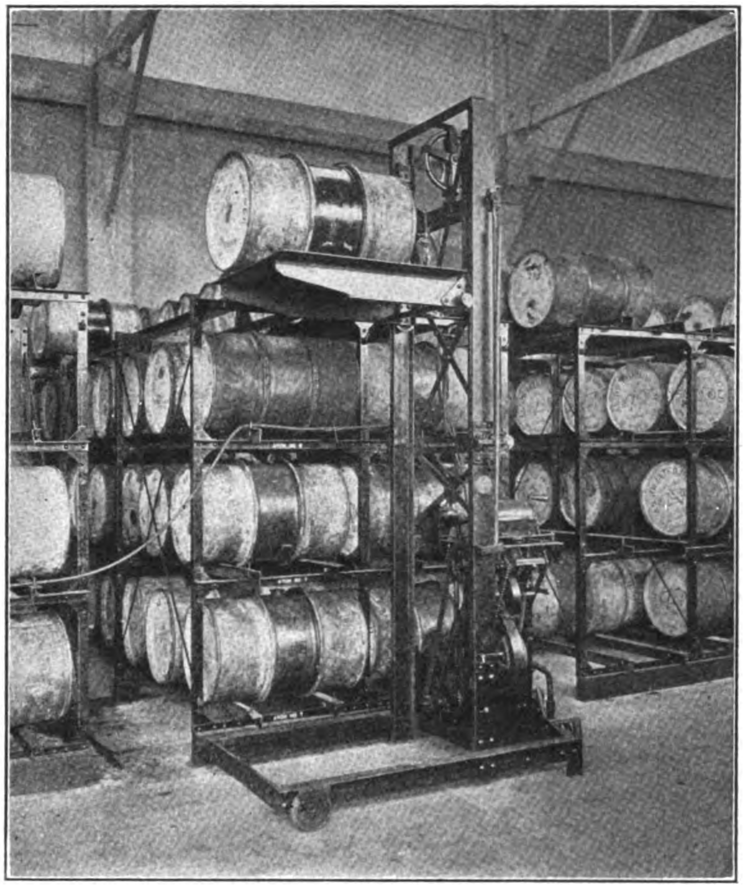
There are three main subdivisions in connection with the maintenance of a steam or hot water heating system, namely, the boiler, piping, and radiation. The operation and care of the boiler are tremendously important and should be carefully checked by the one who is in general charge of the plant maintenance. As a rule the maintenance of the boilers and such piping as is in the power plant is in charge of the chief engineer, but the maintenance of the piping throughout the plant and the radiation is under the pipefitter. However, the writer has found that it is best to make the chief engineer responsible for heating and have him make a round of the plant at least once a week and report any necessary repairs to the plant engineer. In this way the responsibility for correct heating is up to one man.

The fire brick in a boiler are exposed to the action of the fire for a short space above the grates and many types of blocks have been designed to lower the maintenance of the brick in this area. Large blocks of high refractory material are extensively used, many of them having perforations to allow air to be blown through them to keep down the temperature of the surface exposed to the fire. This prevents the formation of clinkers and reduces maintenance. High temperature cement should be used for laying up all fire brick unless a dip of thin fire clay is used and the brick shoved into place. Bad workmanship is responsible for a great deal of trouble with fire brick linings. The brick setting of a boiler should be tight and free from air leaks if boiler efficiency is to be maintained. Often the outside of a boiler is coated with a troweled layer of plastic cement that fills up cracks and other leaks. When a boiler is shut down it should be cooled slowly, as the rush of cold air through the setting will cause trouble with the brick lining. When small patches only are necessary in a lining the plastic cements are especially desirable. They may also be used for an entire lining if so desired. A wash coating of high temperature cement over the entire face of the fire brick will preserve it somewhat as it protects the corners of the brick and prevents them from spalling off.

Piping for low pressure heating systems should be of standard weight and have tight joints. On the larger pipes flanged joints should be used and gaskets of canvas insertion rubber or other reliable material should be used. Fittings on heating service should be standard weight cast iron with full taper threads. Valves should be flanged in the larger sizes. It is advisable to grind in the seats of large valves without taking the valve off the line. These valve seat grinders are available in portable sizes for both globe and gate valve grinding.

(*Continued on page 106*)

More *Space* in the Same *Place*



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ECONOMY ENGINEERING COMPANY

2663 W. Van Buren St., Chicago 342 Madison Ave., New York

ECONOMY LIFTERS

(*Continued from page* 104)

Small radiator valves require packing at the stem, and also disc replacements almost every year. Packless quarter turn radiator valves are being largely used and these reduce the maintenance expense. The thermostatic valves at the return end of steam radiators on a vacuum system should be carefully inspected before the heating system begins as they are very important. The steam mains should be carefully lined up to avoid pockets and should deliver dry steam to each radiator branch. The pipe should be anchored at one point and supported on roller supports at other points. In order to take care of expansion large radius bends or their equivalent in the form of expansion joints are necessary. Where large bends take up valuable room the expansion joint offers the best solution. With a vacuum steam system dependable vacuum pumps are a necessity. The newer rotary types with direct motor drive are very desirable from the maintenance standpoint. Steam traps are of several designs, many of them requiring constant maintenance on the valve parts. The function of a steam trap is to remove condensation without wasting steam. This point must be carefully watched as a great amount of fuel is wasted due to traps not working right. If condensation is returned to the boiler quite a saving results, and this should always be done with heating returns because they are free from oil or grease. Feed water heaters are fuel savers and should be kept clean. Open types require very little maintenance, the closed types should be kept free of scale and impurities.

All steam and hot water mains and returns should be insulated. The usual insulation for this service is one inch thick air cell asbestos covering. This is not as expensive as 85 per cent. magnesia, nor is it so efficient, but for heating service it is the most economical. It may seem queer to some people to insulate steam heating pipes, but the radiation should be designed to take care of the heating requirements, and the only way to deliver dry steam to the farthest point from the boiler is to insulate the mains and risers. Underground heating pipes between buildings should be well insulated and protected by split tile or fibre conduit or by a wooden box if the others are not available. There are several ways of insulating the pipe or pipes in a conduit; one method uses a special insulating covering fitted around the pipe and fitting inside the conduit, another covers the pipe or pipes in the regular way, sometimes protecting them with a waterproof coating, then filling the space in the conduit with a loose insulating fiber. The pipe should be supported on roller bearings with provision for expansion at one or both ends and an anchor at the middle of the conduit.

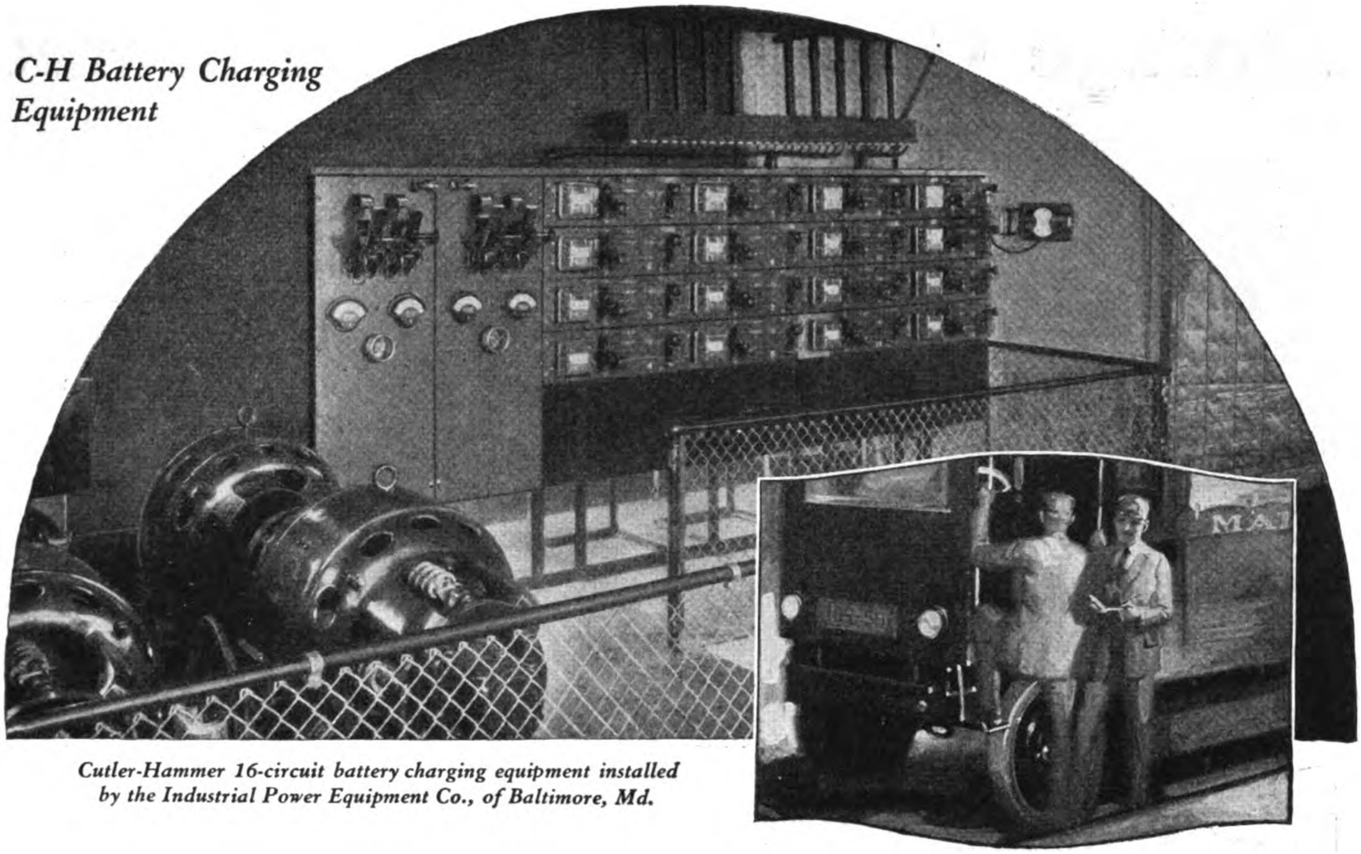
In plants, much of the radiation is pipe coil although the wall type cast iron radiation is largely used. Pipe coils must be lined up to avoid sagging and consequent water pockets. This may easily be done if the coils are hung on adjustable hangers. If expansion is taken care of by mitre bends of the right size, pipe coil radiation does not require much maintenance. However, if coils are not correctly designed the expansion tends to open up joints and makes work for the maintenance men.

Many heating systems lack some little thing that keeps them from operating evenly and efficiently, and by taking care of this defect a comfortable plant is the result. Surely a little extra effort to find the defect will be well repaid by the feelings of the contented workmen.

Index to Advertisements

Editorial Contents, see page 4

C-H Battery Charging Equipment



Cutler-Hammer 16-circuit battery charging equipment installed by the Industrial Power Equipment Co., of Baltimore, Md.

Greatest Efficiency of Electric Trucks Dependent Upon Correct Charging

The new fleet of 16 electric trucks put into service in Philadelphia are systematically kept in most efficient condition by the Cutler-Hammer 16-circuit Battery Charging Equipment.

Alongside each of the 16 standard unit rheostats there is a watt hour meter which measures the da'ly input per truck so that complete operating records may be kept. Each Unit is complete in itself with rheostats, fuses, indicating lamp, protective relay and knife switch—with workmanship as indicated by the illustrations.

C-H Battery Charging Rheostats are furnished singly—in panels of one to six—and in as many panels of six each as are required. Being of the Unit type and standardized, addition can be made at any time to care for increased number of batteries to be charged.

In the Philadelphia installation direct-current is furnished by two motor generator sets, which provide economy since one or the other only is used under light load. For industrial trucks of every kind, street trucks, and battery locomotives; automatic or manually controlled; for constant current, constant potential or modified constant potential charging. Publication 830 mailed on request.

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Motor Control Department
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TRIPLING capacity without increasing the floor space is one of the things this Baker Locomotive Crane did for a Detroit concern faced with a shortage of space.

Quicker and better handling of materials enables the present space to house a greater volume, as well as reducing the number of men required.

Baker industrial tractors and trucks are made in a wide variety of models for more economical material handling—each one supreme in its field.

Write for an explanatory catalog covering all kinds, or ask to have a Baker engineer study your problem and then recommend the most efficient type for your conditions.

Baker Industrial Division

BAKER R & L COMPANY
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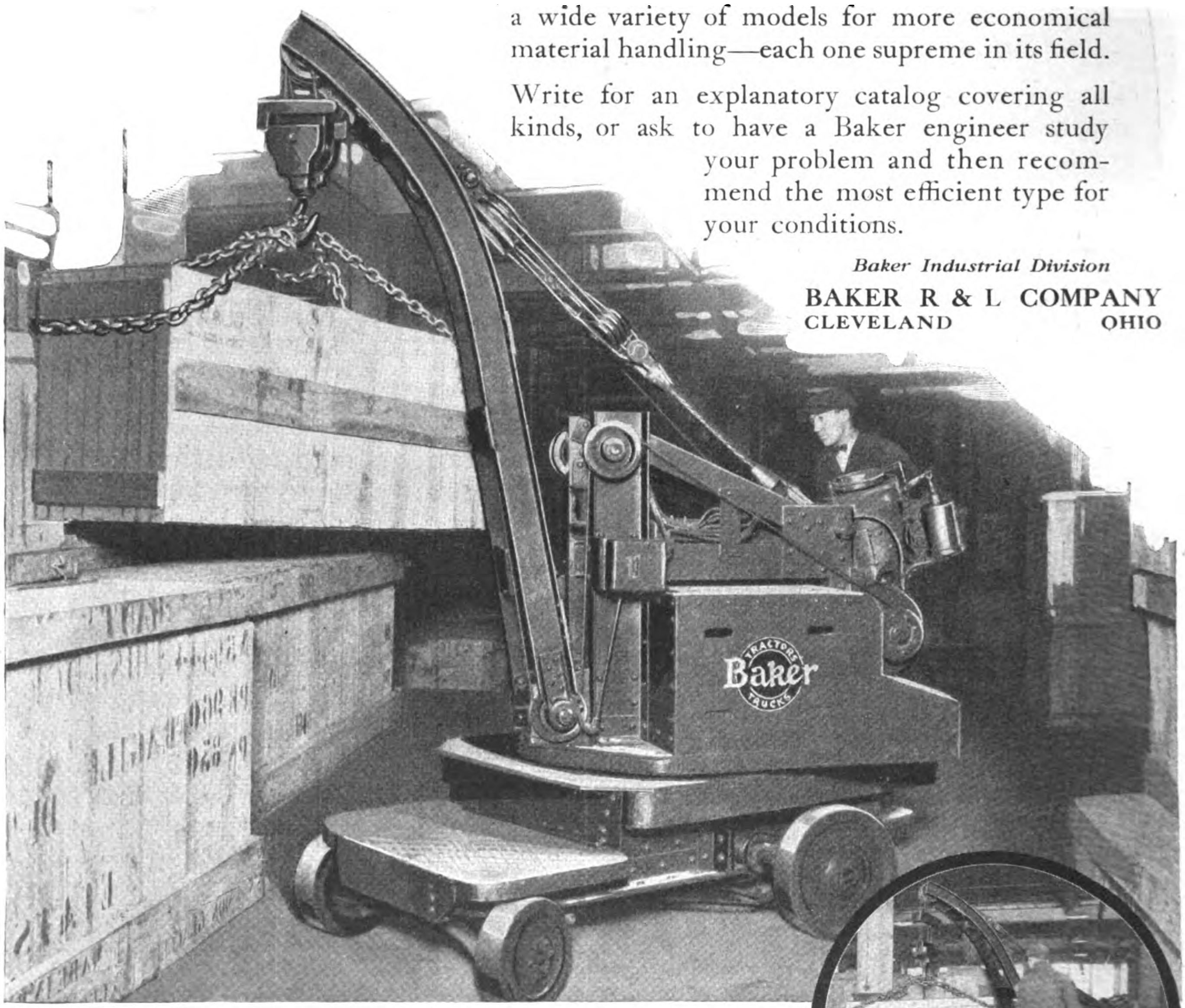

ELECTRIC TRACTORS AND TRUCKS

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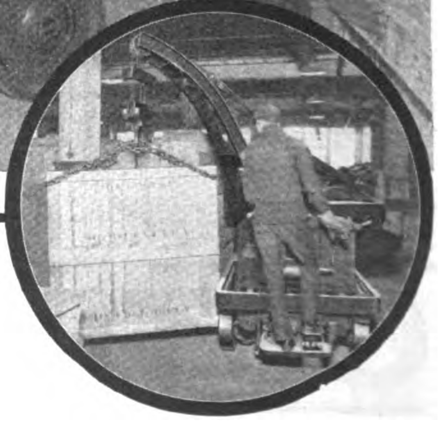

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Industry Illustrated

Men, Methods and Machinery of Modern Ma[illegible]ment

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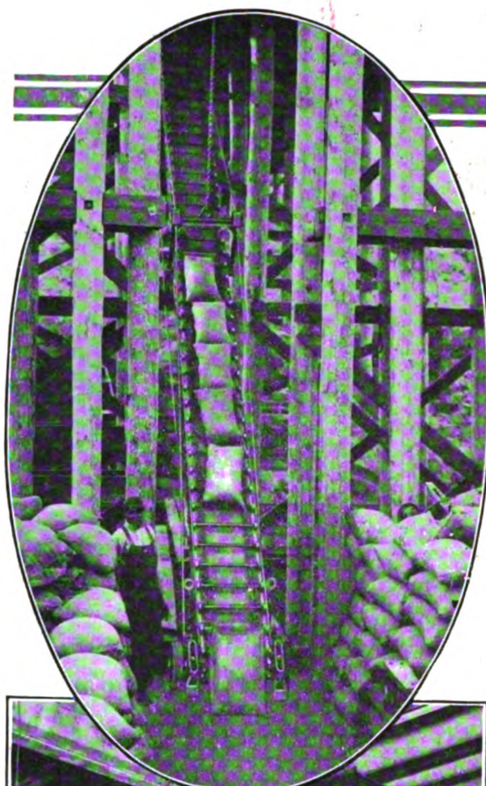
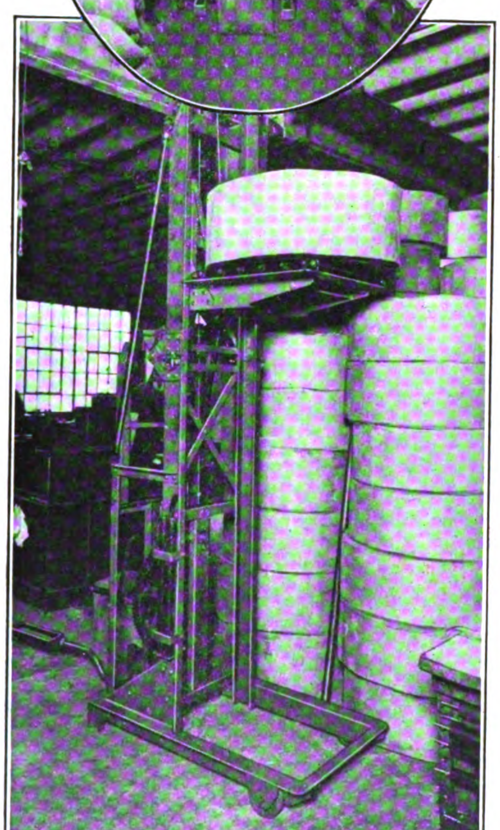


UP—DOWN AND FROM PLACE TO PLACE

WITHOUT WASTE

THE Piler shown in the top illustration is eliminating waste—by piling bags of sugar for the Sacramento Valley Dock and Warehouse Company. One ton a minute is the conservative guarantee of the capacity of such a machine piling to a height of 32 feet. What man or group of men can do half of that?



The center shows a Standard Tiering Machine—used by the Wirth Sales Book Company of Chicago, Illinois. They will tell you that their machine can do the work of piling rolls of paper for one third of the cost of manual labor. This is in addition to a complete utilization of space unattained any other way than by a machine.

Below is a system at the Drake Bros. plant, New York City. Merchandise is lowered from floor to floor by Spiral Chutes and distributed to some other location on the floor by Gravity Roller Conveyors. No other cost is involved except labor at the loading and unloading points of the conveyor.

Waste diminishes earnings. Eliminate it. Handling by system is handling without loss of time, space or motion.

Write us for Booklet I-11 which gives further information on Ways to Eliminate Waste.

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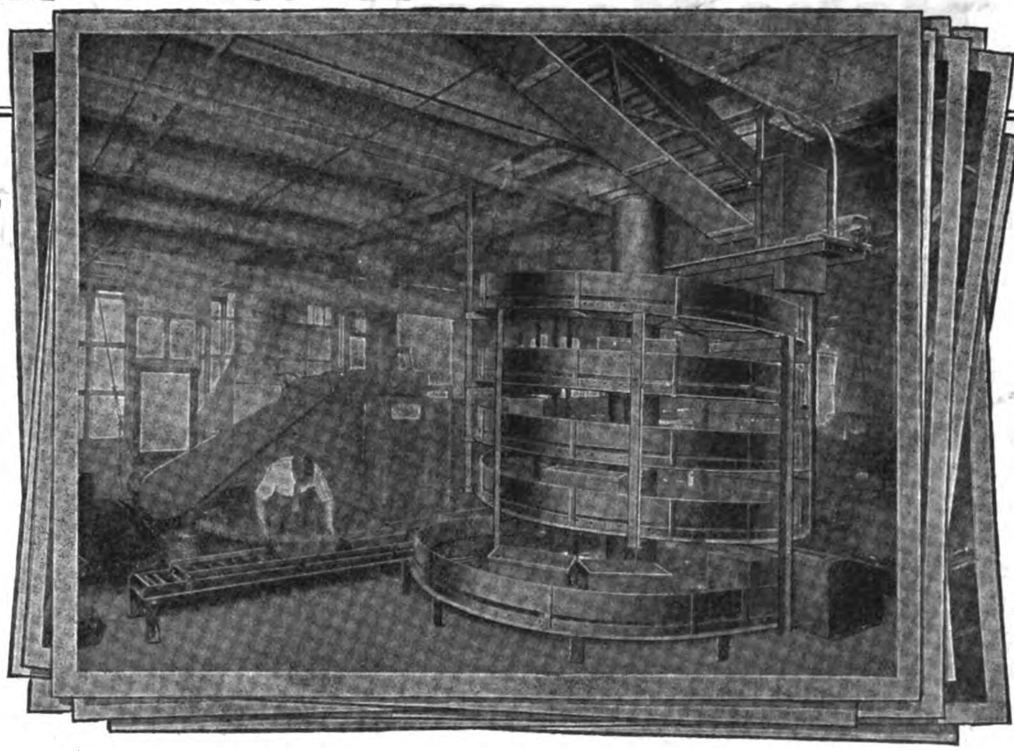

Simple as the P-A-X system of automatic telephony appears in use, hundreds of thousands of parts enter into the assembly of a complete installation. To collect and coordinate these parts naturally requires the utmost in efficiency and dispatch. The photograph on the right shows a Dow Roller Spiral connecting various floors in the P-A-X plant with Dow Gravity Conveyors over which parts move rapidly and automatically from one phase of manufacture to the next—only a part of the complete Dow system of conveyors that insures high speed and low cost in production for the makers of P-A-X.

TALK vs. walk—that's the story of P-A-X. And just as the P-A-X system of interior telephony saves labor in carrying messages from one office to another, the Dow system of conveyors saves labor in transporting parts and finished products from one part of a plant to another.

The P-A-X eliminates crowds and confusion from office corridors, stairways and elevators and keeps employes at their posts; Dow Conveyors rid the factory aisles of slow-moving hand trucks and congestion and enable the skilled mechanic to devote all his time to production. Both P-A-X and Dow save time and money.

It was therefore in keeping with the idea back of the products they sell when the Automatic Electric Company recently chose Dow Conveyors to increase efficiency and economy in their own plant.

The possibilities of increasing production and decreasing costs with Dow Conveyors are practically limitless. *Why not apply the principle to your business?*

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Industry Illustrated

The Pictorial Presentation of Practical Management

CONTENTS

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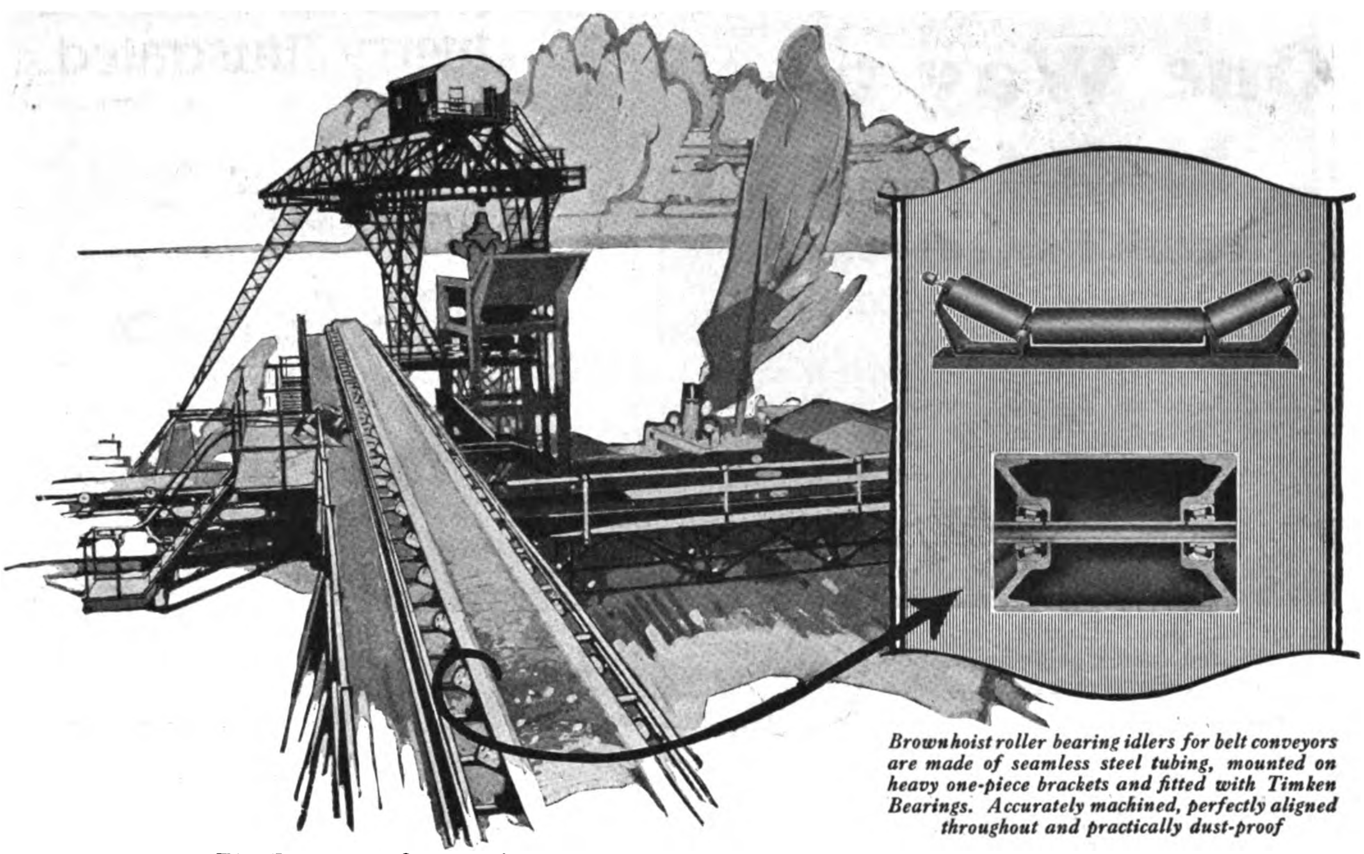
Index to Advertisers see page 100



Brownhoist roller bearing idlers for belt conveyors are made of seamless steel tubing, mounted on heavy one-piece brackets and fitted with Timken Bearings. Accurately machined, perfectly aligned throughout and practically dust-proof

Here's A Way to Reduce Bulk Handling Costs

ON any job where bulk materials are handled, a Brownhoist Belt Conveyor will cut handling costs and pay dividends from the day of installation.

In addition to their ability to handle such materials to your utmost satisfaction, there is a further reason why you should use Brownhoist Belt Conveyors. It lies in their remarkably low upkeep and maintenance costs.

For instance — excessive wear in a belt conveyor is invariably the result of friction and the point of greatest friction is the *idler.*

Brownhoist roller bearing idlers are a decided advance over those in common use. They are fitted with Timken Roller Bearings and packed in grease which needs renewal but once a year. They are practically grit-proof, dirt-proof and friction-proof. Consequently these idlers, like all parts of a Brownhoist Conveyor, give long, economical trouble-free service.

Brownhoist engineers have helped reduce handling costs in many hundreds of plants. Their advice on any handling problem is yours for the asking—without obligation. Write for a copy of "Belt Conveyors". It is filled with practical working data.

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BROWNHOIST

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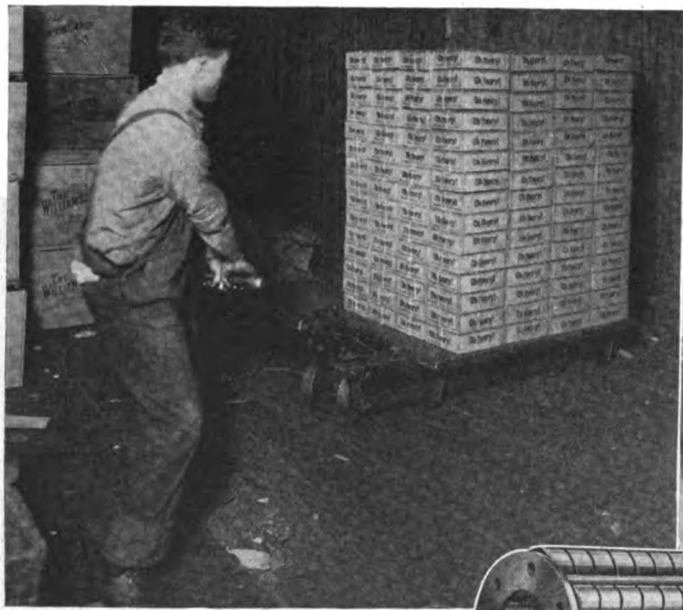
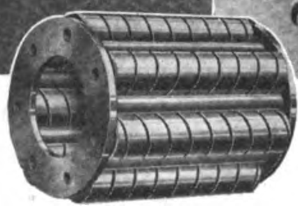


Hyatt equipped Barrett-Cravens lift truck in operation at Williamson Candy Company, Chicago, Ill.



Portable elevator manufactured by The Barrett-Cravens Company, Chicago, Ill. Equipped with Hyatt roller bearings.

Less Friction—

More Pounds Per Load

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The Barrett-Cravens Company gains these operating advantages and economies for its standard lift trucks and portable elevators by equipping them with Hyatt roller bearings.

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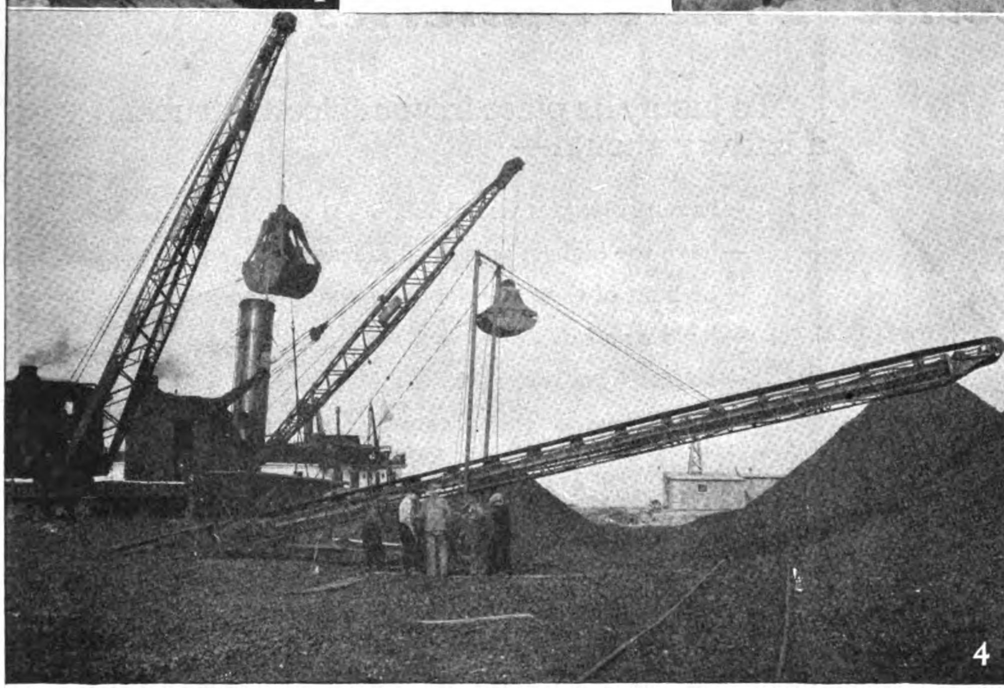
HYATT ROLLER BEARINGS FOR INDUSTRIAL AND FREIGHT TRUCKS

1—The 3 Barber-Greene Conveyors which load a 12,000-ton boat with cement in 30 hours for the Petoskey Transportation Co. The cement is transferred from a 500-foot permanent conveyor to the portables, which feed direct to chutes emptying into the hold.

2—A Barber-Greene handling broken cullet (glass) at the Pitney Glass Division of the National Lamp Works.

3—A Barber-Greene handling soft mud at the Mutton Hollow Fire Brick Company, Woodridge, N. J.



4—A Barber-Greene 60-foot conveyor stores coal for the Petoskey Transportation Co., as fast as two clam shells can feed it. When storage is needed farther back, the Barber-Greenes shown in photograph No. 1 are also used, relaying the coal from one to another.

It keeps two clam shells going to capacity

Barber-Greene Conveyors have solved the loading and storing problems of the Petoskey Transportation Co. When a boatload of coal comes in, a single Barber-Greene 60-foot Conveyor stores the coal as fast as two clam shells can take it from the hatches.

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At the Mutton Hollow Fire Brick Co., Woodridge, N.J., a Barber-Greene Conveyor carries soft mud from the grinding pit to the brick machine, regularly handling 120 tons in a 10-hour day.

At the Pitney Glass Division of the National Lamp Works, a Barber-Greene is placed in the pit under the glass tanks, carrying the broken cullet to batch wagons. The Barber-Greene has replaced a home-made conveyor, and according to J. W. Rogers of the Pitney Glass Division, is far more rugged than the old one.

Invariably, when a company comes to depend upon Barber-Greenes to do the bulk of the handling, production is increased, costs are cut very substantially, with the complete elimination of worry over the erratic performance of unskilled labor. Our Catalog E may help you to solve one of your own important problems. Send for it.

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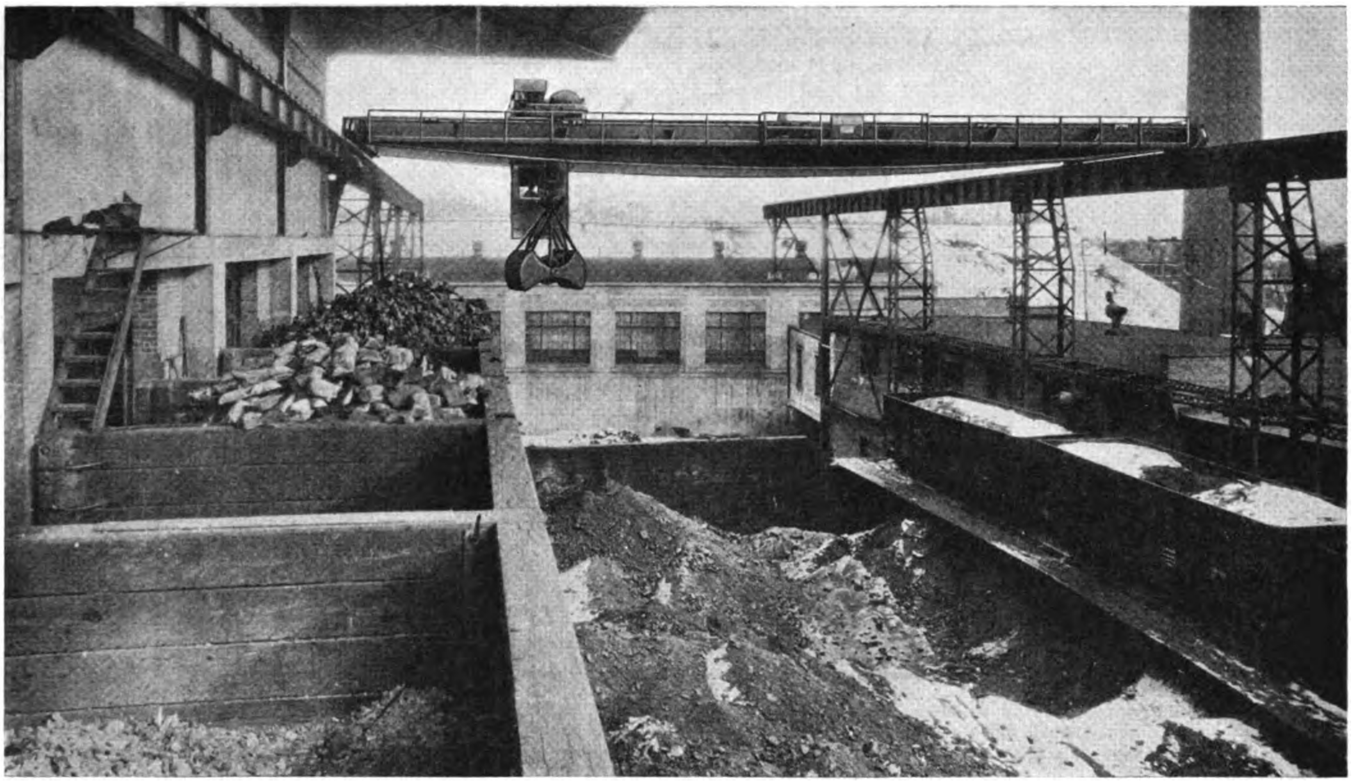

P. & H. Combination Grab Bucket and Magnet type Crane for handling coke, limestone, slag, pig and scrap iron, etc.

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These cranes are designed throughout with special attention to accessibility—bearings are bronze bushed and cast integral to insure alignment, through-bolts are used exclusively, shafts may be removed with gears in place and without disturbing other parts — all braking is accomplished electrically.

Bucket Operates Close to Runway Rails

The design of the P & H Trolley permits picking up and depositing materials close to either runway rail, a valuable feature particularly where runways run parallel with building walls.

P & H Grab Bucket Cranes and Hoists are used by such companies as American Brass Co.; Falk Corporation; J. I. Case Threshing Machinery Co.; Titusville Forge Co.; Sullivan Machinery Co.; Whitaker-Glesner Co.; Wm. Wharton, Jr. & Co.; Tennessee Coal; Iron and R. R. Co.; Inland Steel Co.; Illinois Steel Co.; Wisconsin Steel Co.; and similar plants.

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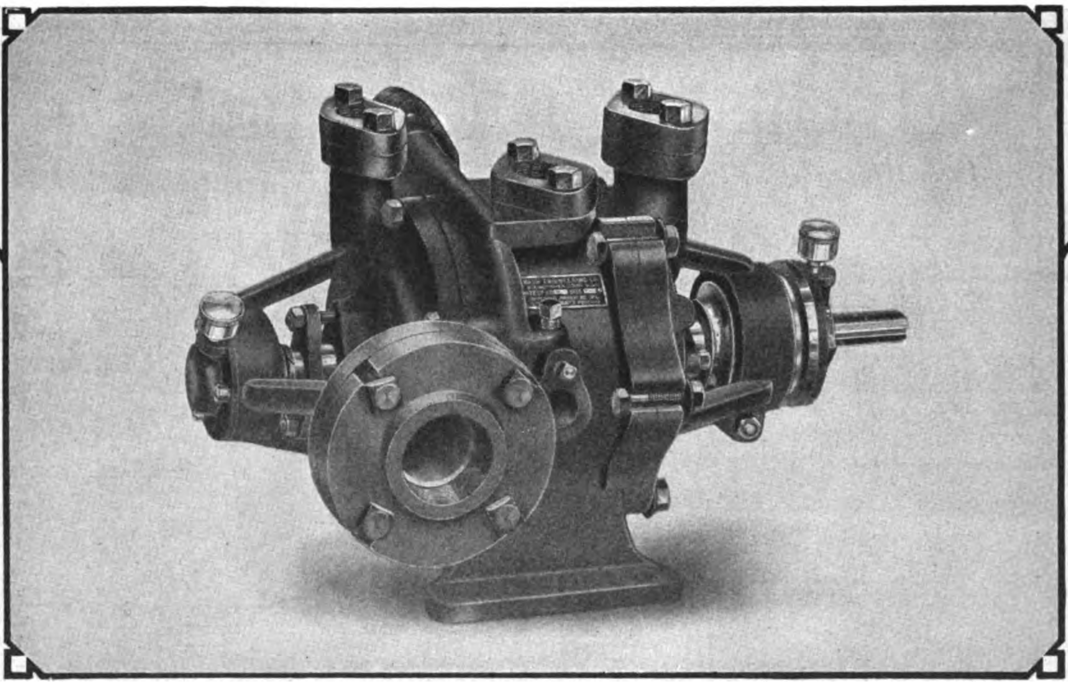
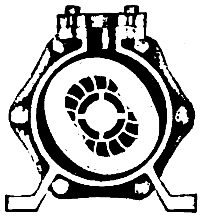


Jennings Hytor Vacuum Heating Pump, size C, suitable for 26,000 sq. ft. radiation. Only 2 H.P. motor, 1,800 R.P.M., is required when delivering from a vacuum of 10 in. mercury against 10 lbs. boiler working pressure.

The heating pump you can use with confidence



Sectional view of Jennings Hytor, showing unique principle of operation

The rotor, consisting of a cylindrical hub around the periphery of which are chambers or spaces formed by heavy shrouds cast integrally, revolves freely in an elliptical casing or housing filled with water.

As the rotor turns, it carries the water around with it. The water, under the influence of centrifugal force, is compelled to follow the contour of the casing, and alternately to enter and leave the rotor chambers, twice in each revolution.

As the water recedes from the rotor, air is drawn into the chambers through the inlet port. As the water is subsequently forced back into the rotor by the converging casing, the air is compressed and then discharged from the rotor through the outlet port.

ENGINEERS and others know that many elements are essential in a steam heating system if the best results are to be secured. The boiler must be of proper design, rating, and manufacture, risers and mains should have adequate capacity and be correctly arranged, valves must be suitable for controlling the flow effectively, radiators should be high grade, etc.

But unless efficient means are provided for removing the air and water, and for returning the water to the boiler or hot-well, the overall economy will not be all that it should be. A good vacuum heating pump is essential.

The Jennings Hytor is the kind of pump you can use with confidence.

It consists of two independent units—an air pump and a water pump combined in one casing. The impeller of each unit is mounted on the same shaft.

Further, the Jennings Pump is quiet in operation, occupies one-third the space of reciprocating units, and is entirely trustworthy in service. It gives the reliable year-in and year-out performance that engineers prefer and demand.

For complete information write for a copy of Bulletin 15. Also for the graphic device, showing the unique principle of operation of all Jennings Hytors.

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Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Industry Illustrated

The Pictorial Presentation of Practical Management

JOHN H. VAN DEVENTER, *EDITOR*

W. THOMSON LEES
MATTHEW W. POTTS } *Associate Editors*

ADOLF SCHILDKRAUT
Art Director

Editorial

Keeping the Wheels Turning

AS this is written, we are in the midst of a presidential campaign. The newspapers are filled with accusations, denials, counter-charges, and all the rest of the familiar political material. Political news, for the time being, is front-page news; in a few weeks to give place to the daily murder or scandal or disaster story.

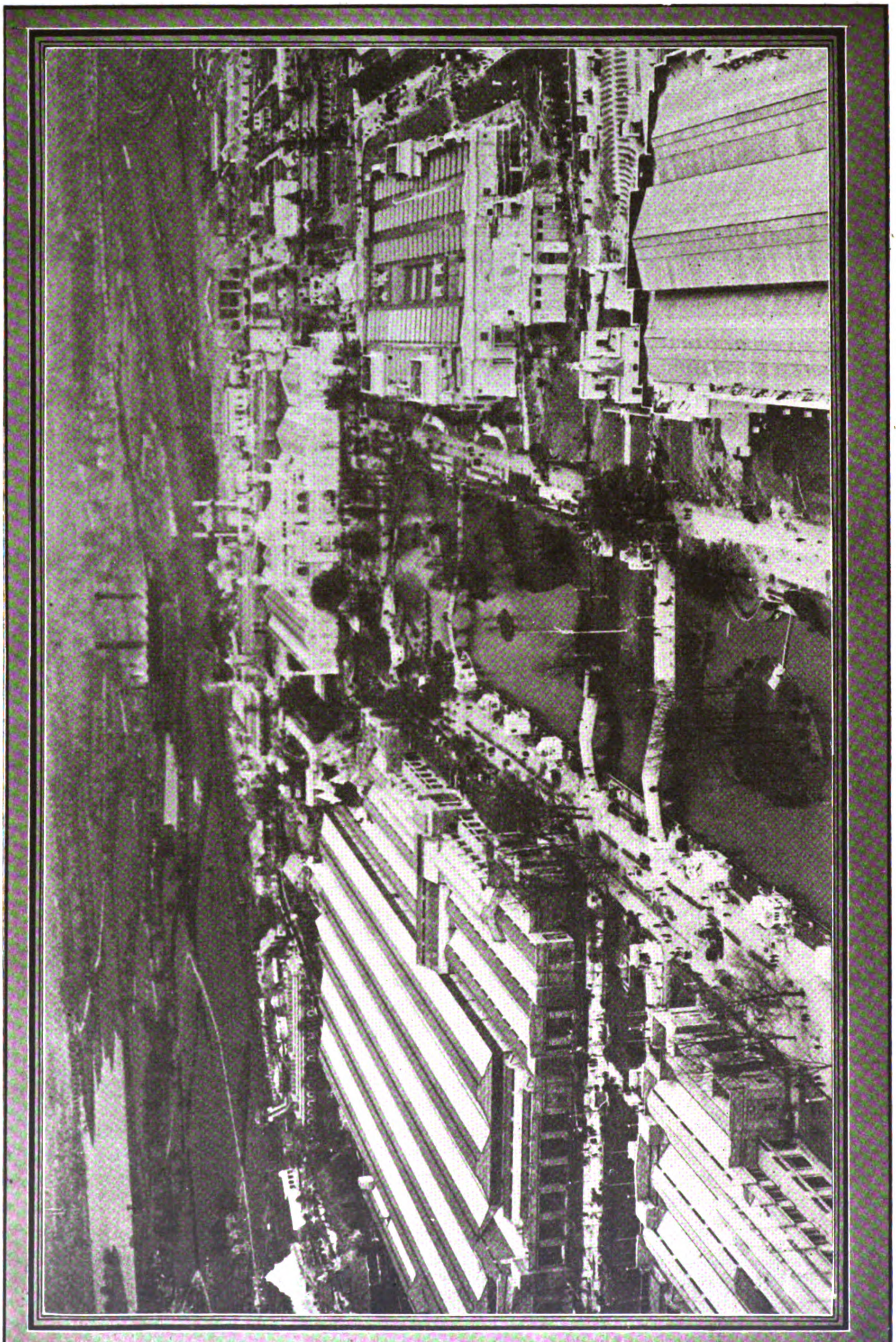
Buried within the columns are a few odd items unworthy of featuring in the headlines; a citation, in the course of a political speech, of wage comparisons here and abroad; figures on the cost of living; production figures, sales figures; brief announcements of new projects in power development.

For example, most of us have a more or less dim realization that American labor is better paid than labor in other countries. President Coolidge, in a recent speech, made this fact more graphic by citing the wages paid by a concern operating here and abroad, making exactly the same products, with the same equipment. The eight-hour-day wage (in August of this year) was: in Italy, 96 cents; Belgium, $1.10; France, $1.36; Germany, $1.46; England, $2.28; in the United States, *five dollars and sixty cents*. News, to most of us; but not front-page news.

Here is another item, perhaps more direct in its inference: the per capita yearly consumption of staple foods. The Italian consumes ten gallons of milk, forty-six pounds of meat, eighteen pounds of sugar, three pounds of butter; in Great Britain, the per capita consumption is fourteen gallons of milk, 120 pounds of meat, eighty pounds of sugar, twelve pounds of butter; whereas, in the United States, our per capita consumption is fifty-three gallons of milk, 183 pounds of meat, 103 pounds of sugar, and seventeen pounds of butter. So the American workman is not only better paid—he evidently lives on a better scale.

Again, at the recent World Power Conference in London, it was brought out that in the city of Chicago were three power stations which produced more power than all of London's 77 power stations; that the total production of the electrical plants in Great Britain is less than the production of electric current in the one city of New York; that the average price per unit of current in London is five cents, as against two-and-a-quarter cents in the United States.

To the casual mind, it is the front page news which is important. It may be true that headline features mean circulation—but it is not front-page news, which sustains the newspapers. What lies buried in unobtrusive space, unworthy of featured headline—figures, "dry" facts, chronicles of industrial achievement—these are what really nourish and sustain not only the newspapers, but all of us. These are what keep turning the wheels of social and economic progress.



A view from the air of the great British Empire Exhibition which opened at Wembley, England, April 23, 1924.

The World Power Conference at London

By Herbert N. Casson
(Owner and Editor, The Efficiency Magazine, London)

NOW that the vast Exhibition at Wembley is coming to an end, the British people are agreed that the most important event at Wembley was the World Power Conference, which met in the first two weeks of July.

This Convention was inaugurated by the British Electrical and Allied Manufacturers' Association—commonly known in Britain as the BEAMA.

The Beama was organized in 1912. The war checked its growth and it was reborn in 1918. It consists of 200 firms, all British, with about $1,000,000,000 capital.

It is a fighting organization—this Beama. Its main object is to protect the electrical industries from the Commissioners of the Board of Trade. There is a Board of five Commissioners, whose will is law in the electrical trades. Only one of these Commissioners is required by law to be technical. The other four may be lawyers, professors or coal miners.

These Commissioners are Czars in all matters pertaining to electricity. No power station can be built, or even extended, without their consent.

To make matters worse, less than half of the electrical companies of Great Britain are private. The most of them are owned by municipalities. Even the big private companies of London are all doomed to be taken over by the City Council in 1971.

In all disputes, the Commissioners favor the municipal companies as against the private companies. There you have the reason why Britain is 20 years behind the United States in electrical development. Also, you can now see the reason why the Beama convened the first World Power Conference at Wembley. It was a heroic attempt to break free from the red tape of the Board of Trade, and to wake Britain up to the fact of her inferiority in the matter of power production.

The Convention was a success. Its Patron was Lord Derby. It was opened by the Prince of Wales. There were delegates from 40 countries. There were 320 papers by

Fig. 1. A general view of the English Electric Company's exhibit in the power division.

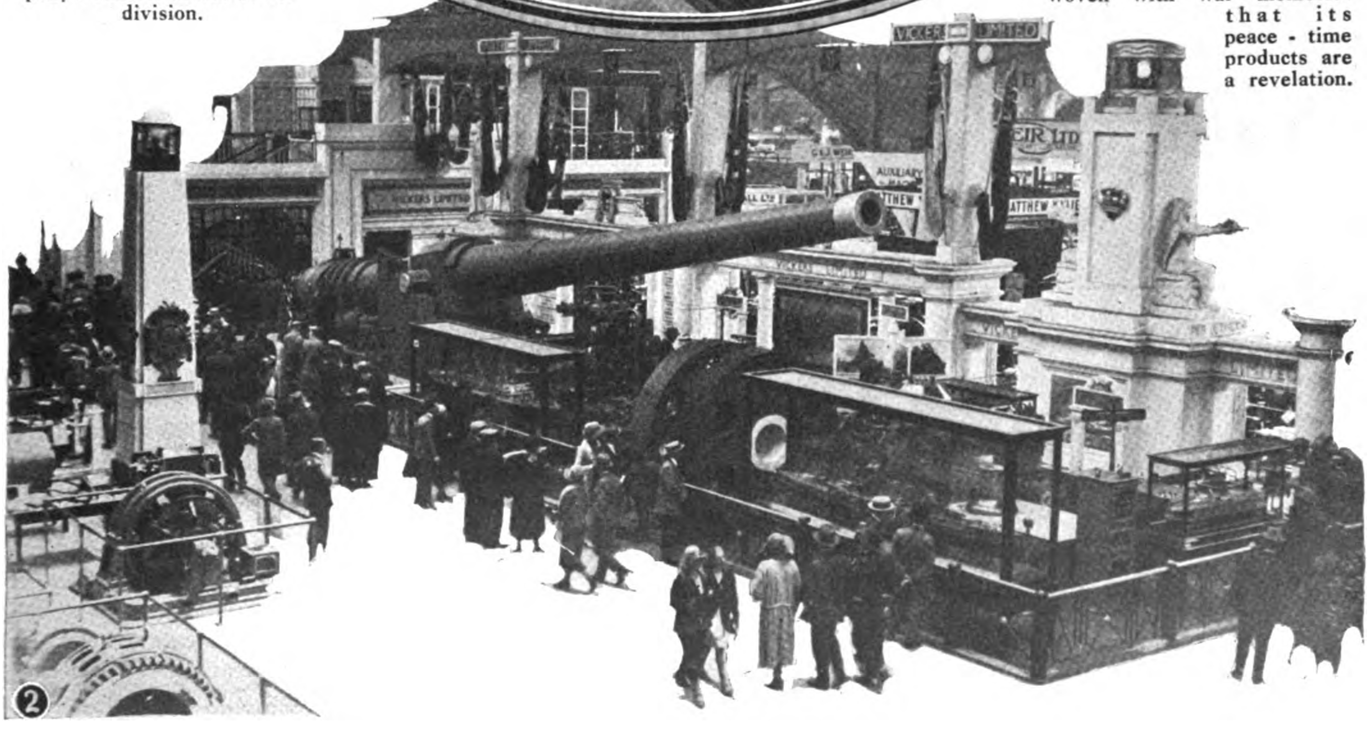


Fig. 2. The name of Vickers, to Americans, is so closely woven with war memories that its peace-time products are a revelation.

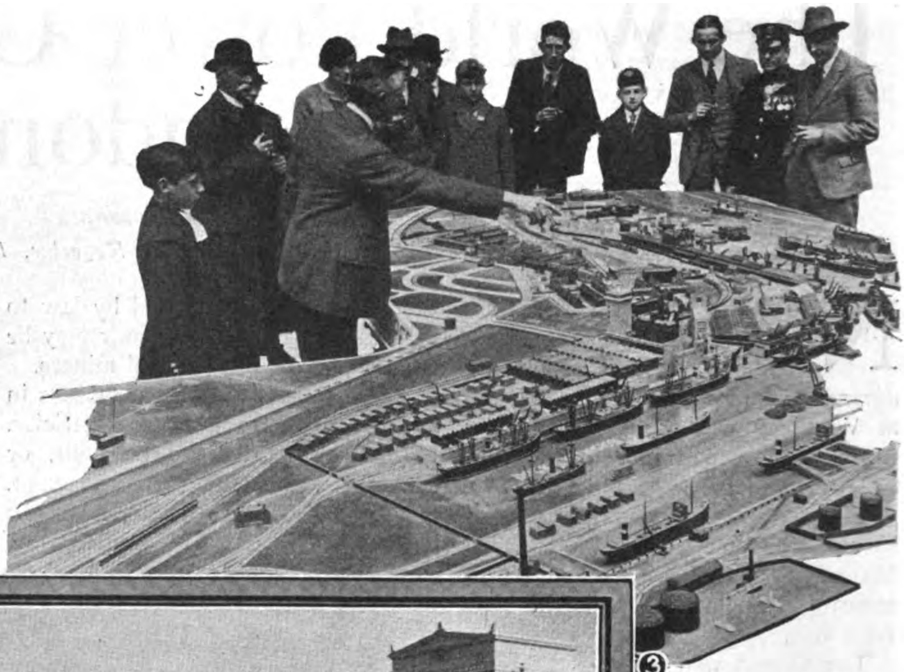


Fig. 3. A model of the Bristol Docks, which helps toward an understanding of Britain's distribution of products.

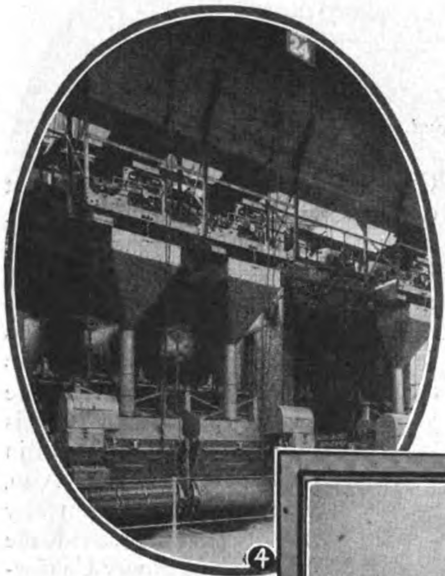


Fig. 4. A modern stoker-feed boiler installation one of the exhibits in the power division.

Fig. 5. The Canada Building at Wembley, where our Northern neighbor's products were exhibited.

Fig. 6. A section of the huge power division of the Wembley exhibition.

Fig. 7. That Great Britain is thoroughly alive to the importance of power, is shown by the completeness of the exhibits.

experts. The contents of these papers certainly did surprise England. And the most surprised people of all were the members of the Beama. They set out to astound England and they were themselves most astounded.

To the amazement of all the English delegates, engineers from America, Canada, Switzerland and Central Africa told tales of stupendous power development that made every plant in Britain look like a child's toy.

A Canadian delegate mentioned a Montreal hydro-electric company that had made $33,000,000 of net profits in the last six years. A Baltimore delegate went one better and mentioned a Maryland company that had netted $39,000,000 in the last six years. Then a Chicago delegate arose and remarked that there were three power stations in Chicago that produced more power than the 77 power stations of London.

The report made by the Swiss delegates was even more extraordinary. In this tiny Republic of the Alps, there are now 7,000 power stations, delivering 1,500,000 hp. Switzerland has electrified her farms as well as her railroads and factories. She has 750 units of electrical power per capita, as against 130 in Great Britain.

Sixty per cent. of her water power is now being used. While Europe was at war, Switzerland was harnessing her waterfalls and rivers and making dividends out of her snow-capped mountains.

Switzerland is now so far in advance of Britain, that if Switzerland stood still, it would take Britain 16 years to overtake her.

No doubt, had any prize been offered for rapid development of power resources, it would have been easily won by the Swiss Republic. Electrically, Switzerland is now further advanced than any other country in the world. She has one kilowatt for every 4 people, as against one for every 7 in America, every 12 in Britain, every 23 in France, and every 24 in Italy.

What impressed England most was the swing to water power in all parts of the world. England has no water power that is worth mentioning. True, a paper was read by Professor A. H. Gibson on the "Water Power Problem of Great Britain and Ireland;" but there was lit-

(*Continued on page* 60)

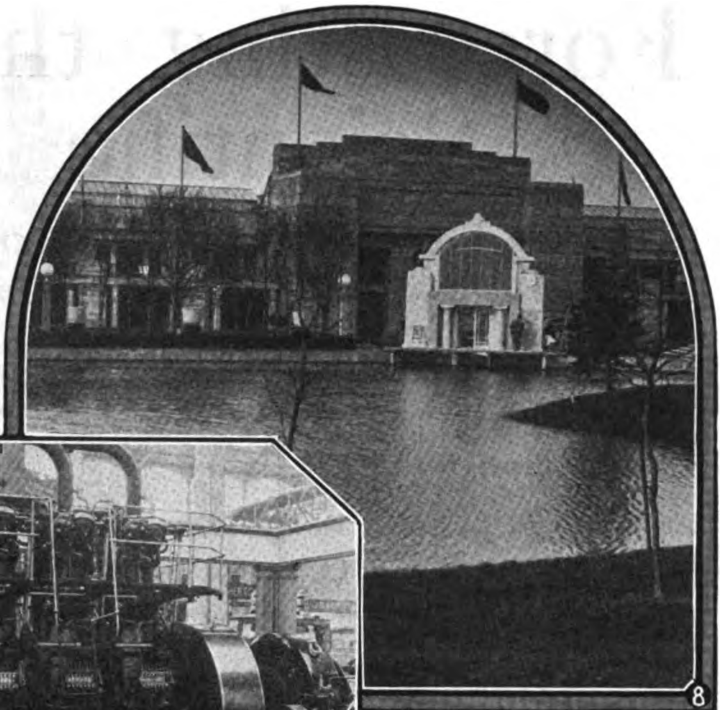


Fig. 8. The Palace of Engineering, in which were housed the exhibits of power equipment.

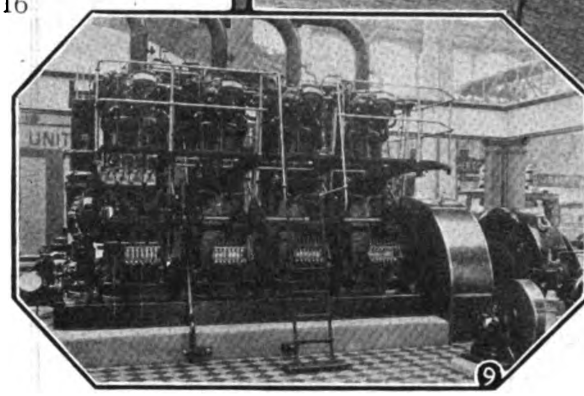


Fig. 9. Below—An injection type oil engine, direct connected to electric generator. This type installation was used to light the exhibition.

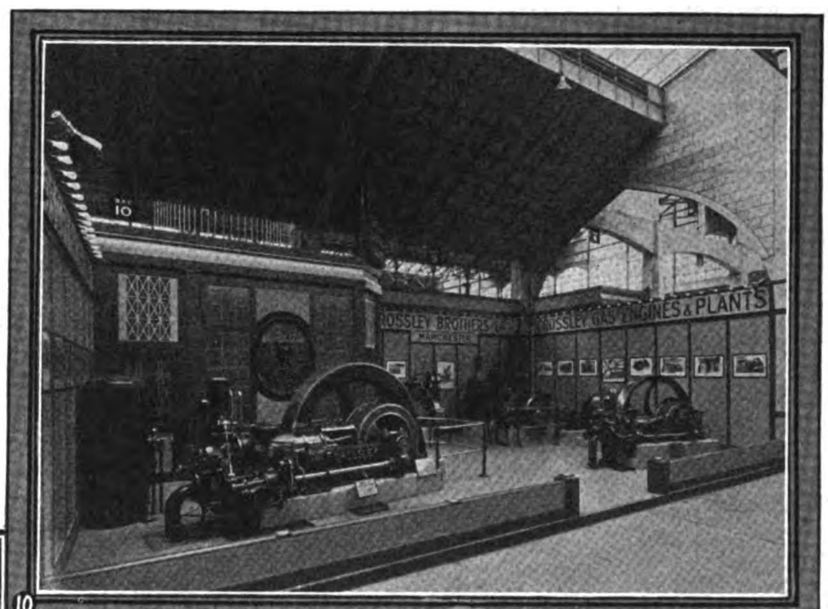


Fig. 10. Oil engines and gas engines received their share of attention.

Fig. 11. High tension transmission is a live subject holding the hope of long distance electric power transmission.

Fig. 12. Below—Another one of the exhibits of power units in the Palace of Engineering.

Forecasting the Future by Scientific Methods

How Telephone Engineers Plan Years Ahead

By Francis A. Westbrook

EVERY successful business undertaking must of necessity take into account, to some extent, the growth which it expects or hopes to make. The reasons are, obviously, that unless the facilities, financial, mechanical and human, are ready when the increased demands occur there is sure to be loss of business, profit and good will. Undoubtedly in a great many instances these forecasts are based very largely on what the owners in their enthusiasm would like to have happen, with the disastrous results that we saw after the post-war boom, for instance. Many other concerns, however, use scientific methods in planning for the future and what can be done in this direction is almost startling in its benefits.

Some of the large public utilities have probably developed the methods of forecasting their business requirements to the highest degree, and foremost among these are the companies comprising the Bell Telephone System. This, naturally, is because a public utility must not only be prepared to render its service when required, but must build up each unit of its plant so that it may be added to when necessary, without undue delay and without excessive cost or replacement of existing plant. For instance, it would be bad for the service and wasteful of money to

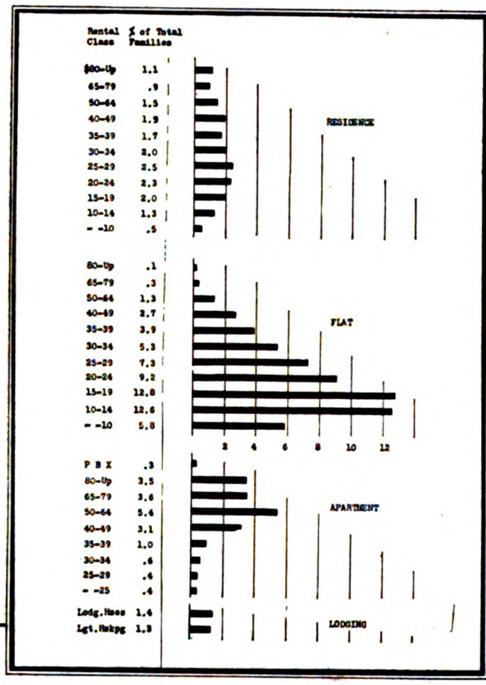


Fig. 1. Note that here 14% of families live in private houses at a rental of $50 or less, 58% in flats, and 5.5% in apartments. Contrast this with another typical city, charted in Fig. 3.

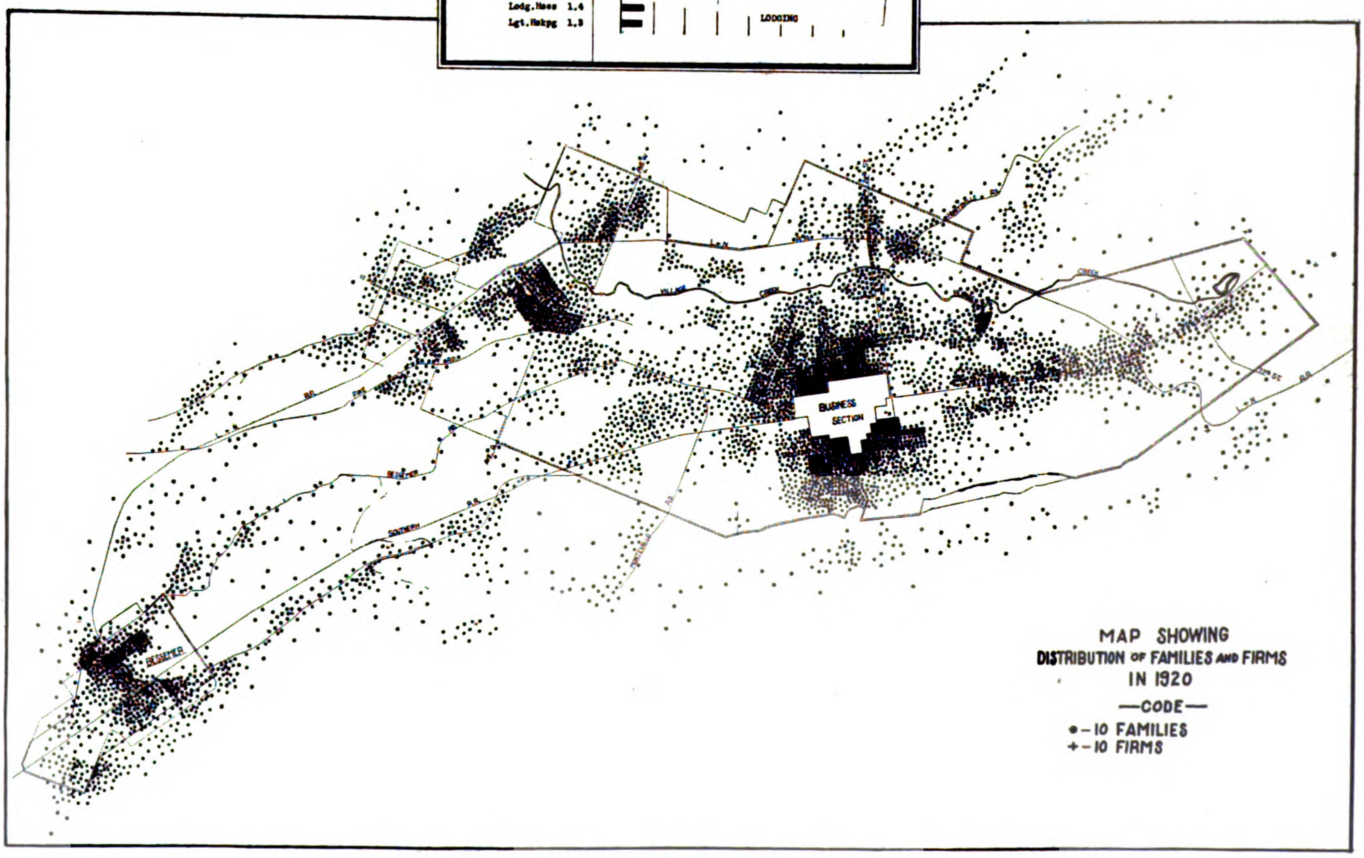


Fig. 2. Maps like this, showing existing families in a community (not merely within city limits), are prepared from records of a canvass. The canvass shows actual conditions; and facilities must be planned, and central offices located, accordingly, to meet the growth of demand.

build an additional pole line between two cities this year to care for increasing toll business, if it could be foreseen that in a year or so the amount of traffic will necessitate a cable between those two points; for under such circumstances the problem of furnishing relief would be handled differently than if an, at least, approximately correct idea of future requirements were lacking. This is an instance presupposing just two communities, but when it is realized that the telephone system covers the whole country, the importance of such considerations is evident.

It will readily be seen that the decision of this question and, in fact, all of the forward-looking questions pertaining to the telephone business, depends fundamentally upon the movement of population. This study of the movement of population is extremely interesting and sometimes complex. It calls for the consideration of such matters as birth rate, immigration, industrial growth, railroads, improved highways, the effect of one community on another, etc. Work of this kind quite naturally falls to the engineers. This may seem like an anomaly because engineering is popularly looked upon as an exact science, whereas forecasting is most decidedly not exact, and cannot be. Nevertheless, the analytical treatment of even a subject like this, which is based on a combination of the study of minute details supplementing a broad viewpoint of the whole problem, calls for engineering methods of the highest order.

Certain events, of course, such as the World War, with its accompanying impulse to industrial growth in the cities, was unpredictable, but previous studies indicated to a large extent the sections in which such growth would take place when it did come. The result was that although the change came sooner and at a more accelerated rate than was expected, still the existing plant had been laid out with those conditions ultimately in view and there was, consequently, a considerable degree of preparedness for it. The difficulties experienced during that period in meeting demands were due mainly to lack of supplies and plant because of the war activities. The fact is that most communities are growing along certain well defined lines which can be analyzed and studied; furthermore, the events which could not be foreseen have been both less numerous in the past than might have been expected, as well as sufficiently gradual in most cases to permit of their being given due consideration. For instance, the advent of the automobile which is now being followed by a great extension of good roads is causing and will cause in the future much redistribution of population but, as it is physically impossible to accomplish such changes except over a period of years, this influence may readily be studied. The thing is to recognize such factors as soon as they appear.

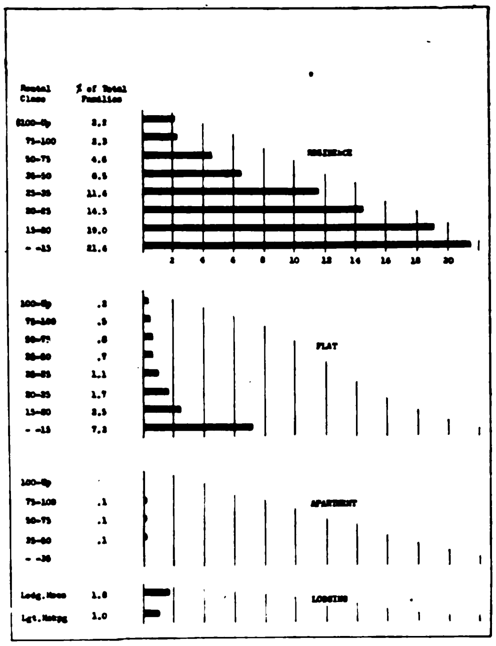
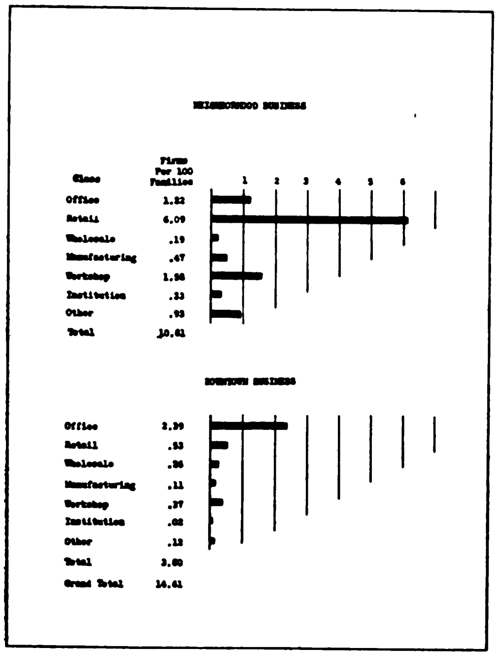
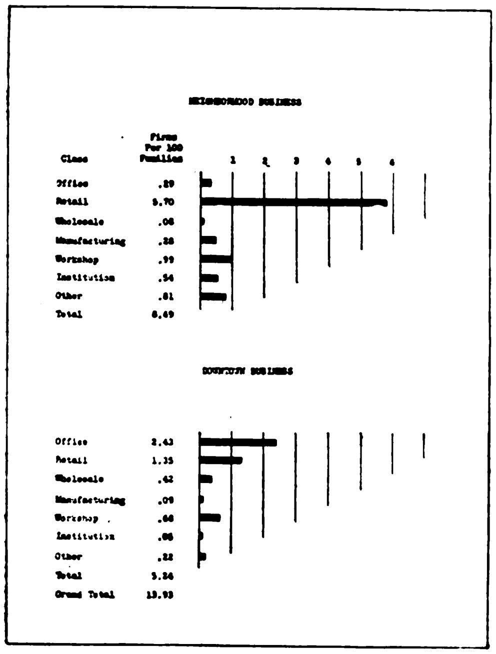


Fig. 3. Here, in contrast to Fig. 1, 73% of families in this city live in private residences; 13% in tenements, and practically none in two-family or apartment dwellings.





Figs. 4 and 5. There is less variation between these two types of cities, in connection with the number of business firms. The important item, of course, is retail and office business, rather than manufacturing.

The effect of the automobile, for instance, on the redistribution of rural population especially, is very interesting. As it is an easy means of reaching the superior advantages of the larger towns, it is causing a definite growth in the "county seat" type of community as compared with the country village. This is now a very decided tendency, and one which is being taken into account.

Estimating Population for the Whole Country.

The telephone engineers estimate population first from the standpoint of net immigration and the birth and death rates. A few figures will be illuminating and show the importance of these factors. Between 1910 and 1920 there were 2,700,000 more people who entered the country than

(*Continued on page 94*)

High Production With a Lowered Accident Rate

By Curtis C. Myers

IT is the purpose of this article to show that it is possible to increase production and at the same time decrease the number of accidents to the workers in the metal working industry which is being considered.

This is contrary to the general opinion that increased production carries with it, as a matter of course, a definite increase in the accident rate.

It is desired to show that the men who are giving their thought and efforts to the design and construction of the proper machinery for more efficiently carrying out the various operations in a modern metal working plant, are incorporating into their designs, not only the necessary construction which will allow the mechanism to be driven much harder in every way, but also other features of design which will allow the operator of this mechanism to turn out more work with less danger from accident and fatigue. Undoubtedly, in many cases, this decrease in accidents has been entirely secondary in the mind of the designer and has only shown up prominently when the particular machine has been put in operation. It will also be shown that in many instances the designer's problem has been purely and simply to reduce the risk of accident and that the final result has been both a reduction in accidents and an increase in production.

It would appear desirable to emphasize this point of increasing the safety of operation as well as increasing the production in a new design of machine because when the question of safety ranks equally with that of production, designers and machine builders in general will give more attention to this all im-

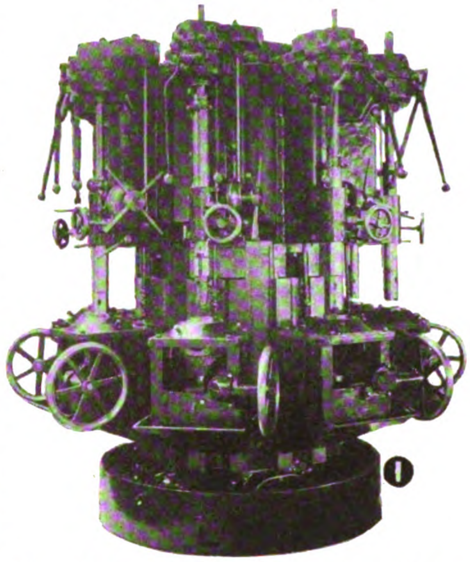


Fig. 1. This 6-spindle drill revolves constantly about the central column lessening fatigue for the operator.

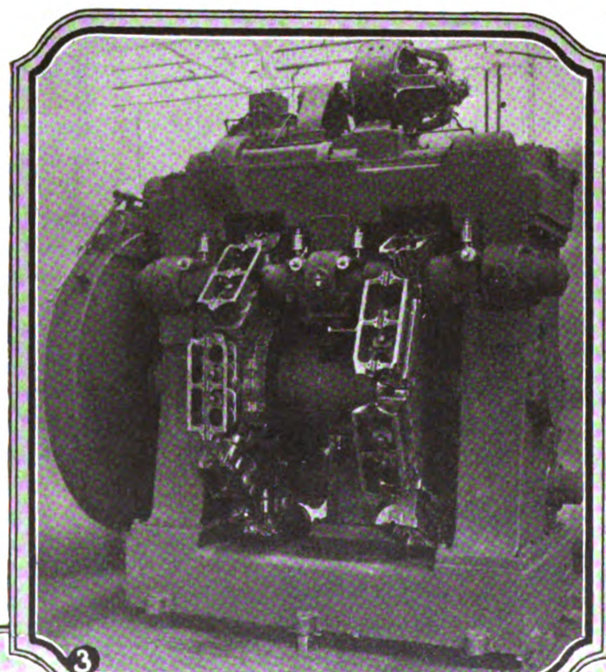


Fig. 3. A special 8-spindle drum type miller. Cutters are shielded, and operators in very slight danger of accident.

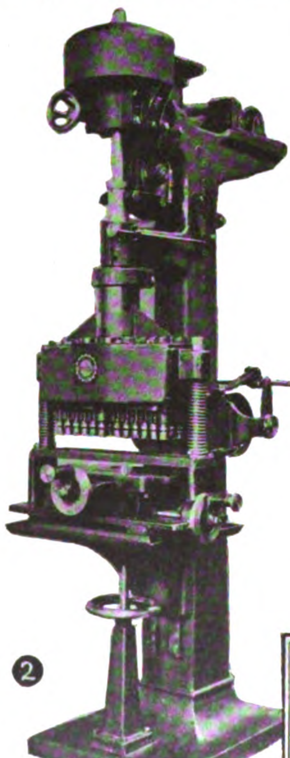


Fig. 2. Sixteen operations drill 576 holes. After the jig is filled, the operator has both hands away from the danger points.

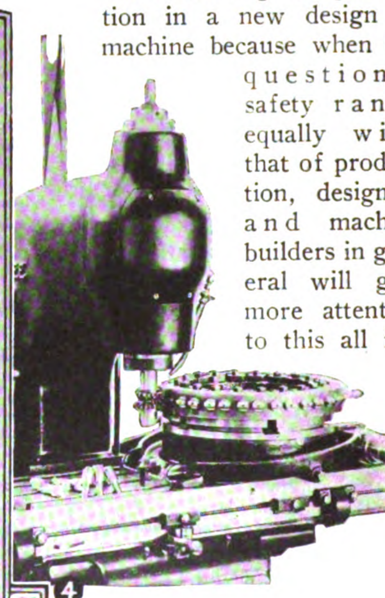


Fig. 4. A standard vertical miller with circular milling attachment which allows the operator ample time to remove and refill the fixture without danger.

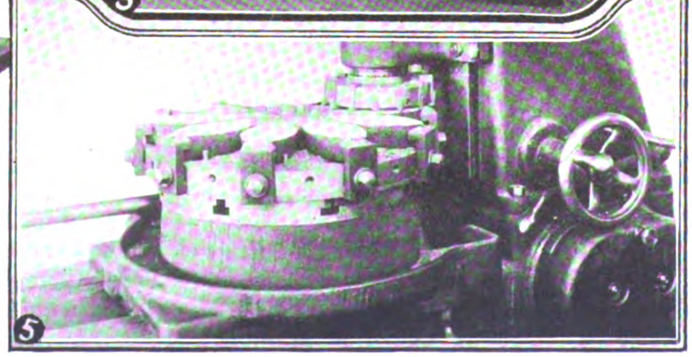


Fig. 5. A heavy duty miller with circular table and fixture; seven of the ten positions being safe for the operator.

portant problem of accidents.

The common feeling at the present time is that any noticeable increase in production carries with it unquestionably an increase in the accident rate. It is natural to hold this view because higher production generally means higher speeds and this calls for quicker motions from the operator. It is on the high speed machinery that accidents occur most frequently, particularly those served by individual operators. It is this class of machinery, therefore, in which we are particularly interested.

The National Bureau of Casualty and Surety Underwriters recently completed an analysis of 350,000 industrial accidents, all occurring in a single year. Mr. Arthur C. Carruthers in the March number of *Safety Engineering* quotes from this analysis as follows:

"The most striking revelation of this analysis was the seriousness of *the point of operation* on machines as an accident factor. Safety engineers have always recognized that unguarded points of operation on machines constituted one of the most prolific

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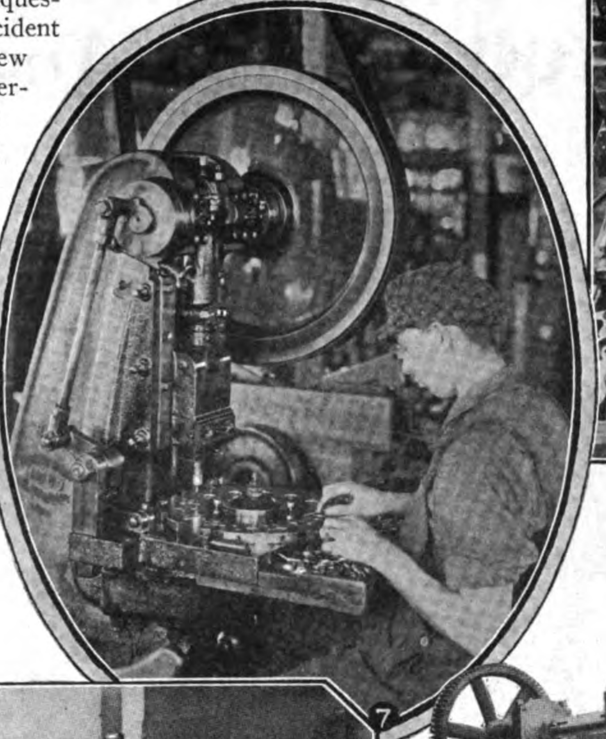
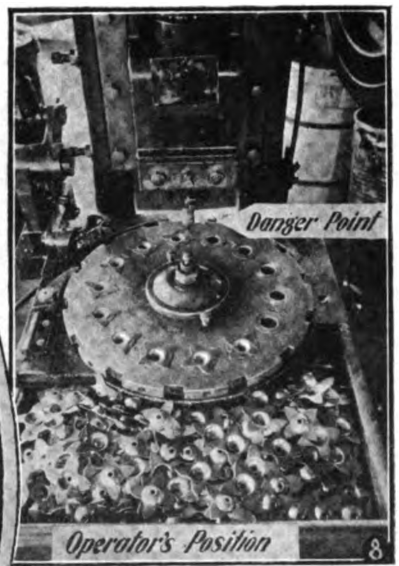




Figs. 7 and 8. Showing the safe operation of a punch press running 60 strokes per minute.

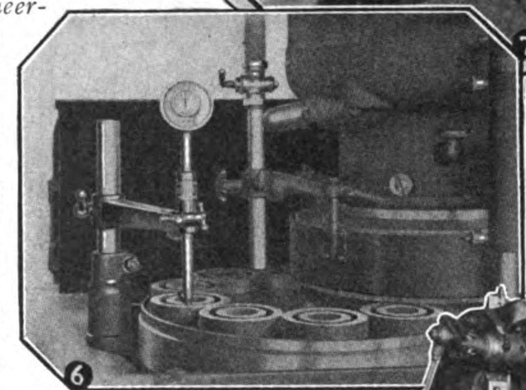


Fig. 6. A high power vertical surface grinder. In operation, the water guards protect the operator.

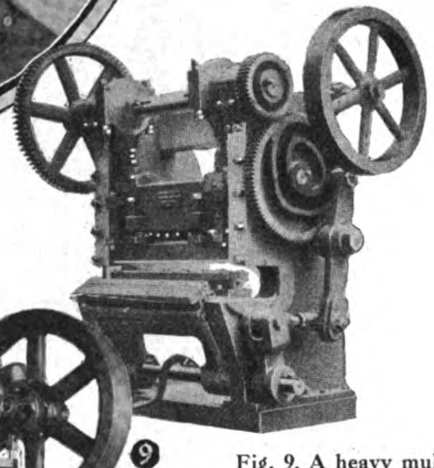


Fig. 9. A heavy multiple punch, especially designed as a safe machine to operate.

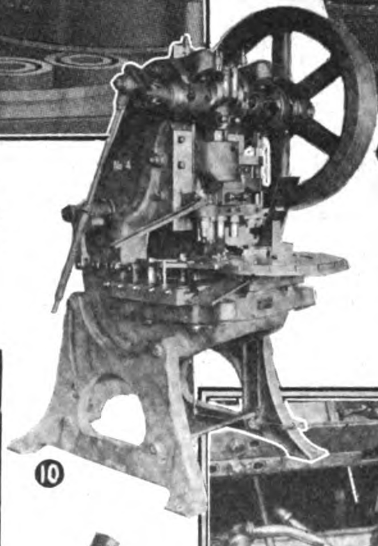
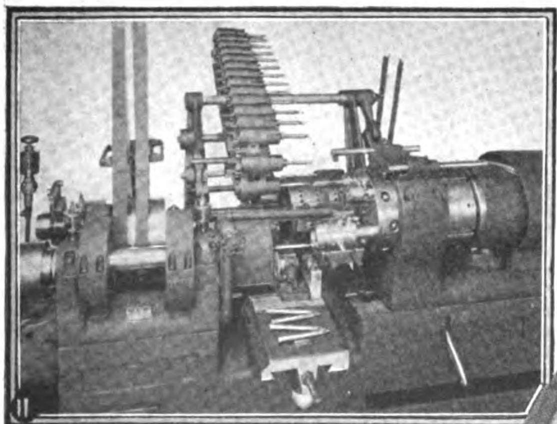


Fig. 10. A dial feed where the operator's hands are protected because of slides which feed and receive the work.



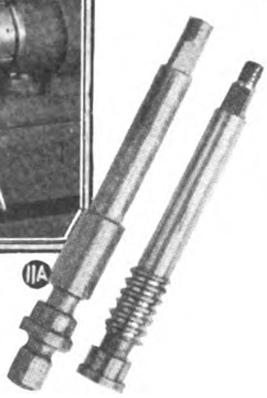


Fig. 11. Magazine feed on an automatic forming machine. The operator is little more than a watcher. Insert shows some of the work.

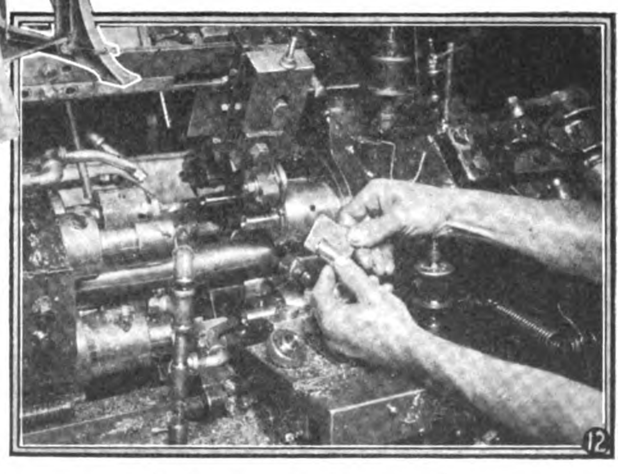


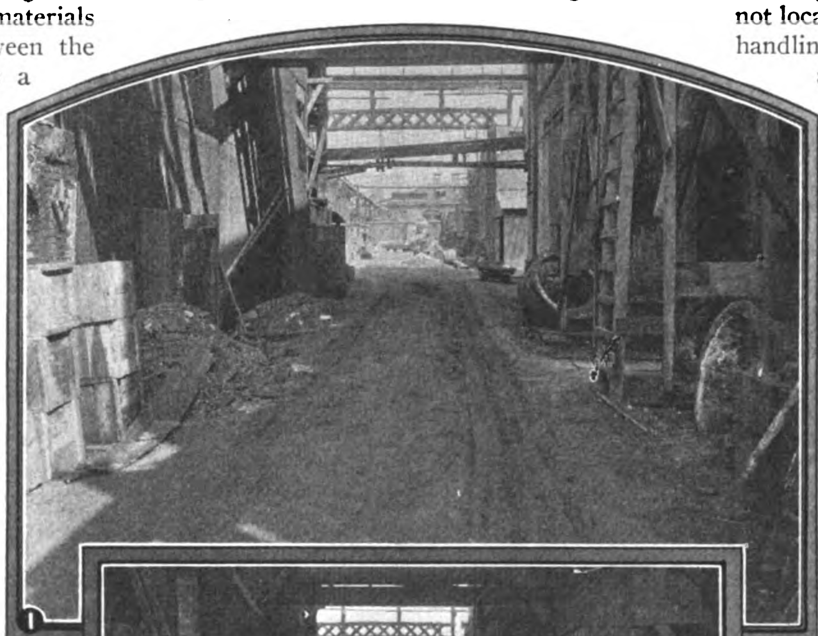
Fig. 12. A 4-spindle automatic, economical of floor space, and possessing low accident risk.

Making the Plant Yard a Production Asset

By William G. Ziegler and Matthew W. Potts

FEW of us realize the importance of the plant yard in a medium or large sized plant. The manner of handling raw, semi-finished and finished materials in the yard and between the various buildings has a very marked effect on the cost of production. It is not so long ago that no thought was given to the subject of yard facilities. Buildings were located at random without considering their relation to one another in the sequence of manufacture. In old existing plants it is often very hard to overcome these earlier shortcomings but a serious study of the problem often gives very promising results. It is often necessary to entirely rearrange a plant in order to get the most economical arrangement, but once the plan has been made and all are agreed on it, the change should be made as soon as possible in order to save further losses due to uneconomical layout. In new plants the buildings are not located until the method of handling materials in the yards and between buildings has been carefully worked out. In fact, the buildings are built around the handling equipment instead of installing handling equipment in standardized sizes of buildings. In order to straighten the flow of production, conveyors may be run in tunnels under the yard or on overhead steel structures across the yard from one building to another. These overhead structures should be at least fourteen feet high in the clear to allow trucks to pass under them.

The maintenance of the various items of handling



Figs. 1 and 2. A good road from plant yard equipment makes for cleanliness and higher efficiency.

Fig. 3. Portable belt conveyors have to operate under all weather conditions. Are you protecting yours?

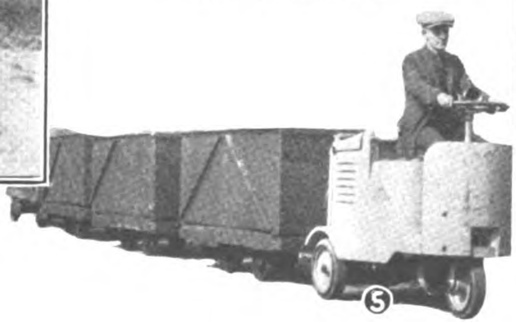


Fig. 5. The small wheels on tractors and trailers give better service in the plant yard when operated on good roads or runways.

Fig. 4. Operating industrial trucks over rough ground and sharp railroad tracks is both dangerous and expensive.

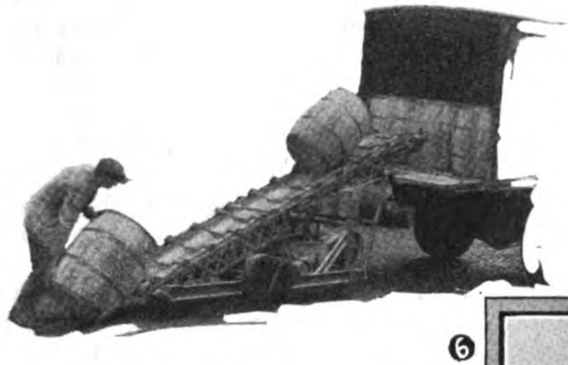


Fig. 6. Portable slat conveyors of this type stand a lot of abuse but frequent alignment and good maintenance will increase their life.

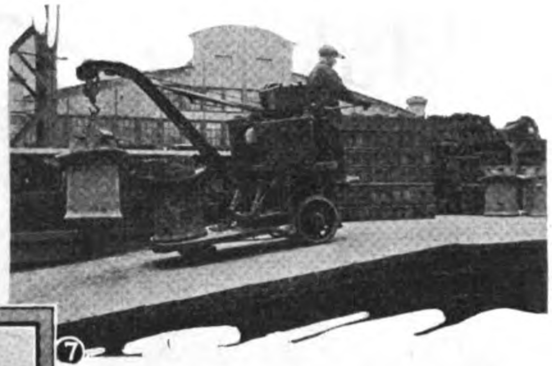


Fig. 7. If the initial cost of concrete roads cannot be justified, plank roadways should be installed.

equipment used in the modern plant yard is an important part of plant maintenance. Inasmuch as this equipment is subjected to the ravages of rain and snow and heat and cold, in addition to the ordinary depreciation due to wear, this class of outdoor equipment needs more care than similar equipment inside the plant. It is human nature to slight the maintenance of outdoor equipment in wet or cold weather, but this should not be allowed if dependable service is expected. The roads in the plant yard are important links in the transportation chain and they should be kept in good repair. Walks, too, should be kept free from holes, as these are used by the smaller trucks. Fences, sheds, and other small yard buildings must be kept in repair and all underground piping must be maintained in good condition.

It is usual to draw on the yard gangs for furnishing labor for the many general work jobs around a plant. The well-trained plant yard laborer is at home helping a skilled mechanic or doing any kind of labor work. It is to be expected that each crew of skilled mechanics will have their regular helpers, but when extra help is necessary, the yard men should fill in. Usually, the transportation department, or receiving and shipping department takes charge of handling incoming and outgoing freight, but when heavy or bulky merchandise is handled, the yard gang is called on to furnish labor. With the right kind of handling equipment, the number of men necessary in the yard gang can be cut down very greatly as apron conveyors, overhead cranes, and monorail hoists are now quite

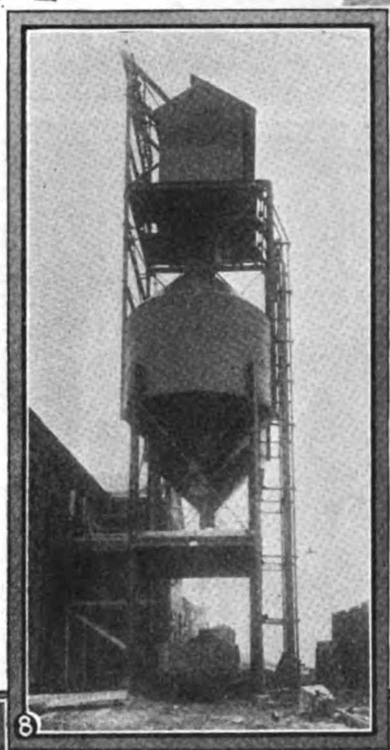


Fig. 8. Skip hoists and outside storage tanks require constant supervision by the maintenance department. Paint is a great preservative.

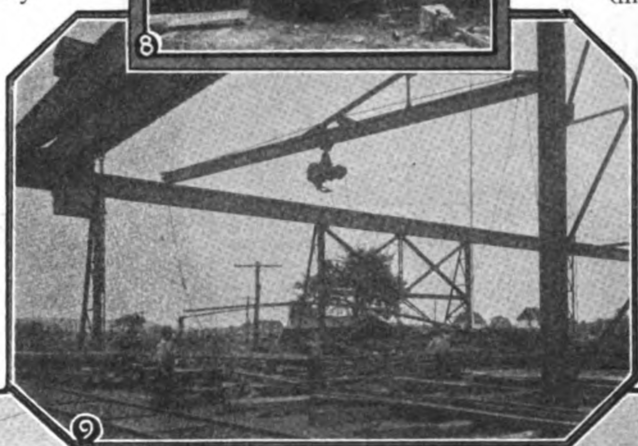


Fig. 9. Equipment such as an electric hoist should be provided with some form of protection.

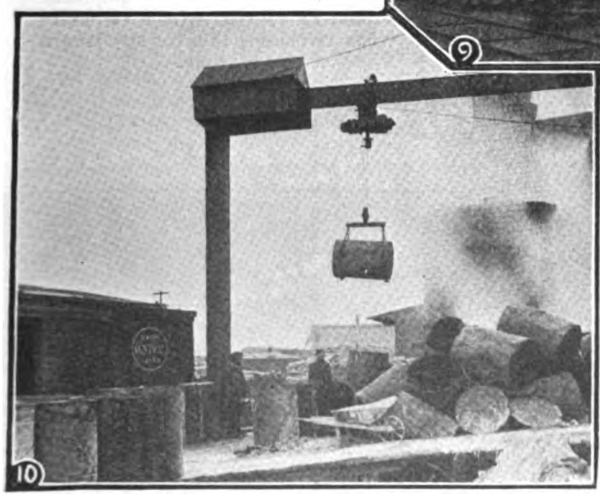


Fig. 10. The little dog house at the end of the crane track is one form of protection for the electric hoist.

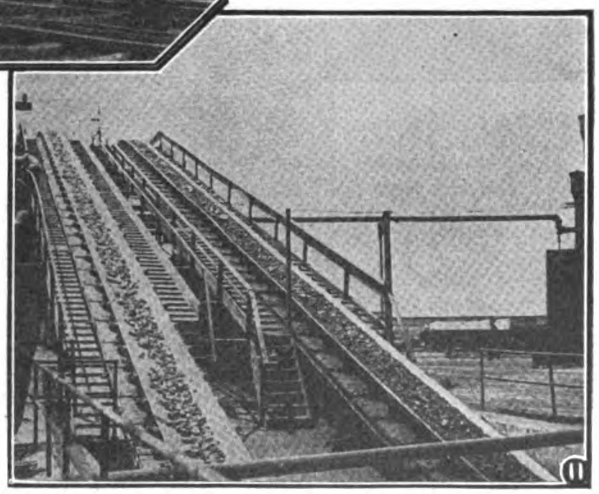


Fig. 11. Belt conveyors are frequently installed out in the weather. A point to watch in such installations is puddles of water remaining on the belt.

commonly used on loading platforms. If loads can be set on lift truck platforms directly after being unloaded from the cars, trucking by hand or electric lift trucks is simplified.

Outdoor materials handling machinery is often rough, crude-looking equipment with large toothed gears, and because of this fact, the equipment is not maintained properly. It is unfortunate that this is so, because without proper care, the equipment cannot give the long service for which it was built. It should be considered as important as any other production machinery in the plant and given the same amount of care and lubrication. In general, it is most important to take care of the power unit on all types of handling equipment, whether it be a motor, gasoline engine, or steam engine. If this unit is carefully taken care of and oiled and greased regularly and protected from the weather, it will give as good service as if it were in-

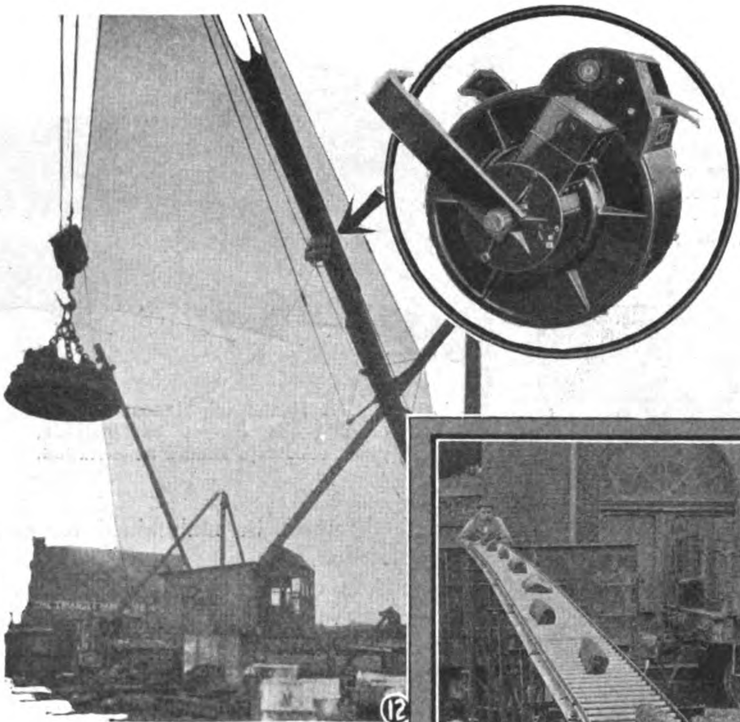


Fig. 12. Automatic reels reduce maintenance costs on all extension cables for electric magnets or portable machines.

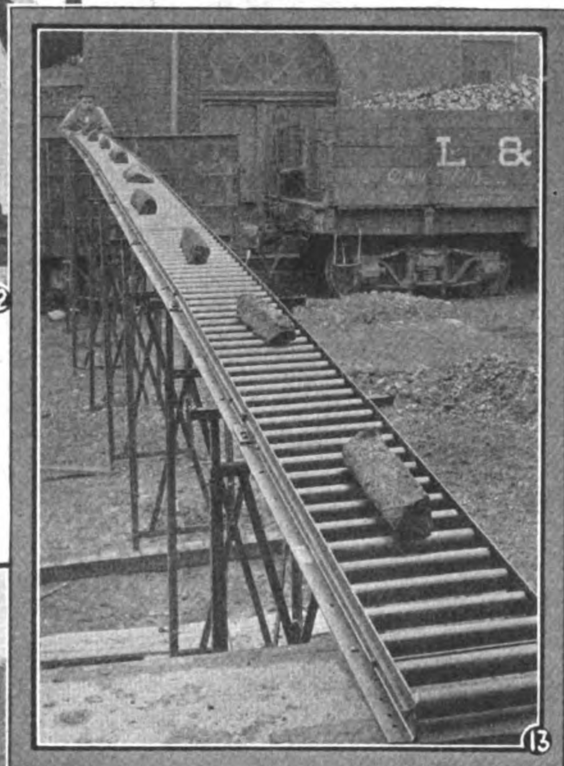


Fig. 13. Gravity conveyors require plenty of paint and oil as rust is their greatest enemy.

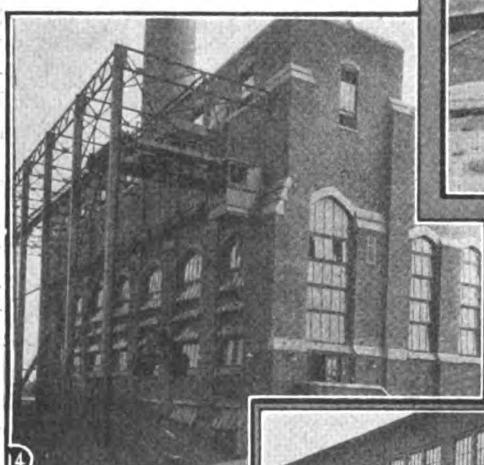


Fig. 14. Crane trolleys and cabs should be covered to protect both machinery and operator.

Fig. 15. The above equipment should be covered with a tarpaulin when remaining idle for any length of time.

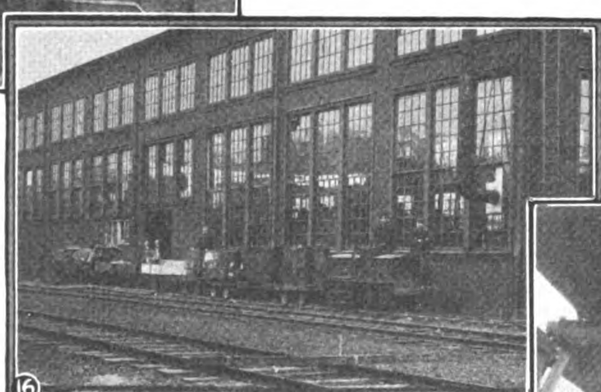


Fig. 16. Storage battery locomotives operating on industrial tracks should be protected from derailment by proper track maintenance.

Fig. 17. A roof over the craneway protects machinery and provides a shelter for workmen.

doors in the plant itself. A great deal of outdoor equipment is rendered useless each year due to rusting away. This equipment should be painted at least once a year with a good wear and weather resisting paint. Before painting, the surface should be wire brushed and any rusty spots touched up with red lead or other primer.

Perhaps the most important items in connection with yard maintenance are coal and ash handling equipment, for the economical operation of the power plant is usually dependent on the proper functioning of this equipment. The methods of coal storage are quite varied, dependent on the physical layout of the plant, but once the coal reaches the power plant the distribution is usually by elevators and conveyors. The skip hoist is often used instead of bucket elevators and requires very little maintenance. The cable must be watched and the winding drums and brakes kept in good condition. With push button control to start the skip upward it may be made to raise, dump and return to the pit. Coal crushers require only lubrication if they are equipped with safety devices to protect them against accidents due to stones or other foreign matter in the coal. Bucket elevators that are well built with hardened bushings and pins in the side chains will last a long time. All coal handling machinery, however, is subjected to more than the usual amount of dust and unless it is given care it

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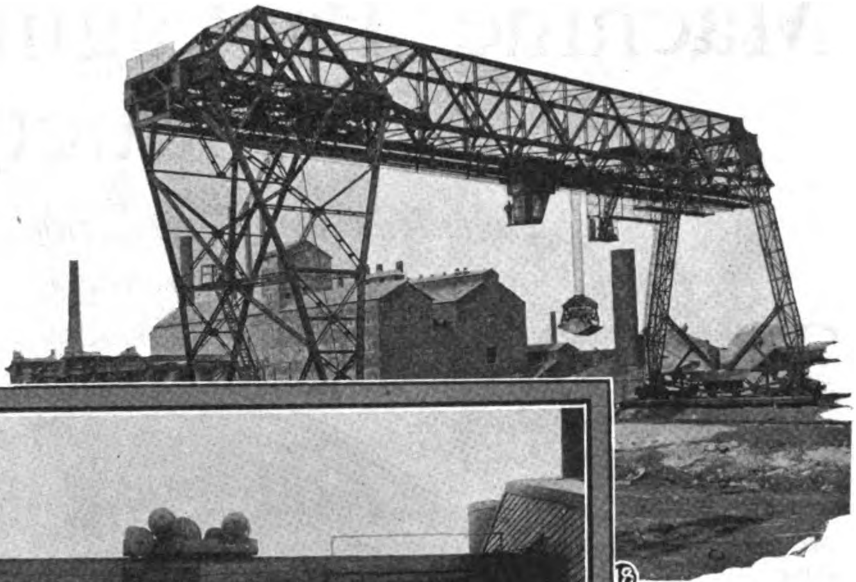


Fig. 18. Gantry cranes have a lot of structural work which requires constant supervision. The tracks on which they operate should always be kept in alignment.

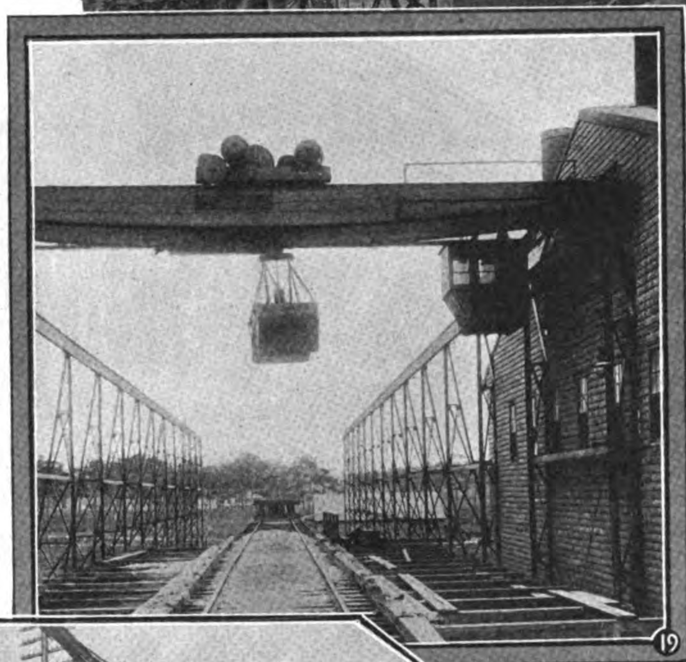
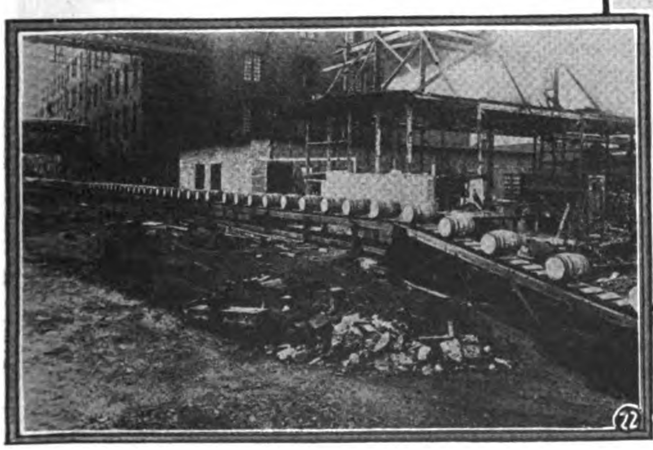


Fig. 19. An unprotected overhead crane hoist is an expensive piece of equipment to operate.

Fig. 20. It is important to enclose gasoline and locomotive cranes with some sort of a cab both for protecting the machinery and the operator.

Fig. 22. For a slight additional cost, this platform conveyor could have been enclosed. In new plants this class of equipment is being located in tunnels.



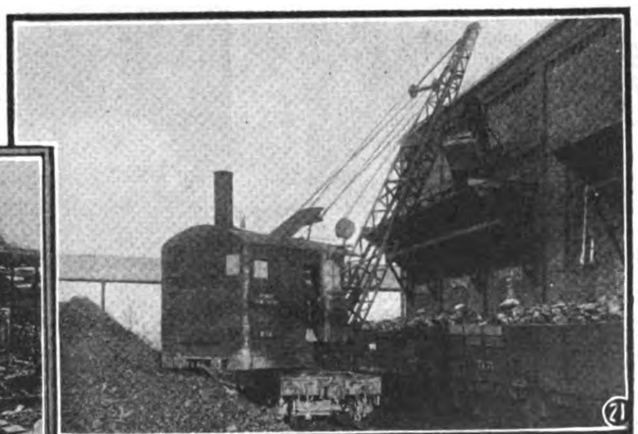


Fig. 21. This all-metal crane cab insures adequate protection in all classes of weather.

Machine Packaging of Food Products

Ingenious and Interesting Adaptations

By C. H. Gullion

THE purpose of this article is to tell what one large company has recently accomplished in several typical cases in the Machine Packaging of Food Products.

The article deals primarily with the packaging of lard and cheese but reference is also made to investigation methods, coördination of ideas, and interesting adaptations from other industries.

The universal practice on carton lard has heretofore been to use an end opening carton and an ordinary paper bag. The bag was inserted in the carton, (previously formed up by hand) the operators usually inserting the hand inside the bag to ram it in the carton. Aside from the question of sanitation, the new machine method to be described later being a vast improvement in this respect, the practice of trying to spoon the lard from the bottom of the bag has always been an annoyance to the housewife, in that it has been difficult to extract all the lard from the deeper end opening carton—and waste of lard or greasy hands has usually resulted.

The new lard carton and its distinctive features are pictured, in contrast to the old, in Fig. 2.

The parchment paper sheet liner, which has been substituted for the old style bag, is fed into a forming and lining machine (Fig. 1) along with the new die-cut carton. This machine neatly and effectively forms, lines and locks the cartons, dropping them to a conveyor belt ready for imme-

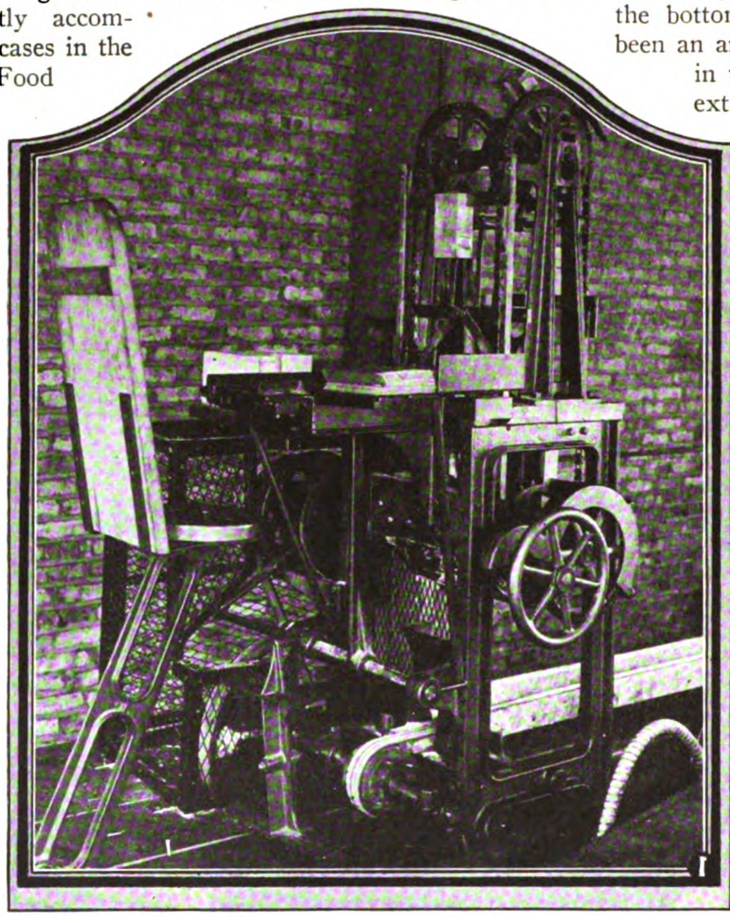


Fig. 1. Forming and lining machine which forms, lines, and locks the new lard cartons.

Fig. 2. The old and the new package; note the greater convenience of the one at the right, which opens lengthwise.

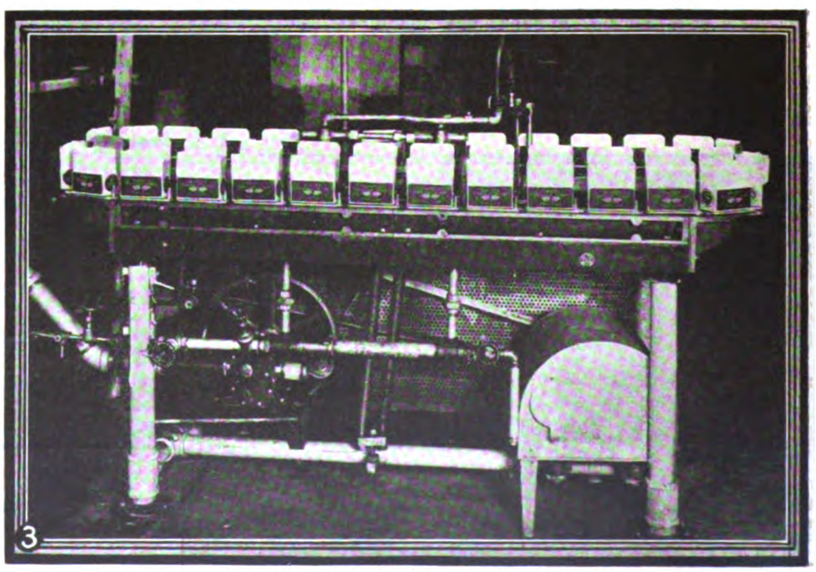


Fig. 3. **Filling lard cartons by machine so timed as to deliver the proper quantity to each carton.**

diate passage to the Filling Machine.

While the basic idea of a formed and lined carton is not new, much painstaking development work had to be done before this new Lard Carton was perfected. This development work involved shoulder to shoulder work with the die maker and printer at the manufacturer's plant, close coöperative work with the machinery company who built the machines, and persistent endeavor to get the carton just *right*—in such matters as "raised score lines," proper functioning "double lock," correctly designed "tuck-in" flap, symmetrical registering of the printing on folded ends of carton, etc.

The type of carton as formed and lined by these machines and as used in other industries, such as the biscuit or cracker industry, is usually hidden by a wrapper which makes careful carton design unnecessary—but the formed, lined and "double locked" carton in the case of this lard package, which is not wrapped, must present a very neat finished appearance.

The formed and lined cartons are automatically fed from a conveyor belt onto the chain carrier trays of the filling machine by an interesting device developed by the manufacturer—automatically and accurately filled by this machine and automatically discharged therefrom. The warm liquid lard flows from the filling machine outlet in a stream about ¾" in diameter, and the travel of each carton under the filling head of the machine is so timed as to give the proper weight of lard in the carton. There are two types of filling machines in use, as shown in Figs. 3 and 4.

The closing machine receives all filled cartons of the new type sent to it by belt from two distinct lines of equipment—each line comprising forming and lining machine and filling machine.

This closing machine (Fig. 5) neatly folds the liner, wrapping the contents within the

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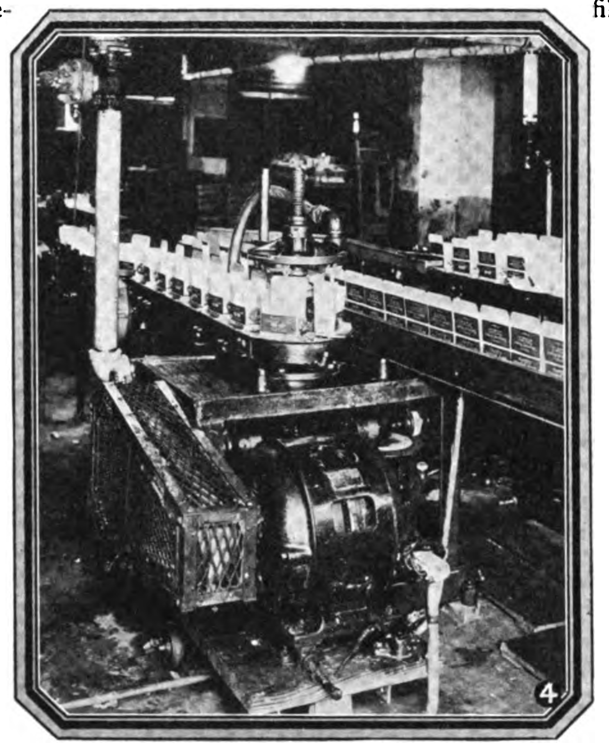


Fig. 4. Another type of filling machine, for filling lard cartons.

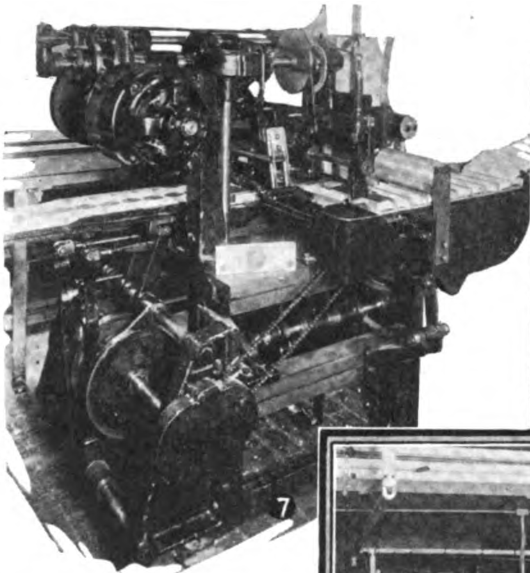


Fig. 7. A cartoning machine which takes the flat cartons from a hopper, opens them, inserts wrapped sliced bacon, and tucks in the carton flaps.

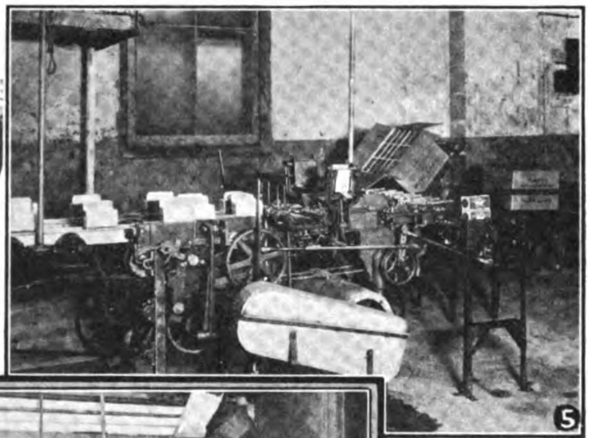


Fig. 5. From the filling machine, cartons pass to the closing machine (above), where they are handled at the rate of 80 per minute.

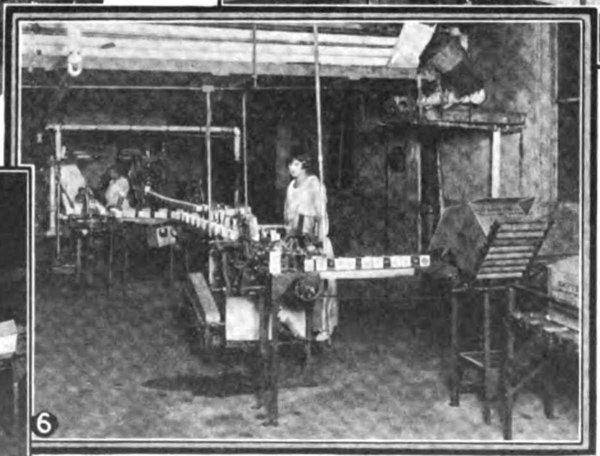


Fig. 6. A view showing the layout of machines which make, fill, and seal the lard cartons.

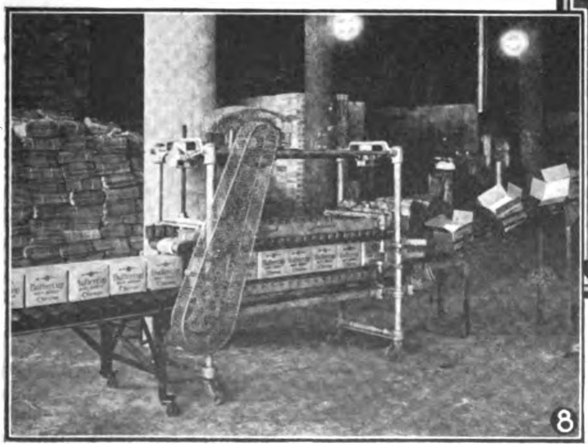


Fig. 8. Lard and cheese cartons, when filled, are each packed in corrugated containers here shown being sealed on a sealing machine.

The Automobile Industry

Factors Which Are Gradually

By John

IN man's increasing struggle to find the favored places on the earth's wide surface for production, profit, and happiness, industry is beginning to imitate agriculture and commerce, which from the very nature of their being have studied the geography of opportunity with infinite care.

Old minds change slowly. It was fitting that the strapping youth of American industry should lead its elder brethren in the now recognized necessity of locating factories scientifically so that the product can be made as cheaply as possible, and distributed with speed and economy.

The automobile industry stands out boldly among the others, and challenges the customs and inertia of 200 years. A necessary luxury that makes life more abundant, a vehicle whose cost goes down as everything else doubles, a contraption that denies perfection and stimulates invention, the motor vehicle escapes the petrification of a score of other products and produces industrial leaders and keen competition whose slogan is perforce service and whose permanency is assured.

This industry bows down to the consumer, pursues him with ever better styles and mechanisms at ever-lower prices, and is logically rewarded

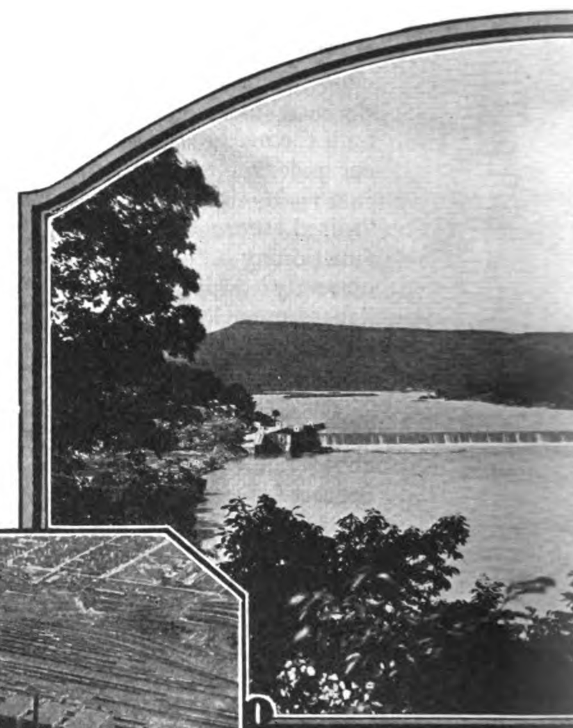


Fig. 1. The Southern automobile industry will be a new development within the next five years. Hardwood is now shipped north, and cars shipped south. Chattanooga,

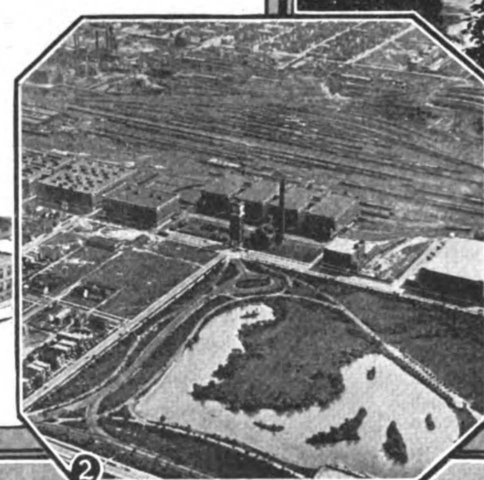


Fig. 2. Chicago is a great motor accessories manufacturing center. The Central Manufacturing District, shown below, is a good example of the excellent manufacturing facilities in Chicago.

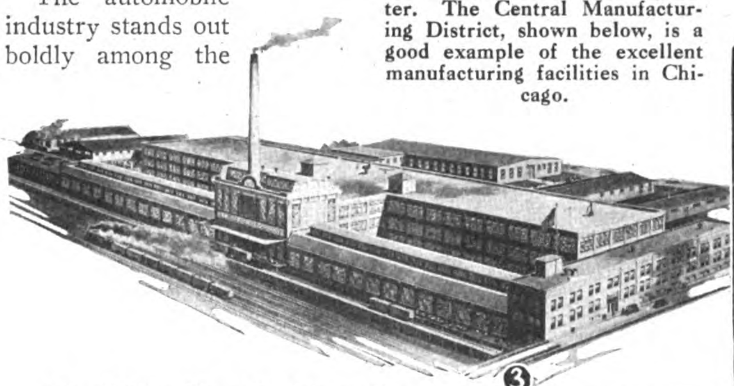


Fig. 3. The Chevrolet Motor Car Co., Fisher Body Co., Dunlop Rubber Co., and the Hewitt Tire Co., (shown above) are a few of the plants locating in Buffalo.

Fig. 4. The auto industry is not centered in Detroit. Trucks, particularly, **are made near local markets. This is one of the units of the Autocar Co. at Ardmore near Philadelphia, covering the rich Eastern market.**

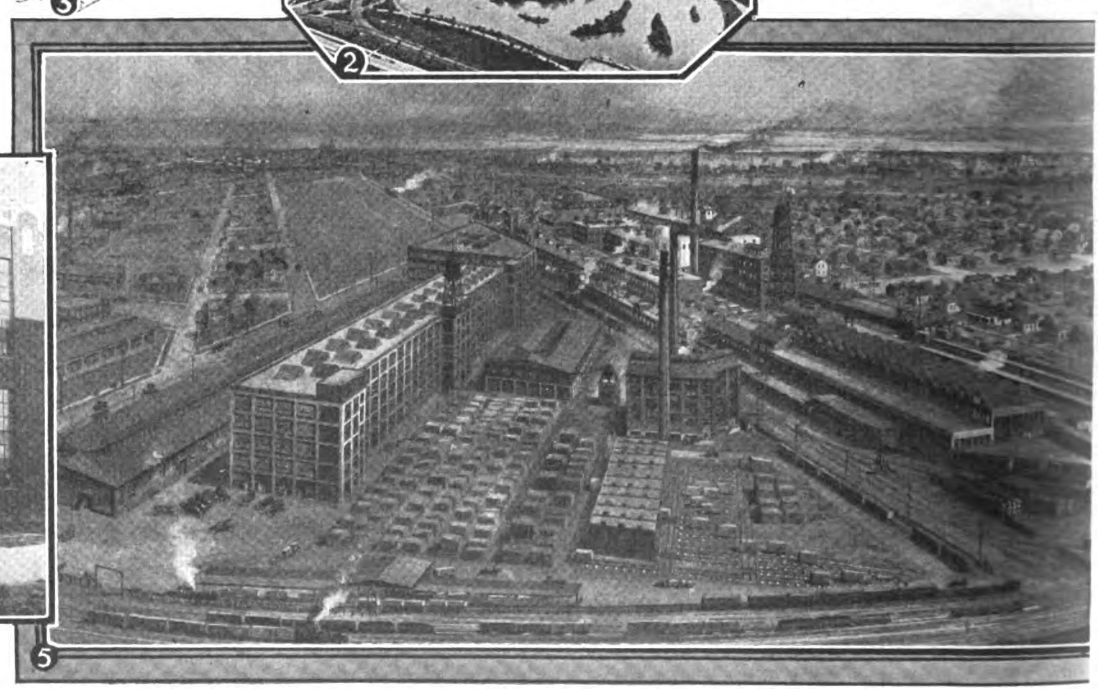


Fig. 5. The automobile industry is the child of the wooden coach business. This great plant of the Nordyke and Marmon Co. at Indianapolis which makes the Marmon car

Locates for Efficiency

Altering the Industrial Map

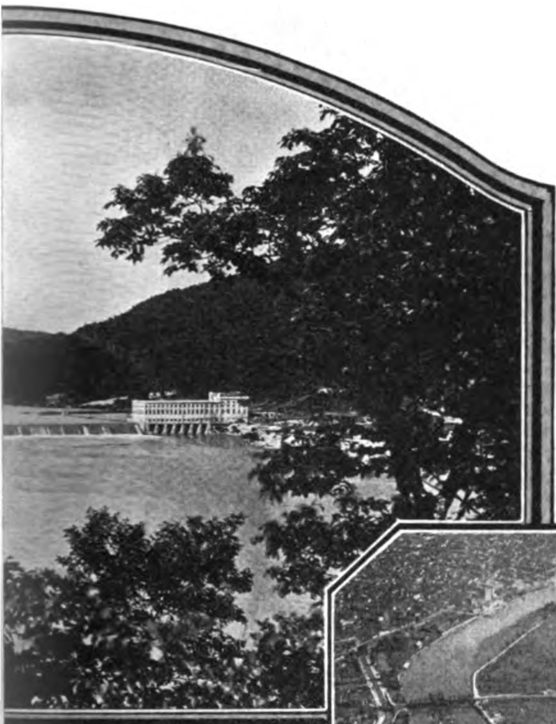
A. Piquet

by leaping sales. In 1923 over 4,000,000 cars and trucks worth nearly three billions of dollars were turned out by a million workers to an increasing clientele so that every telephone is matched by a car, the suburbs and country are opened up, the appeal of crowded cities is lessened, industry and people decentralize to wider spaces, the acquisition of individual homes and gardens is enormously increased, the standard of living and the incentive for more purchasing power is raised, and the old pre-war congestion, poverty, and inefficiency steadily gives way to fresh air, ambition, and a better industrial civilization. Such is the service of science and leadership and modern business methods to the people.

This necessary cultivation of the consumer, the impossibility of monopoly possible in dull and simple things, has made competition supreme, so that many auto concerns fail, few are chosen. The struggle develops masters. The contest makes necessary the scientific location of plants.

Ford is born on a farm near Detroit. Ransom E. Olds lives at Lansing. Dodge we find making parts to sell to the young Ford plant. Dave Buick is at Flint. There also is a carriage company named Dort-Durant.

Michigan produces excellent hardwoods in these

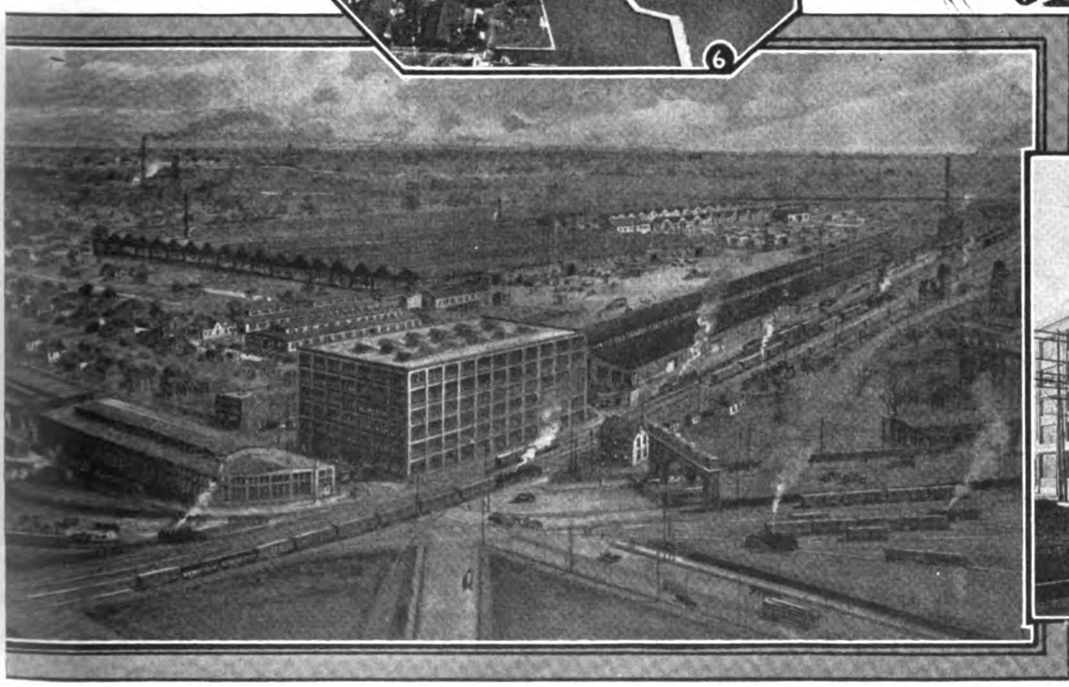


Tennessee, which has this beautiful water power nearby, is one of a number of Southern cities which has excellent distribution facilities to Southern markets.

©Ronne & Washburn

Fig. 6. In the city of Buffalo is the largest inland lock in the country, through which ships pass from Lake Erie to the Niagara River.

Fig. 7. Canadian plant of the Firestone Tire and Rubber Co. at Hamilton, Ontario, where fine rail facilities and cheap electric power are found.



and other products, originally turned out wooden carriages only. It is a splendid example of a modern suburban plant, with shipping, production, and housing facilities.

Fig. 8. Eighty thousand cars are assembled annually at this St. **Louis Ford plant, which also makes tractors and parts. This is one of the thirty-five Ford plants, not counting Detroit.**

early days. Steel is not far away. The leaders are there, and the materials, and the automobile industry is born. Then Cleveland takes the lead. In the small town of Detroit some unknown and unsung bankers of civic ambition for growth strain their resources, pledge their shirts, so the story goes, and build up local auto enterprises, and attract them from Ohio. So Detroit takes the leadership and holds it.

Elsewhere carriage, bicycle, metal industries add automobiles to their lines. Stevens-Duryea at Springfield, Mass., arms makers, builds automobiles. The Amesbury, Mass., coach companies build bodies. At Indianapolis, Nordyke and Marmon add cars to their milling machinery. Studebaker at South Bend finds wooden coaches lead to automobiles.

Population and competition grow. Prices come down. Ford becomes famous by gigantic production of one style, by specialization of the manufacture of each part to the nth degree, by an assembly plant distribution system at all given points, by enunciating the scientific location of industry as a prerequisite to efficiency.

He pursues the consumer relentlessly. Thirty-five assembly plants dot the country from Boston to the Pacific. Fifty to a hundred and fifty thousand cars are made up and distributed from each. Ford parts are manufactured in twenty-two of these well-built and lighted factories.

Ford says that each factory should make but one part, and make that part on a vast scale, cheaper and cheaper and cheaper. Such is the gospel of a great system, each plant coöperating with all others, for the finished product at the "impossible" price. The heavy work is done at Detroit, at an aggregation of blast furnaces, coke ovens, foundries, power plants, terminals, factories, and whatnot that is the nucleus or rather center of a stupendous integrated horizontal monster dependent on no monopolies of raw material,

(*Continued on page* 88)

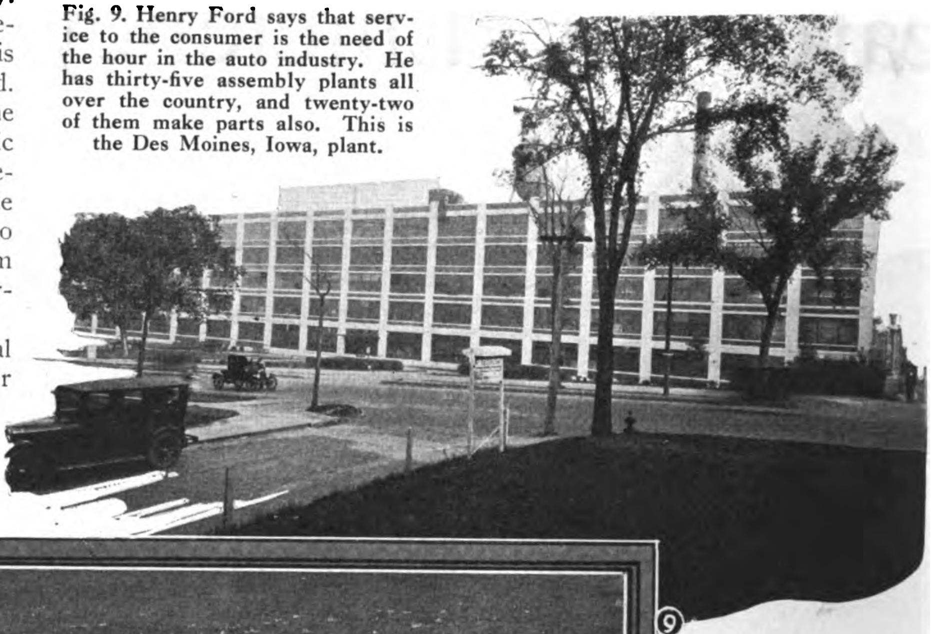


Fig. 9. Henry Ford says that service to the consumer is the need of the hour in the auto industry. He has thirty-five assembly plants all over the country, and twenty-two of them make parts also. This is the Des Moines, Iowa, plant.

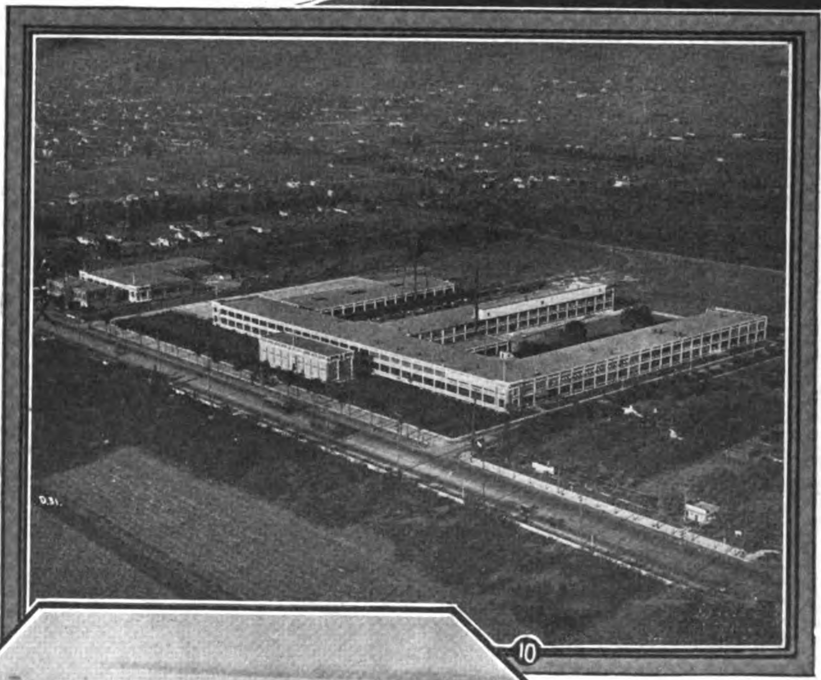


Fig. 10. Durant and Star cars are made at this Oakland plant, in the outer suburbs, near easy rail connections to all Pacific coast points.

Fig. 11. This is one of Buffalo's fine terminals and also the entrance to the New York State barge canal, opening up the state to water transportation.

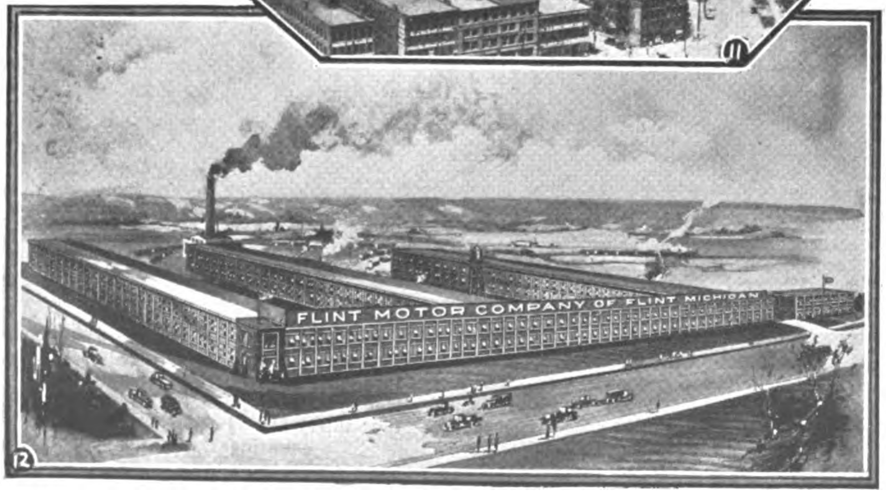


Fig. 12. This is the Flint plant of Durant Motors, whose factories are all spacious and placed in the countryside near the cities.

What Concrete Has Done for Industrial Construction

By James F. Springer

Fig. 1. The Medical Arts Building, at Dallas, Texas. Concrete construction, in this case, was estimated to be $75,000 cheaper than steel frame.

Fig. 2. Placing wooden piles for an extension to the Philadelphia Terminal Warehouse. Note how the original structure was planned for this extension.

CONCRETE has, in recent years, made wonderful advances in popularity. This is due in part to its really fine qualities, when the materials employed and the modes of mixing and placing are what they should be. It is also due to the rapidity with which many classes of structures can be carried to completion. However we are not to get the idea that concrete is a perfect construction material. We must take account of certain matters which tend to make of concrete something less than a perfect ideal.

Among the good things may be reckoned the following: (1) A very large part of the total weight consists of materials procurable pretty much everywhere, so that only a moderate part of the weight requires railroad transportation from a distance; (2) the preparation of the concrete, while capable of being mismanaged, may nevertheless be carried out under proper management in just about any season of the year; (3) this material lends itself to use in varied forms and shapes; (4) comparatively cheap labor can be used for a great part of the work; (5) the cost is apt to be moderate; (6) the life of the structure will be long, if reasonable control is exercised; (7) the upkeep will be low or perhaps next to nothing; (8) the resistance to fire will be excellent; (9) the compressive resistance is good; and (10) the poor tensile strength

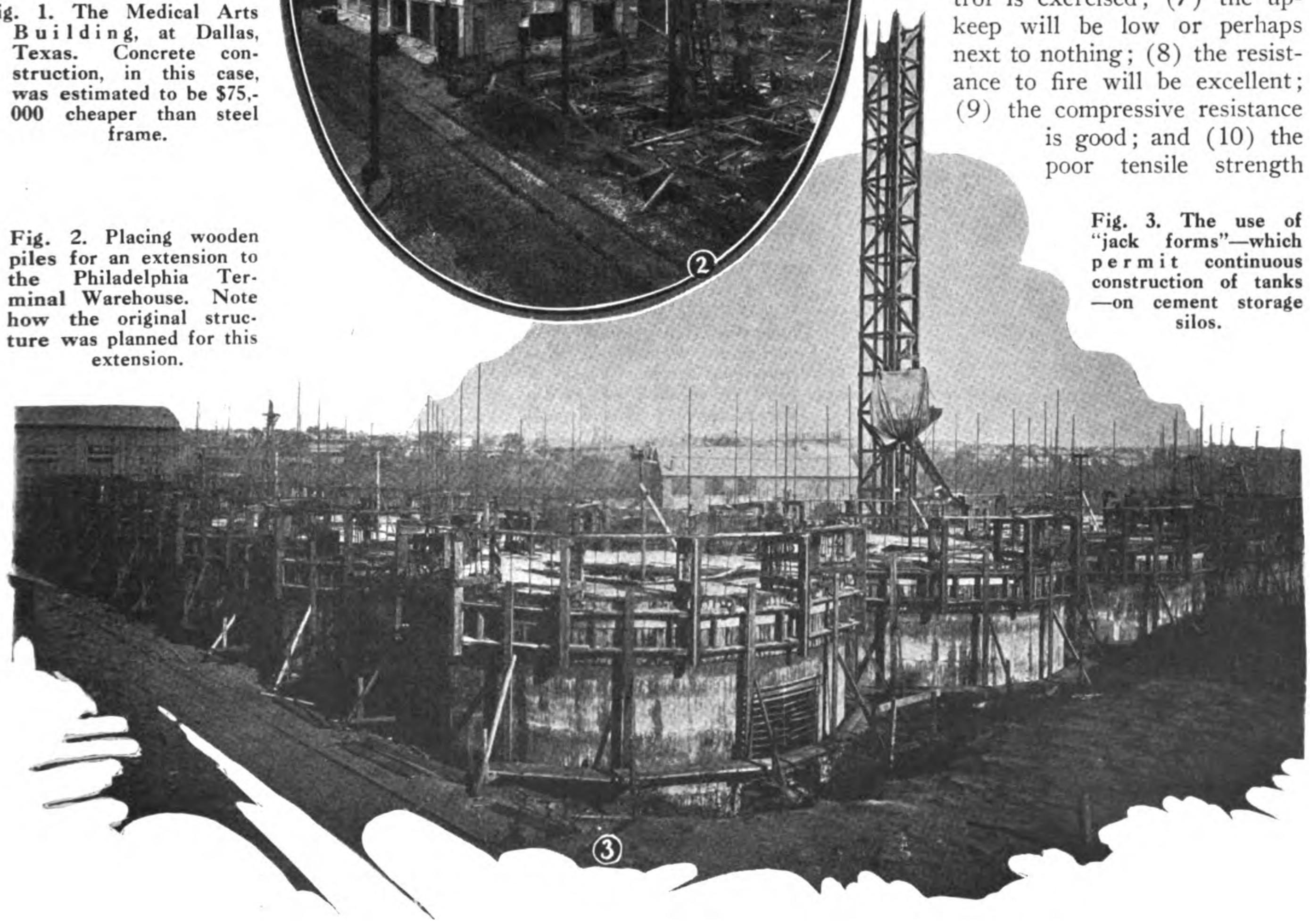


Fig. 3. The use of "jack forms"—which permit continuous construction of tanks—on cement storage silos.

Fig. 5. A part of the storage cellar of the United Drug Company, St. Louis, Mo. The white cement finish makes for good lighting.

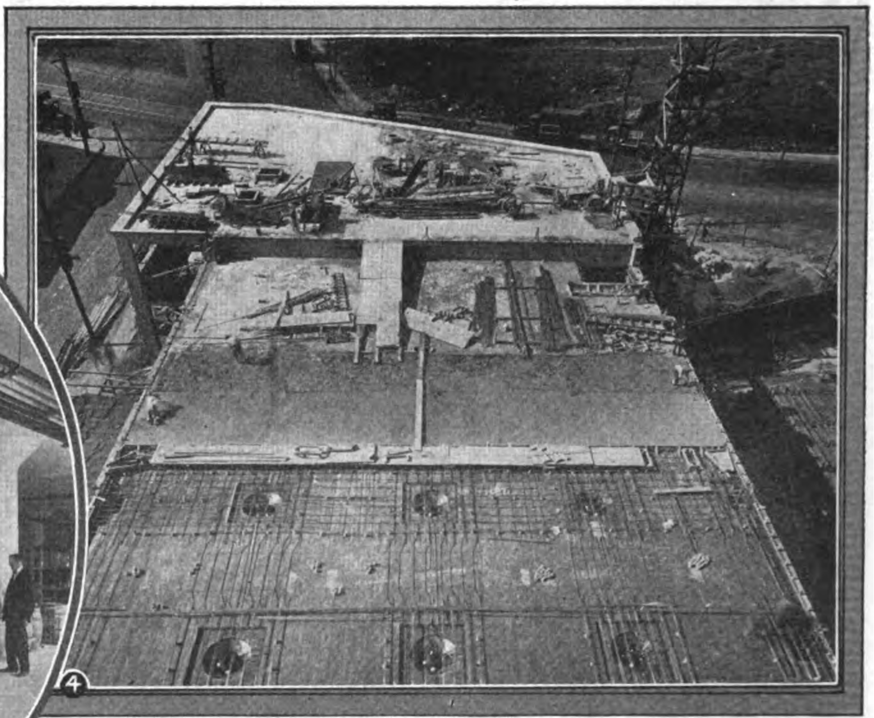


Fig. 4. Looking down on a reinforced concrete warehouse under construction. Note the successive stages of completion.

Fig. 6. The United Drug Company factory at St. Louis; one of the country's largest concrete factories. An interior view is shown in Fig. 5.

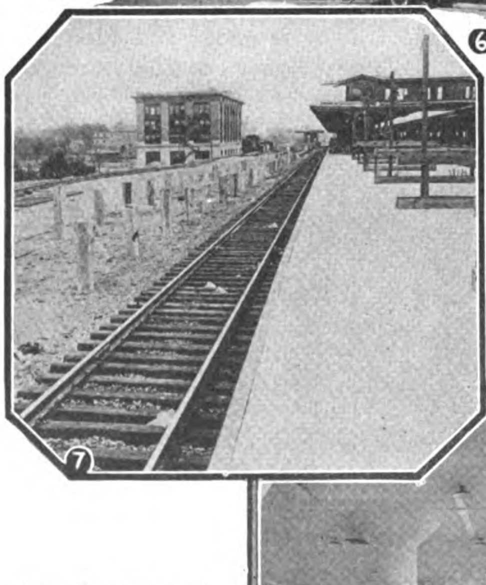


Fig. 7. Reinforced concrete piles in filled ground, as a permanent support for station platforms. Tops of piles are broken off, to tie the reinforcing to the platform.

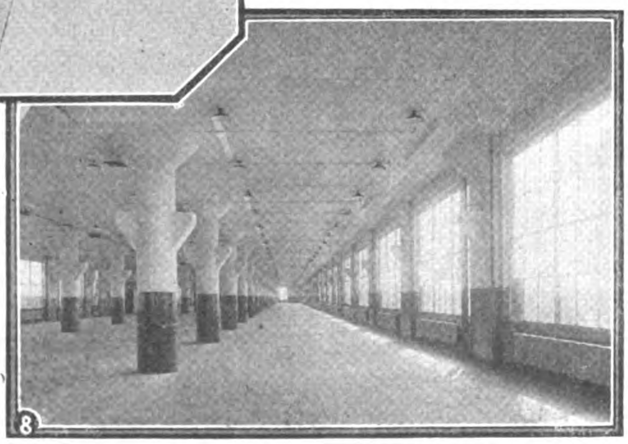


Fig. 8. Note the lack of beams or girders, and the excellent lighting advantages of this well designed reinforced concrete structure.

can be rectified by the use of steel reinforcement. The last item, in fact, is what has made concrete so valuable.

It is suggested in the foregoing that concrete is naturally not strong in tensional resistance. This is, perhaps, its chief defect. But there are other construction materials which have little or no strength in tension that is of any considerable practical service. Brickwork and stone masonry are examples. No one of the three is suited to the construction of suspension bridges. However, in the case of concrete, a wonderful remedy has been found. Steel, in the form of bars, wire, etc., may be imbedded in the simple concrete with the result that a combination product is formed that does have great strength in tension. That is, reinforced concrete is concrete that has most of the good qualities of simple concrete, and is in addition very strong in its resistance to tension.

The possibility of using steel in this way turns upon the fact that the co-efficient of linear expansion and contraction is about the same, both for simple concrete and for steel. When, under the influence of the heat of summer and the cold of winter, the concrete and the steel expand and contract, they do so together. If this were not the case, reinforced concrete

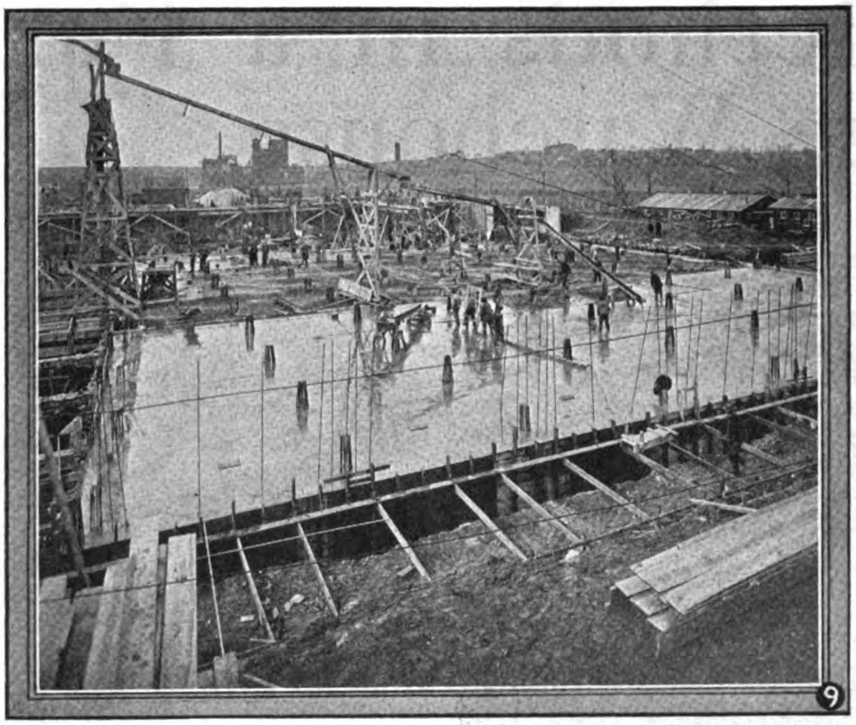
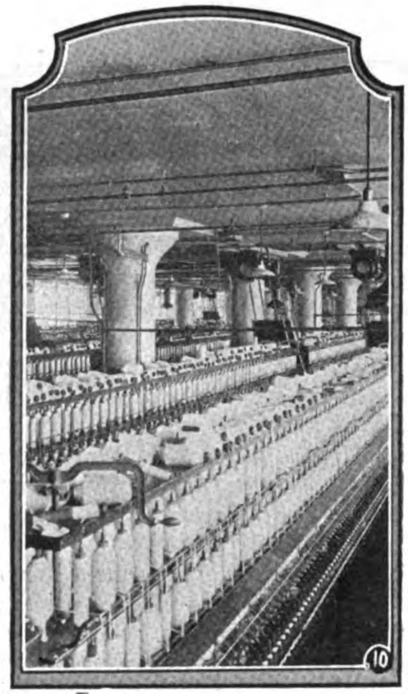


Fig. 9. Concreting a typical large reinforced concrete building. Note the column reinforcing bars for the next floor columns, and the steel chutes for concrete distribution.

Fig. 10. A typical knitting mill of reinforced concrete, with good lighting, low fire hazard, and good sanitation.



would not be usable in the great variety of construction work in which it has found such success.

The fire resistant property of concrete is a highly valuable thing. The incombustibility of this material is conjoined with a low capacity for the conduction of heat. It is this combination of qualities that helps to make concrete so important a construction material. It resists fire for itself and it hinders the transmission of heat to its reinforcement. Of course, like everything else, concrete may be mismanaged in the making or the application. It is not a "fool proof" material that can be properly prepared and used by just anybody at all. When the knowledge as to its character that is now available is utilized along with adequate engineering ability, there seems no reason why concrete may not be used with great advantage in the following classes of construction:

1. Factory foundations.
2. Foundations for heavy machinery and other equipment.
3. Framework, walls, girders, columns and flooring of factory structures of nearly all descriptions.

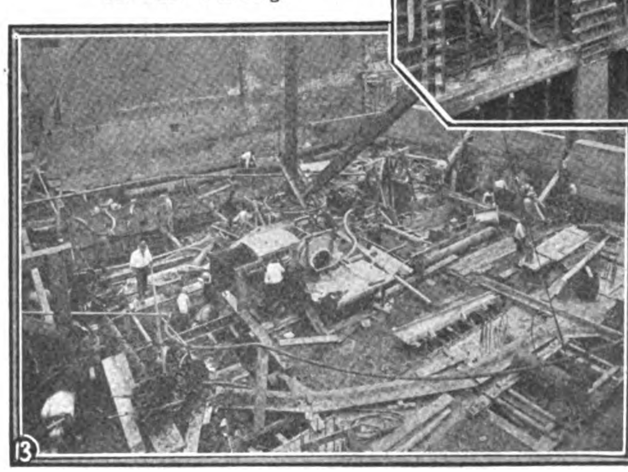
I can not, naturally, in a short account such as the present, give a complete exposition of the errors

(*Continued on page* 42)

Fig. 11. The Wheatena factory at Rahway, N. J., vermin-proof as well as beautiful.

Fig. 13. Foundation work for the Hide and Leather Building, New York. Concrete piles were jacked down to a definite bearing power, to assure proper support for this building.

Fig. 12. Flat slab forms used in floor construction on the Allied Realty Company building, Philadelphia. Note the column reinforcements.



Modern Methods in a Fur Storage Warehouse

By William Greaves

THE average cold storage warehouse is strictly a thing of utility—and seldom is any effort made to beautify its exterior As a matter of fact, this is only natural: because space requirements dictate that such warehouses be located in sections where real estate is not too expensive, and these sections offer scant inspiration for architecture.

This was but one of the factors which confronted the firm of Revillon Fréres when they decided upon the need for a larger New York warehouse. Another factor was the importance of locating near the market—which in this case means the large and small fur garment manufacturers. It was after consideration of these factors, as well as of the important one of keeping the overhead to a minimum, that this large fur concern determined: (1) to erect its own building, rather than to rent space; (2) to locate this building in a section which would be most accessible to the trade; (3) to so design it as to incorporate the most modern and up-to-date equipment; and (4) to make it, architecturally, anything but an eyesore. That the last-named feature has been accomplished is shown in Fig. 1—an exterior view of the combined warehouse, office building, and wholesale sales rooms, located at Eighth Avenue and Thirtieth Street, New York. The first floor is devoted to sales rooms, the second floor to fur grading rooms and general offices, and the third floor to fur grading rooms only. A glance at the exterior view of the building (Fig. 1) makes clear the location of offices.

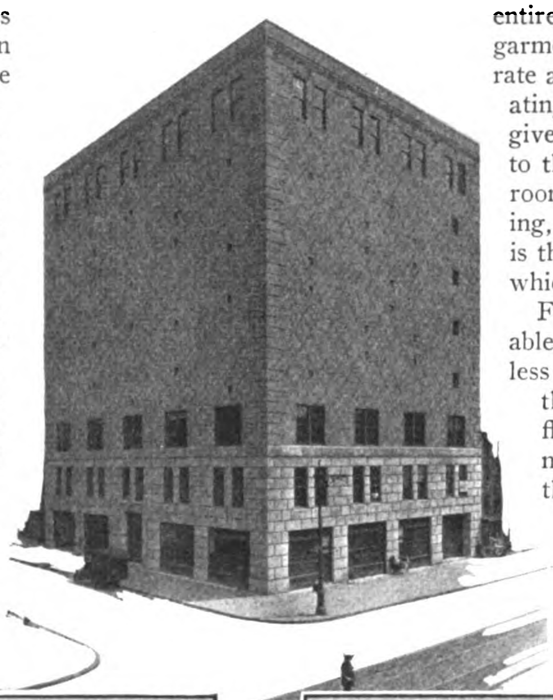


Fig. 1. The new cold storage and warehouse of Revillon Fréres, located in New York City, represents a unique style of architecture combining beauty and utility.

Four entire floors—the fourth, fifth, sixth, and seventh—are devoted entirely to cold storage of furs and garments, being served by an elaborate and thoroughly modern refrigerating system. The eighth floor is given over to the service incidental to these storage facilities: receiving rooms, cleaning, inspecting, packing, record-keeping, and so on. It is the equipment of this eighth floor which is particularly interesting.

Fur garments are not only valuable, but they are perishable. Careless handling materially shortens their life. This consideration influenced the decision to install modern handling equipment in this department, and a very complete overhead conveyor system is the result. Garments for storage are received and recorded, and are then put upon hangers suspended

Fig. 2. General view of the receiving and shipping room showing overhead carrier system or method of transporting the pieces or garments into and out of storage.

Fig. 3. Each piece is inspected and a record made of its condition immediately upon being received in the warehouse.

Fig. 4. This looks like a vacuum cleaner; but it has been found that vacuum cleaning is not beneficial for the fur, so the furrier is here using a special compressed air blowing attachment which blows the dirt out of the fur instead of sucking it out by vacuum.

Fig. 5. The cleaning of furs is done in many ways. This shows a furrier loosening the dirt by slight beating.

from the monorail track; passing along this track to the inspection department. Remaining on the hanger, each garment is carefully inspected (Fig. 3) and a record made; this record being made a part of the storage receipt, so that there can be no question of the actual condition of the garment when placed in storage. Inspection completed, the garments continue on the conveyor to the cleaning department.

Proper cleaning of fur without damage requires both equipment and special knowledge of furs. Not only must dust be removed, but moth larvæ as well. And, while vacuum cleaning is excellent for heavy fabrics, this system is unsuited to furs. Instead, cleaning is carried out in glass enclosed booths (Fig. 4) by means of gentle beating and (Fig. 5) by *blowing out* the dirt by compressed air, instead of sucking it out (with attendant danger of loosening the fur). Naturally, this blowing process distributes dirt and dust into the air. It is for this reason that the operation is carried on in these glass kiosks; each kiosk being equipped with an exhaust fan which draws the dust laden air into a collecting system, shown in the background of Fig. 6.

After cleaning, the garment is again placed on a hanger—this time, under a dust-proof cover—and is then ready to go to the storage vaults on one of the four floors immediately below.

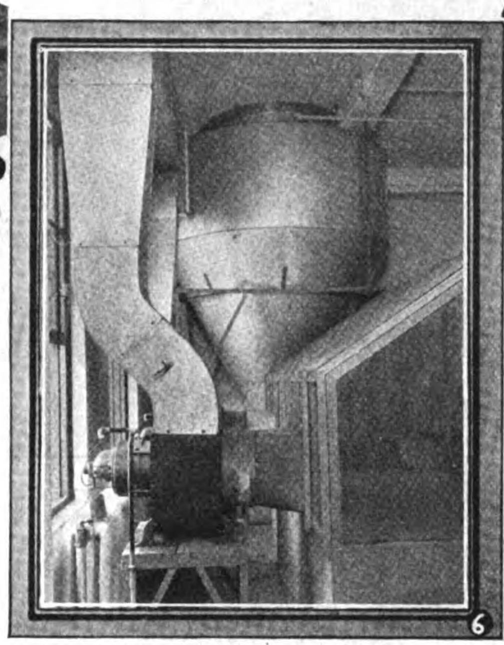


Fig. 6. All loose dirt, blown from the fur, must be immediately collected and carried off. This shows the air blowers and dirt collector in connection with the cleaning rooms.

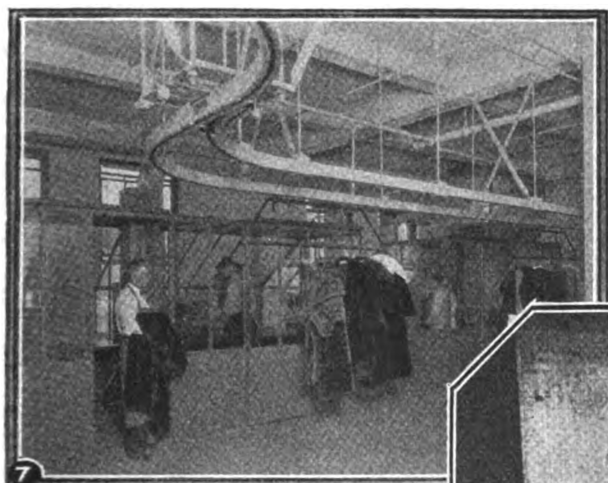


Fig. 7. General view of the cleaning rooms showing furriers at work and the method of bringing garments and pieces direct to the cleaning room by overhead carrier.

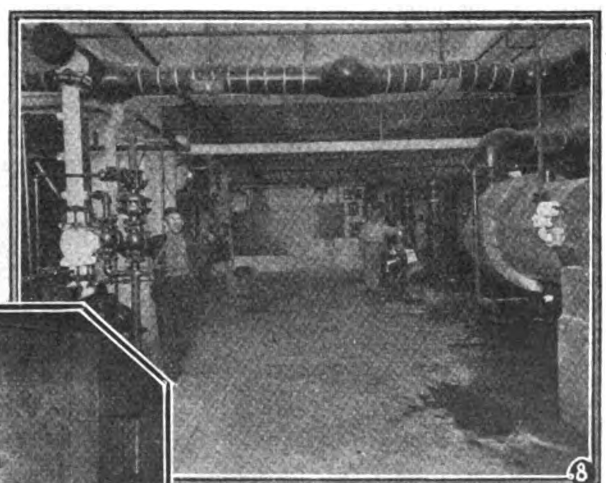


Fig. 8. Part of the refrigeration plant and distributing system in basement of the building.

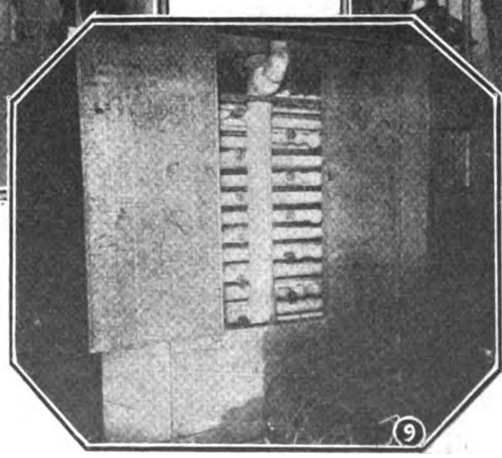


Fig. 9. By passing fresh air over the refrigeration coils, located on each floor, it is possible to extract the moisture and at the same time regulate the temperature within a half degree.

Fig. 10. A view in one of the fur garment storage vaults showing system of racking and method of covering each garment with a dust proof sack.

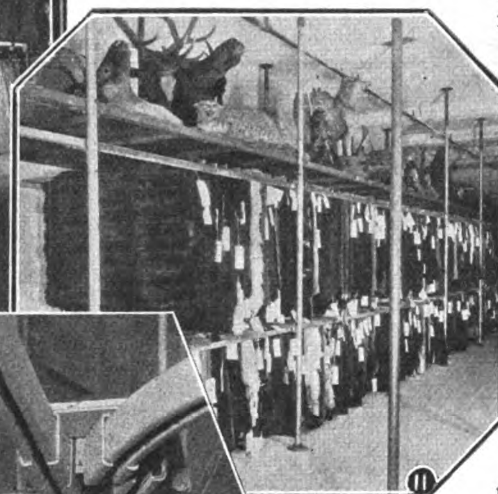


Fig. 11. A vault where rugs, robes and mounted specimens are kept in storage.

The storage vaults, in accordance with best practice, are served by a system of pipes in which cold brine circulates; the ammonia system being in the basement. Fig. 8 gives a general idea of the equipment in the basement for cooling the brine by ammonia circulation, while Fig. 9 shows one of the "bunker rooms" on an upper floor. These bunker rooms are located on each of the cold storage floors, and air is blown over the coils for circulation in the storage vaults. Condensation removes the moisture, assuring dry air in the vaults.

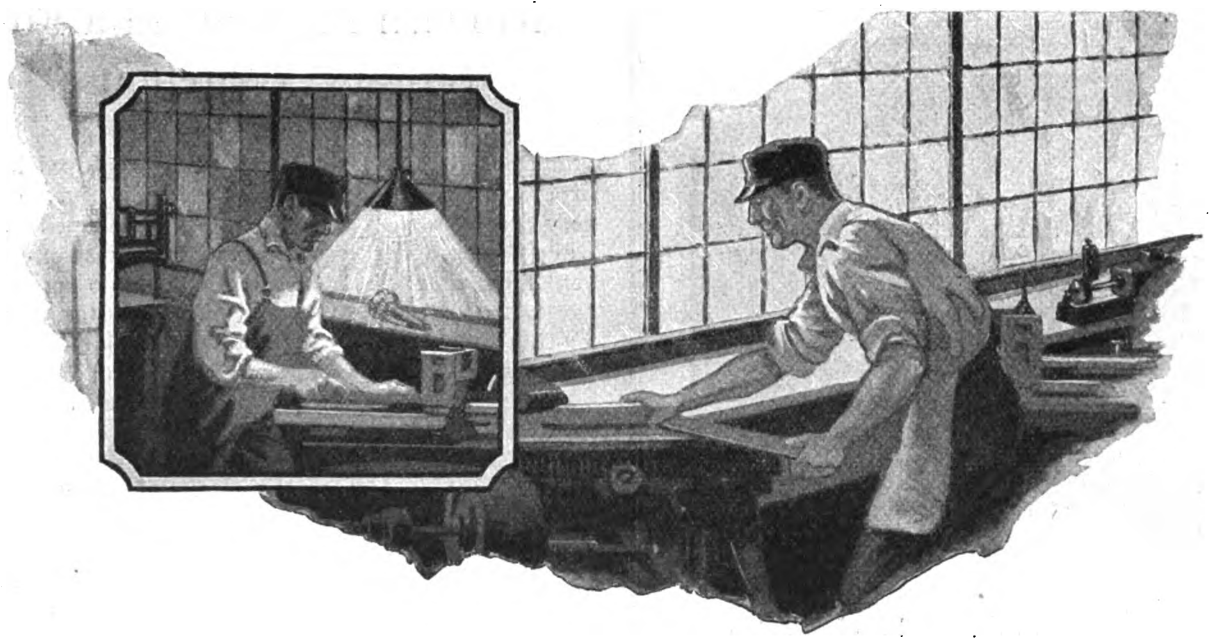
Control of the vault temperature is by thermostat, and the engineer, in the basement, is constantly aware of conditions throughout the system. In the basement, too, are signal boards which reveal when a vault door is opened, as well as a system by which anyone accidentally locked in a vault can signal for release. The vault lights are so wired that a control board in the basement gives notice if lights are inadvertently left burning in any vault. The entire building is sprinkler

(*Continued on page* 38)

Fig. 12. Multiple switch or junction point where several lines of overhead carriers branch out to the various departments.

Fig. 14. Each fur or garment is wrapped in tissue paper, packed in a neat cardboard box, wrapped in brown paper, in which condition it is delivered to the owner's home by Revillon Fréres' own motor truck service.

Fig. 13. Before garments are delivered out of storage they are again carefully examined by a furrier and the records are properly checked so as to avoid mistakes.



The Fall Days Are Shortening—*Rapidly*

SKYBRYTE Will Lengthen Them in Your Plant—If You Act NOW!

TO insure more daylight in your plant this winter, NOW is the time to clean your window and glass areas. It is very nearly "now or never" as far as fall window cleaning is concerned. In a few weeks, winter and freezing weather will be here and it will be too late!

SKYBRYTE is the Miracle Glass Cleaner! It instantly removes the most stubborn crust of dirt, rust or carbon scale. Five gallons clean 4,000 square feet of dirty glass. An unskilled laborer cleans 5,000 square feet per day. The average cost, including both labor and material is only a fraction of a cent per square foot. Try it—use coupon below.

But DON'T DELAY. Every day there's less daylight to work by; from now until March, daylight will be from 1 to 2 hours shorter. Never is clean glass as profitable as in winter.

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The* SKYBRYTE *Company,
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You may ship us five gallons of Skybryte on trial and one regular 75c. Skybryte brush FREE. We will use one gallon of Skybryte at your risk. If we are not fully satisfied we will return the balance to you within 30 days return charges collect and you will cancel invoice. Otherwise we will pay your invoice for five gallons Skybryte at $3.00 per gallon, F. O. B. Cleveland.

Skybryte in bbls. $2.50 per gallon freight allowed.

Company ....

Street ....

City ....

Modern Methods in a Fur Storage Warehouse

(*Continued from page* 36)

protected; the dry-pipe system being employed because of the low vault temperatures. At the same time, a very careful system of inspection is maintained, since—while the sprinkler system would extinguish fire in the vaults, the water would at the same time do untold damage to the expensive furs and garments stored therein. In this connection, it is interesting to know that the thermostatic control system probably would give prior warning of any fire, because of the sudden rise in temperature.

Seen from the angle of modern management, this building is an excellent example of intelligent planning. It serves to illustrate, also, how the methods which but a few years ago were confined to the machine industries, are more and more finding application in industries where hand labor and haphazard methods were a settled tradition.

THE Third National Exposition of Power and Mechanical Engineering will feature a series of lectures on recent developments in important phases of power-plant and mechanical engineering practice. The Exposition will be held in the Grand Central Palace, New York, from December 1 through 6, 1924, and the lectures will be held in the assembly hall at times that will not conflict with the more formal papers presented at the Annual Meetings of The American Society of Mechanical Engineers and The American Society of Refrigerating Engineers, which parallel the first four days of the Exposition.

A large number of schools of mechanical engineering will send delegations of students and instructors to the Exhibition and a series of lectures is planned to give the students, and any others who may be interested, a complete picture of recent developments of power plant and mechanical engineering practice with the Exposition as a background. The lectures will be supplemented with visits to the various exhibits. The topics selected are: The Boiler Room, Steam Prime Movers, Oil and Gas Engines, Hydro-electric Power Plant Equipment, Materials Handling, Modern Machine Tool Developments, Mechanical Power Transmission, Mechanical Refrigeration, Heating and Ventilating.

The selected list of technical moving pictures which was shown last year attracted large crowds at the several showings. At the coming event the picture program will be elaborated by recent releases which will add greatly to the novelty and interest of the Show.

The exhibits, which will occupy 150,000 square feet on three floors of the Palace, will include a complete showing of all lines of power plant apparatus and accessories, materials handling equipment, and many showings of heating and ventilating apparatus, refrigerating machinery, machine tools, and machine shop equipment. As the Exposition attracted all types of mechanical engineers and industrial executives and operating men, the manufacturers of machine tools and shop equipment have come to realize the opportunity they have to display their products before an excellent audience and many of them have purchased space at the coming Show.

Materials Handling FORUM

Conducted by Matthew W. Potts

This Forum provides a place for the discussion of materials handling problems of general interest. Questions regarding the best *type* of equipment for handling specific commodities are pertinent; as are questions regarding the *adaptability* of various types of equipment for a specific problem or installation.

Each question published will be answered on the basis of our experience and available information. Further discussion of these problems will be welcome, and we will publish such letters as, in our estimation, contribute to a clearer understanding.

Question No. 6.

"We would appreciate advice from you as to what in your opinion is the best sort of lift to use for the following condition:

"Floor on ground level. Loads, averaging 350 lbs., carried on two wheeled hand trucks, must be lifted to auto or car level.

"It seems to us that the most desirable apparatus would be a quick acting, presumably a thrust elevator on which the operator can run truck and load, and be lifted along with the truck to the level of runway, to continue trip to car or auto without being compelled to rehandle the load."

We are mailing, under separate cover, a copy of the February, 1923, issue of INDUSTRY ILLUSTRATED.

We would recommend as a solution for your problem, the use of a portable elevator as shown and described in the article "What's in a Name?" on page 24. The cut surrounded by pencil marks shows such equipment used for the loading of trucks and the article tells of many other uses for the same equipment.

* * *

Question No. 10.

"At the plant where I am employed we use a bucket elevator for handling coal and ashes. The casing on this elevator is of steel and quickly deteriorates by rust or abrasion, the exact cause we cannot determine.

"Can you tell us, from your experience, something to eliminate the high maintenance cost on this equipment?"

The first recommendation we would offer would be the use of a wood casing if conditions permit, as wood can be easily repaired and does not have a tendency to corrode or cut from abrasion as is the case with the steel casing.

If it is necessary to use the steel casing, we would recommend the painting of this casing both inside and outside with a paint that would resist sulphur fumes. It has been found that manufacturers of such equipment do not paint their casings on the inside nor do the erecting companies or users paint the casings on the inside. This is an important item especially when handling chemicals or other materials which attack the metal.

We are not convinced that the casings are cut out by abrasion, but if the trouble still continues after having painted the casing as noted above, we would recommend investigating the feeding of this elevator. It might be the buckets are too full, due to clogging in the boot, and it is this handling of a surplus of material which causes the ashes to fall back down the casing with the resulting cutting action.

* * *

Question No. 11.

"Can you give us, from your experience, advice regarding a method of cleaning the inside of elevator legs?

"Our elevators consist of 3 x 5 cups on No. 77 detachable chain, running in 6 x 8 legs constructed of wood, while others are constructed of metal. We are handling dusty materials which collect in the corners and this material frequently loosens and appears in bulk in a batch of finished products, thus spoiling some of the production.

"We have tried occasionally hitting the elevator legs, but find that this is rather haphazard, and if the leg is hit hard enough to loosen the material there is an indentation made in the metal or marring of the wood or paint finish.

"We would like to obtain a mechanical method which would be positive at all times."

We would recommend for your particular difficulty the use of a brush fitted to the size of the casing and attached directly to the chain. There is a brush on the market manufactured expressly for this purpose. This has proven, in our experience, a satisfactory solution of the problem, but we should be glad to hear from readers who may have found other ways of solving it.

* * *

Question No. 22.

"I want to get some authentic information on coal storage, giving the best method of storing coal so that it won't burn until it's in the place where it's supposed to be used.

"If you have any articles on this from your magazines and can send copies of them it will be very helpful. There seems to be some doubt as to whether a coal pile should be ventilated or made as compact as possible.

"Any details you can give us will be greatly appreciated."

It is rather difficult to give definite advice on the storing of coal so as to eliminate spontaneous combustion, for the reason that most investigators seem to disagree.

This subject has been under investigation for the last fifteen years by the Bureau of Mines and since receiving your letter, I have read most of their reports. The following information includes that upon which the various investigators agree and does not cover points upon which they disagree: With full appreciation of the fact that any one or all of the following suggested precautions may prove impractical or unnecessarily expensive under certain conditions, they are offered as advisable for safety in storing bituminous coal.

The following is taken from technical paper No. 16, published in 1912, by the Department of the Interior, Bureau of Mines, on the subject "Coal Pile Fire," by Horace C. Porter and F. K. Ovitz:

1. Do not pile over 12 feet deep, nor so that any point in the interior of a pile will be over ten feet from the air cooled surface.
2. If possible, store only screened lump coal.
3. Keep out dust as much as possible; to this end reduce handling to a minimum.
4. Pile so that lump and fines are distributed as evenly as possible, not as is often done, allowing lumps to roll down from the peak and form air passages at the bottom of the pile.
5. Rehandle and screen after two months if practical.
6. Do not store near external sources of heat, even though the heat transmitted be only moderate.
7. Allow six weeks "seasoning" after mining and storage.
8. Avoid alternate wetting and drying.
9. Avoid admission of air to interior of pile through interstices around foreign objects, such as timbers or irregular brickwork, or through porous bottom, such as coarse cinders.
10. Do not try to ventilate by pipes, or more harm may often be done than good.

The following questions and answers were taken from technical paper No. 235, published in 1920, by the Department of Storage, Bureau of Mines, on the subject of "Safe Storage of Coal," by H. H. Stoek, and dealt with storage of from 200 to 1,000 tons:

* * *

Do Fires Occur in Lump Coal Storage Piles?

Very seldom, if at all, and investigation will usually show that the coal has been broken by being dumped from a height, the fire starting in the fine coal thus produced.

Is a Definite Plan for Storing Necessary?

Before it is time to begin actual storage, a suitable place should be prepared and a definite policy outlined far enough in advance so that everyone who will have to do with the storing may receive definite instructions and not merely suggestions. It is unwise to wait until coal to be stored has been delivered and then dump it anywhere on the ground merely to relieve the cars promptly. Storage instructions should be prepared in advance and carried out to the letter. Many failures in storing coal have been due not to faulty instructions, but to the fact that instructions have *not been* followed.

What Kind of Surface Should Coal Be Stored On?

A concrete floor is best, but a hard clay bottom thoroughly drained is desirable if the former is too expensive. Coal should not be dumped on ground covered with ashes or refuse of any kind, and the ground should always be clean of vegetation and leveled off so that the coal can be reclaimed as easily and the dirt or refuse not become mixed with the coal.

Is It Well to Ventilate These Large Piles?

The effect of ventilating coal piles is a disputed point, but the weight of evidence in the United States seems to be against the practice.

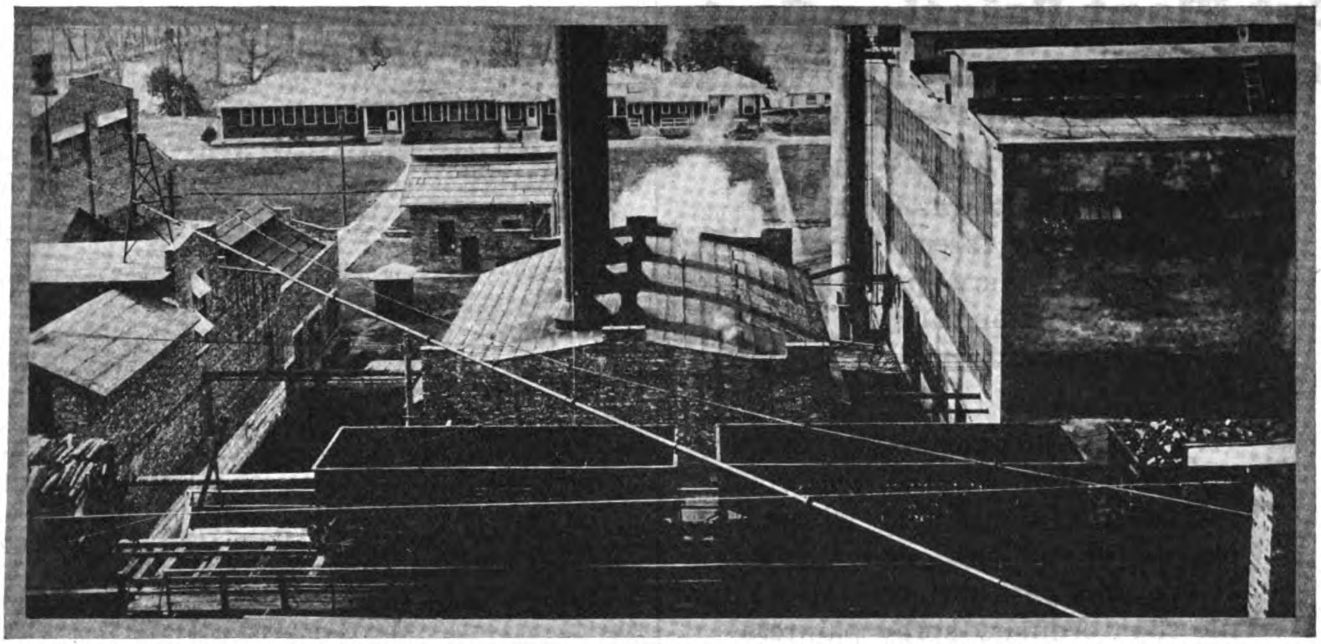
We are sending you, under separate cover, a copy of INDUSTRY ILLUSTRATED, June, 1923, which contains an article on page 10 by J. F. Springer, "Keeping the Fire Demon Out of Your Coal Pile." This article gives some interesting information and treats on submerged storage.

Recently we had brought to our attention a new method of coal storage which has not been touched upon by the Bureau of Mines. This is a typical coal storage using locomotive cranes for storing out and reclamation. The storage is that of the Philadelphia Electric Company and the quantity stored ranges from 80,000 to 125,000 tons. It is of interest to know that bituminous coal is here stored out from cars to a height of thirty feet and allowed to remain in storage over a long period of time without any evidence of spontaneous combustion. This risk is eliminated by the simple process of rolling the coal with a crawler tread tractor and a one ton roller. As the coal is stored out, it is laid rather evenly over the entire pile in layers of from three to four feet deep. Each layer is then thoroughly rolled. This method seals the coal and prevents the entrance of circulation of oxygen. It has been found that this is an effective preventive against spontaneous combustion, as coal has, on occasion, been allowed to remain in storage as long as two years without disturbance and with no sign of combustion or internal heat.

It is the writer's opinion, from the various reports read, that oxidation is the main cause of trouble. As circulation assists oxidation internally, the elimination of air passages would do much to prevent internal heat. For this reason, the above method of storing, which has already been tried, seems to hold out definite promise.

It might be well for you to address the above company direct in order to obtain first hand information.

You will note that great stress is placed upon the method of handling and we would very much like to know what method you now employ, as possibly this could be corrected to conform with the various suggestions given here.



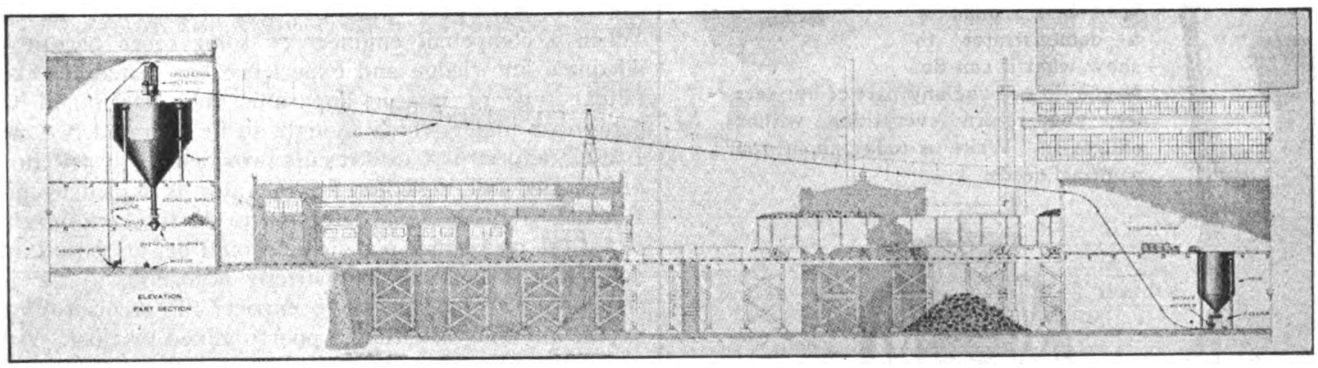
Conveying a Steady Stream of Materials Without Waste, Difficulties or Labor

A DRACCO Pneumatic Conveying System solved here a difficult problem in materials handling. This is another example of the many DRACCO installations where waste, difficulties and manual labor were eliminated and which only DRACCO could do.

In this plant—that of a chemical concern—acetate of lime is conveyed through a pipe line 2½" in diameter, a distance of over 400 feet across the entire plant. The material is collected by the Pneumatic Collecting Station at one end of the plant and automatically discharged into packing bins at the other end. The material is conveyed in a steady stream at the rate of 2½ tons per hour.

Thus another material handling problem has been solved by systematic and ingenious application of a few simple principles. But simple as these principles are, they are the results of years of experience that DRACCO Engineers have had in the design and construction of equipment that successfully conveys by air.

We are specialists on Fume Recovery Dust Collecting and Pneumatic Conveying. Your problem, no matter how difficult, may be one that can only be solved by pneumatic conveying. At least, there is no obligation to have our engineering department confer with you.



DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

What Concrete Has Done for Industrial Construction

(*Continued from page 33*)

which those who have not acquired a scientific knowledge of concrete and its use are liable to make. However, I can touch one or two "high spots" and in this way put the reader, who is more or less inexpert, upon his guard.

Concrete is made by mixing four ingredients—cement, sand, large aggregate and water. All of these, as a rule, are cheap, with one exception. Portland cement is very expensive in comparison with the others. Now the cement is, in plaint concrete, the only thing which produces the cohesive and adhesive qualities which operate to hold the ingredients together. Perhaps it is unfortunate that this is so, because it is impossible for the contractor to skimp the relative amount of this, the most expensive ingredient, and still get the best results. Good mixing promotes strength of the product because it distributes the cement to all points where sand and aggregate are in contact with each other and with themselves. But, if there is not enough cement for all such places, then, wherever this material is wanting, there is nothing to hold things together. Good mixing tends to produce an adequate distribution so that unnecessary concentrations of particles of cement are avoided. But, neither good mixing nor anything else in the concrete can take the place of cement.

We have here what is probably one of the most widespread of the errors made in the preparation of concrete. The contractor is tempted to cut down the right proportion of cement because of the expense. He may be ignorant of the seriousness of the fault of using too little or he may be fully aware of just what he is doing. The result will be the same—a concrete honeycombed with places where there is no adhesion between contracting particles.

The matter of mixing has already been mentioned. This is something as to which there is more or less difficulty of control. The mixing may be done by hand. If done by a skilled man, the results will doubtless be excellent. Mixing is often done by mechanical devices. When a competent engineer or some other person of adequate knowledge and experience has tested the particular type of mixing apparatus and determined the conditions under which it ought to be operated, we can, I think, expect first rate results provided the instructions are carried out, whether the operator is skilled or not. But too often the man delegated to do the hand-mixing is not the competent person he should be, or the mixing apparatus is not operated strictly according to the instructions. What are we to expect? It seems folly to expect anything else than a poorly mixed product. And that poor mixing is pretty sure to produce a concrete lacking in strength, may be surmised from the consideration that unless the cement is really distributed everywhere and finds its way into the spaces between particles of sand and between sand and aggregate, we will have points where no adhesion exists.

Let me give another illustration of sources of weakness. The sand used in concrete should be clean. There appears to be no point as to any requirement that it should be angular. That specification may be regarded

(*Continued on page 44*)

How to save the cost of maintaining your concrete floors

YOU seldom see that concrete floors are wearing until the actual need for repairs is close at hand. Then it is too late to forestall maintenance expense.

The first outward sign of floor wear is dust—fine abraded particles of cement. This dust is harmful enough in itself. It acts on lungs, clothing, equipment and machinery much like fine emery. But still more serious are the holes, hollows, cracks and worn patches that quickly follow in its wake.

Take a concrete floor in time and you can absolutely forestall all dusting and wearing. The process is very simple. A treatment with Lapidolith will do the trick.

Lapidolith is a liquid chemical that penetrates the concrete quite a distance when flushed on a floor. By chemical action the loose, coarse-grained particles are changed to a fine, even, close-grained substance of crystalline formation. The dense topping that is formed is flint-like in its hardness.

This topping is dustproof, wearproof, waterproof. It needs no attention for many years, because it is impervious to truck wheels, scuffing feet, jolts, wear and friction.

There are many so-called "hardeners" on the market that are really nothing more than surface paints. The coating and its protective action soon wear off. On the other hand, many of the first floors that were treated with Lapidolith when it was developed fifteen years ago are still in service today and in excellent condition.

The biggest proof of Lapidolith's efficiency, however, is in its widespread use by architects in the leading industrial plants of the country. Such plants as Standard Oil, Ford Motor, Swift & Company, Bethlehem Steel, etc.—where Lapidolized concrete floors total hundreds of millions of feet.

Lapidolith is easy to apply; anyone can do the work. A floor treated at night is ready for business by morning. Old floors can be hardened, with few exceptions, just as efficiently as new ones. If you would put an end for good and all to spending money on your floors, treat them with Lapidolith. Write for literature giving further details today.

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(*Continued from page 42*)

as now obsolete. But a clean sand is indispensable. If a sand is used which contains an intermixture of clay or loam, or the like, then all particles of this will mean regions of weakness in the completed concrete, whether the particles are attached to sand and aggregate or whether they are distributed through the cement. Where ever a particle of such material exists, there you have a lack of cohesion and perhaps adhesion as well. Similar remarks apply to the aggregate. It must be clean. In addition, the aggregate itself should be sound. It becomes part and parcel of the concrete. Where a piece of it is, there the concrete is neither weaker nor stronger than this piece.

Now, when sand and gravel are dug, say, from the old or the present bed of a stream, we may find that Nature is not supplying the cleaned materials. She may be leaving the cleaning to the contractor. Well, it takes time and it costs money to clean sand and gravel, and it is very easy for an uninstructed man to think that it is nonsense to clean them. So, in many cases, concrete is made up from dirty sand and dirty aggregate.

Anybody can make plain concrete; but if really high-class concrete is to be made, quite a number of precautions are to be taken which it so happens are unknown, partly or altogether, to many persons. Cheap labor, in fact rather stupid labor, can be successfully used in preparing concrete, but *somewhere* must be knowledge and brains. They are just as indispensable as the cement.

I do not wish to be understood to say that no one but a real engineer is competent to construct anything of concrete. It depends upon the object. If it is a question of a sidewalk or the laying of a concrete floor on the ground or any one of a considerable number of jobs, a good many intelligent people are quite competent to supervise the work, especially if they get instructions from one of the reliable manufacturers of cement. But in case life and limb are to be put in jeopardy if the concrete is not suitably proportioned, or if the reinforcement is not suitably designed and placed, or if any one of a rather large number of special matters is not attended to properly, then we have a situation where it will be best to "stop, look and listen." There are many jobs where the neglect of a technical point will result merely in something less than perfect, where the defect will entail no injury or serious loss. Generally, where *reinforced concrete* is to be used, in situations where life is risked, an engineer who knows his business should be employed. Thus, where reinforced concrete is to be employed in factory walls, factory girders, factory columns or the like, the job is apt to call for expert scientific knowledge and judgment.

Let me illustrate this point. Columns of buildings are very often properly constructed of reinforced concrete or of steel protected by concrete. The duty, or part of the duty of the concrete, will be to prevent for a reasonable time, in case of conflagration, the transmission of much heat to the metal. Steel and iron lose their rigidity as they are heated to higher and higher thermal levels. It is important to know, as well as the advance of science and experiment permit, and know in advance, just about what the behavior of a column of either kind specified will be when a conflagration is at hand and also a stream of water from a fire hose. It is the up-to-date engineer who may be expected either

(*Continued on page 46*)

(*Continued from page* 44)

to know the facts and principles involved or where to get them.

In illustration of the severity of the requirements which concrete ought to satisfy when fire and water have to be taken into consideration, permit me to reproduce from Urquhart and O'Rourke's "Design of Concrete Structures" (1923) a requirement specified for fireproof partition walls by the Building Code of the City of New York: "A vertical panel of not less than 14 feet long and 9 feet high shall be subjected to a fire continuous for not less than one hour at an average temperature of 1700 deg. Fahrenheit during the latter half hour, followed by an application for not less than 2½ minutes of a hose stream from a 1⅛ inch nozzle at 30 lb. nozzle pressure, without passage of flame during test."

This may be taken as illustrative of the point that when it comes to really important elements of construction which may be exposed to severe conditions, a thoroughly informed engineer is the man for the control of the job. Do not misunderstand me. By a "thoroughly informed engineer" is not necessarily meant one who has had the degree C.E. There are doubtless many incompetent "C.E.'s" in the country, and also many incompetent concrete engineers, alert to all available knowledge, who have no degree conferred by a technical association.

FOUNDATIONS.

Simple concrete—and sometimes reinforced concrete—is undoubtedly one of the best of all foundation materials available to the construction engineer. Of course, the foundation itself must have adequate support. But, concrete is so adaptable that it may be used in numerous ways. And among these are modes of applying concrete successfully where nothing adequate appears to be readily available to sustain the concrete. For example, we may wish to locate a factory on a site, where exploratory bore holes or other means of testing shows that there is nothing solid at any reasonable distance below the surface. In such situations, *concrete piles* will often solve the problem. Wooden piles are also often satisfactory. There is this difference, however, in order to prevent serious deterioration, not to say early failure, the wooden pile should be *perpetually* submerged in water or wet material. There should not be alternating periods of complete submergence and incomplete submergence. With the concrete pile, this requirement scarcely needs to be met. Concrete piles are used in a variety of ways. They may be cast and matured in advance of being put down. They may be driven with an ordinary pile driver, if a suitable driving cap is used on the pile or if the pile is properly reinforced at the head. If the soil is sandy, or otherwise of a suitable nature, hollow piles may often be put down by means f a suitable water jet which operates to clear away the soil just below the foot of the pile. Other concrete piles may be cast in final position in the ground. Thus, in one type of pile of this description, a slightly tapered shell of sheet metal is driven by the use of a removable core. When the shell has reached the full depth to which it is desired to put down the pile, the core is withdrawn and an electric lamp lowered into the shell to make sure that a clear and satisfactory opening exists all the

(*Continued on page* 48)

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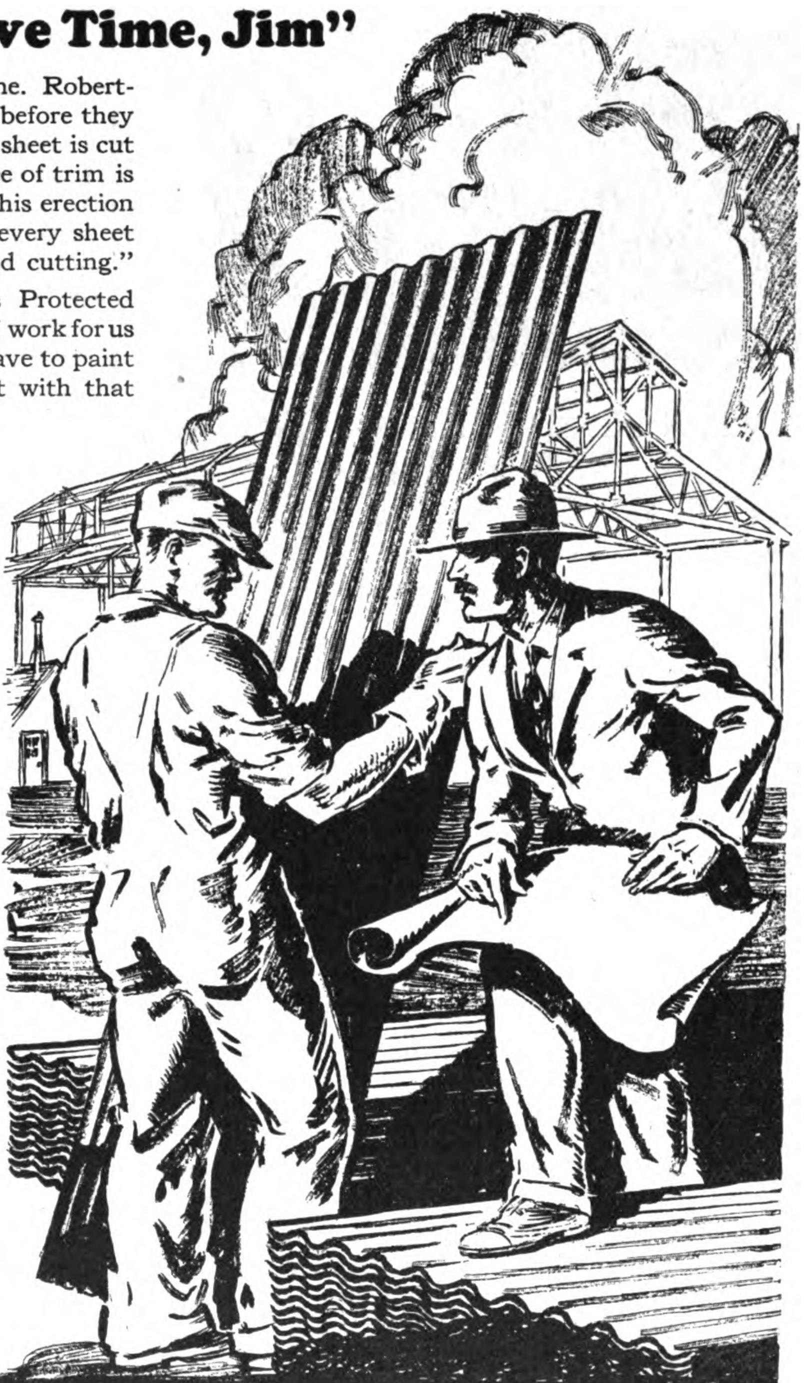

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(*Continued from page* 46)

way down. The concrete is then filled in and the pile is in place.

Sanitation and Vermin Avoidance.

Concrete construction is perhaps the very best when it comes to the question of sanitation and the avoidance of vermin and the like. It is easy to keep a concrete building clean. There are but few cracks and crevices if the work has been done in an up-to-date manner. So the opportunities for the lodgment of filth and the hiding of vermin are reduced to a minimum. The case of cleansing is to be considered. A heavy stream of water may be used without damage.

Clean, light and airy buildings constitute in themselves a valuable asset. They promote output, they tend to keep the operatives healthy and cheerful.

In illustration of what precedes may be taken the case of the Wheatena Company, at Rahway, New Jersey. This concern, as everybody knows, is engaged in the exploitation of a cereal product. This company says of its concrete building: "It is strong, sightly and easy to keep clean, and is thoroughly vermin-proof, the latter being an important consideration where cereals are manufactured." This structure is finished in pure white and has a tremendous amount of window area. The satisfaction of this concern is good testimony to the suitability of concrete for factory construction, for service in housing the manufacture, and storage of foodstuffs.

Ease of Daylight Illumination.

Of course, in the present industrial world, it is comparatively easy to provide artificial light for factory operation. We may use electricity, for example, and we may use it when we please. At the same time, electric current costs money and so do tungsten lamps. Sunlight costs nothing at all. But we must provide for its entrance into the building. Here is where concrete construction enables us to secure a great advantage over types of construction which do not facilitate great window areas. How far the windows have been permitted to encroach on the total wall area may be well illustrated by the case of a great building belonging to the Aluminum Goods Manufacturing Company at Manitowoc, Wisconsin. Looking at the two street facades, one is ready to allow that the glazing must amount to 80 or 85 per cent. of the total wall area in sight.

A similar instance is afforded by the case of some factory structures belonging to the United Drug Company at St. Louis, Mo. This factory is one of the largest concrete structures of the kind in the country. The admission of light has been carried to a very high point, though perhaps not so far as in the case of the Manitowoc structure. A tremendous flood of light normally enters.

Even the electric people, themselves, seem to recognize the great economy of utilizing sunlight as far as possible. The Sprague Electric Works of the General Electric Company at Bloomfield, New Jersey, affords an example of this. In a great concrete factory used by them, the provisions for the admission of sunlight are very extensive indeed.

Concrete construction is very readily adapted to cases where a great abundance of natural light is to be provided. It is, in fact, very fortunate that concrete lends

(*Continued on page* 50)

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If you wish to save money and time—remember Blaw-Knox buildings will serve your purpose 99 out of 100 cases equally as well as more expensive construction.

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(*Continued from page* 48)

itself so easily to this line of advance in the design of modern factories.

A Machine-Tool Construction Shop.

The American Tool Works Company of Cincinnati, Ohio, is one of the important builders of power-driven machine-tools. Not long ago, this concern erected a large building, five stories in height, of reinforced concrete. The plan is not exactly a square. However, the maximum dimensions are 250 feet each way, and this fact will enable the reader to gain a rough idea of the size of the structure. This building stands on concrete piles, 859 of them. Each pile is rated as having a supporting strength of 50 tons. Some of these piles are 55 feet long, and the average is 35 feet. It may be gathered from this that it would probably have been impracticable to build on bed rock. The total length of piling amounts to about 34,000 feet, or nearly 6⅛ miles. The columns, which with the walls carry the building are very numerous, as is understandable when we consider that the building is devoted to the construction of machines, many of which are large and heavy, and to the housing of big and weighty operating machines. However, there is in the interior of the building a large erecting court, whose floor is part of the second floor of the building and which extends to the level of the fifth or top floor. This court is 60 x 140 feet and is lighted by the skylight above it. In the construction of this building 750 tons of steel were consumed, 18,000 barrels of cement, 6,000 cubic yards of sand, and 12,000 cubic yards of stone.

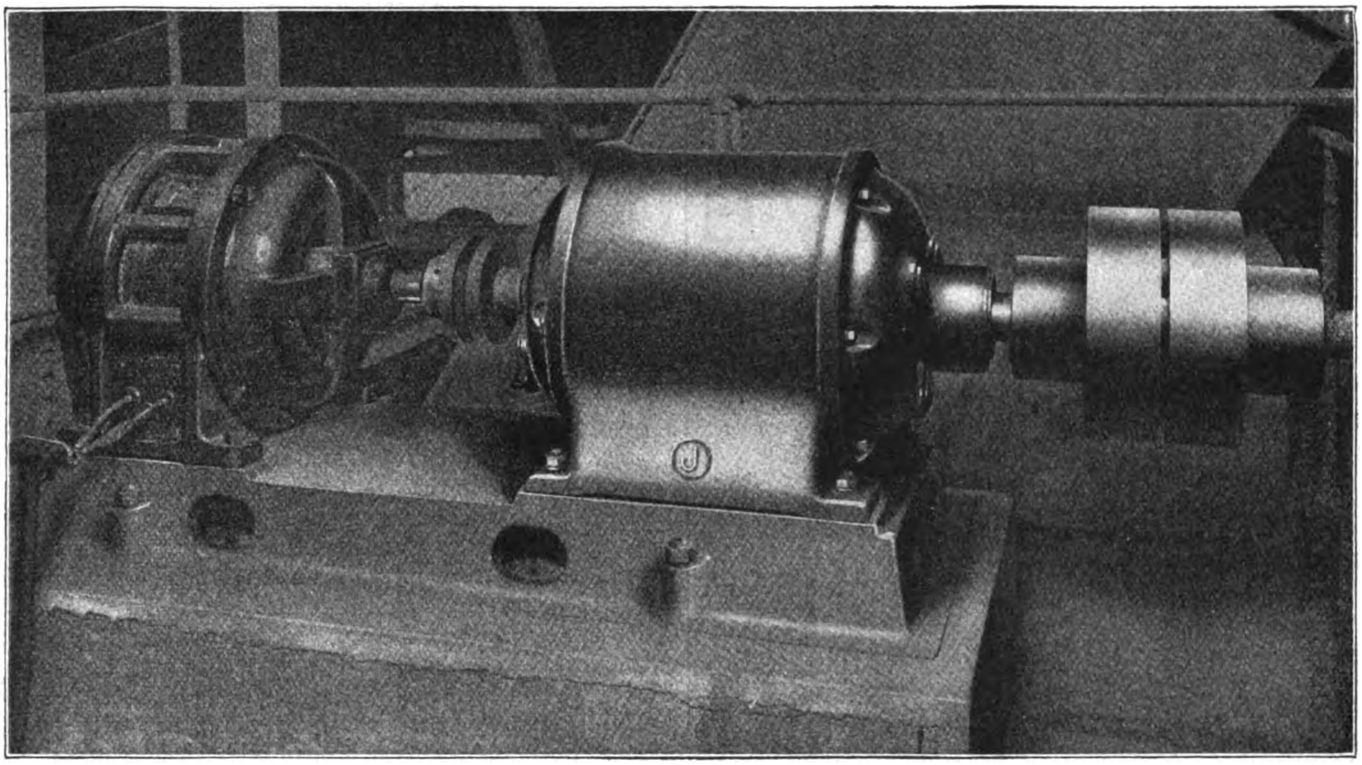
Combination With Brick.

Reinforced concrete has been conjoined with brick in factory construction. The bottling warehouse of the Anheuser Busch Company in St. Louis is a notable example. This structure is about 602 x 252 feet in plan area. There is one 26-foot story below ground and eight stories of ordinary heights above. The floor area amounts to considerably over 1,000,000 square feet. The structure occupies two city blocks. The floors and columns are of concrete. The exterior walls consist of a granite base, 6 feet high, and have for the first two stories a facing of limestone, and for the remaining stories red mat brick. Terra cotta is used for the cornice and for wide overhanging brackets.

The basement walls on the exterior of the outline are 3½ to 4½ feet thick and are of concrete construction. They are 30 feet high and may be technically described as of gravity-section, cantilever type. They are designed to resist the external earth pressure independently of the bracing afforded by the ground floor. There are 310 interior columns of concrete which have diameters ranging from 24 to 40 inches. Those in the lower story are designed to carry 1,500,000 pounds apiece. Vertical rods and spiral hooping supply the reinforcement. There are 68 concrete columns on the exterior. These are square in horizontal section, the side of the square varying from 21 to 33 inches.

It may be gathered that the principal work of supporting this building and its contents is performed by the concrete columns and floors. Steel reinforcement supplies the necessary tensional strength in various elements and thus coöperates with the good compression strength natural to concrete itself. The amount of reinforcement totalled 8,750 tons.

(*Continued on page* 52)



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It steps down the whirl of high speed motors to any required number of revolutions per minute. Action is direct, positive, protected.

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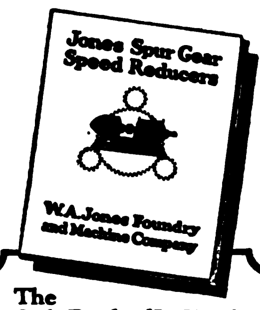
The Jones Speed Reducer is the simplified and perfected medium for reducing speeds. It links power to production in the most economical and satisfactory manner yet devised. Investigate it.



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Jones Speed Reducers

and Power Transmitting Machinery

(*Continued from page* 50)

THE HIDE AND LEATHER BUILDING.

In New York City, in the downtown section, and at a point near the Manhattan terminus of the Brooklyn Bridge, is one of the tallest of reinforced concrete business structures. This is the Hide and Leather Building, eighteen stories tall. From basement floor to roof is 223 feet. The plan area is about 75 x 75 feet. The floors are flat slabs of concrete reinforced in two directions. These are supported by interior and exterior concrete columns. The entire building, including the curtain walls and the 10,000 gallon water tank on the roof, consists of reinforced concrete. No structural steel was employed, nor any brick. Even the foundation is of concrete.

The foundation here was a serious problem. This was in part due to the character of the soil. The immediate neighborhood has been named "The Swamp," probably because in the olden days it was really a swamp. At any rate, the bearing soil consisted of about 100 feet of sand of varying quality underlying strata of muck and peat. What was the best type of foundation for the structure in contemplation? Safety, economy, and time all had to be considered. Because of the danger of settlement, ordinary pile foundations were, it appears, considered unsuitable. When a load is carried by ordinary soil, there is a distribution of the pressure in all kinds of directions. The Public Service Commission, it seems, has determined that this distribution results in a kind of pear-shaped "bulb of pressure." The tip of the pear is under the load and the base spreads out very considerably all round. Outside of the bulb is no pressure of any account. It is the soil within the bulb which sustains the load by the cohesion of its particles. So long as the load is kept constant, the bulb of pressure will be maintained, but if part of the load be removed, the cohesion amongst the particles will be broken and the soil will be incapable of carrying its former load until a new bulb of pressure is set up by the addition of more load. In applying the principle of the "bulb of pressure" to concrete piles, a certain patented type seeks to provide a fixed region of pressure. That is, "after the bulb of pressure is created it is always maintained and no settlement occurs." I have not the space to go into details. Suffice it to say in addition that eleven piles were placed under each exterior column of the tall structure, the total load being estimated at 750 tons. The piles under the walls are in two rows and crowded close together.

Another point of interest in connection with this city structure concerns the *exterior finish* of the concrete walls. Let me quote Mr. A. E. Wynn as to this point: "The method of finishing the exterior concrete surfaces is particularly interesting, as it is so often claimed that concrete cannot be used externally when the appearance of the building is important from an æsthetic point of view. Usually, the lower two stories of a high building are faced in stone, but as it was desired to maintain the monolithic character of the building, it was decided to cast the facing integrally with the concrete of the columns and curtain wall." The surfacing concrete consisted of *white* Portland cement, colored aggregate made up of quartz, feldspar and greenstone chips. After the concrete had seasoned all winter, the colored aggregate was exposed by the application of "bush-hammering."

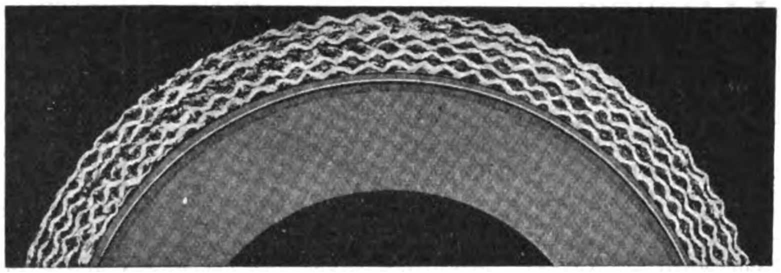
(*Continued on page* 54)

BRIEF TALKS ON RUBBER BELTING

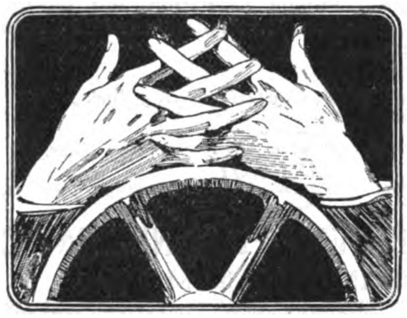
The Friction is the Life of a Rubber Belt

THE friction or rubber compound in a belt fills the whole fabric and must hold fast at every point, give at every point, and resist permanent elongation at every point, if the plies are to remain unseparated and in permanent relation to one another.

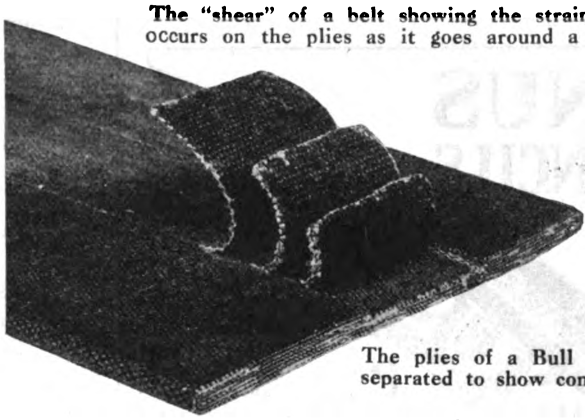
When a belt goes around a pulley the outer plies of fabric move relatively faster than the inner ones, that is, they move a greater distance in the same time. The inner plies are cramped, the outer stretched. When the belt leaves the pulley the plies are of the same length again. The gum compound must yield to this "lateral shear" or sliding of the belt plies on one another as the belt turns.



Section of belt on pulley. The belt has been cut lengthwise to show the effect on the plies.



The "shear" of a belt showing the strain which occurs on the plies as it goes around a pulley.



The plies of a Bull Dog belt separated to show construction.

Good friction should be as much like pure rubber in its properties as possible, consistent with the diverse requirements it is to meet. When the plies of a finished belt are pulled apart in the friction test the long teeth or rubber bonds which are seen uniting the plies indicate the quality and serviceability of the compound used.

Every condition of a perfect gum compound, both in its own needs and in its relation to the fabric, is met by Bull Dog friction as is abundantly proved in laboratory and service tests.

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ST. LOUIS, MO.: 2206 Pine Street	DETROIT, MICH.: 306 Lincoln Bldg.	SEATTLE, WASH.: 318 L. C. Smith Bldg.

(*Continued from page* 52)

The result was a surface indistinguishable from granite and yet a true concrete.

The speed with which this big building was erected is a further point of interest. Operations began in October, 1920, and the frame was completed in March, 1921. In four months, fifteen of the stories were constructed—say, an average of a floor every 8 days. Here we have one important factor contributing to the popularity of concrete—speed of construction.

Medical Arts Building at Dallas, Texas.

The concrete building recently constructed at Dallas, Texas, and known as the Medical Arts Building, is a still higher structure than the Hide and Leather Building in New York City. This southern tower is 255 feet high from the basement floor up and consists of nineteen stories. This is not an example of factory construction, as the building is devoted exclusively to the use of the medical and dental professions. Like the Hide and Leather Building, however, it shows what may be done in constructing factories which are not expected to house heavy machinery or other exceptional weights. The first three stories cover the somewhat irregular-shaped site, but above their level the building has a plan outline of cruciform shape. It is as if we took five squares of about equal size, placed one in a central position and arranged the others to form wings or extensions on all four sides. This arrangement provides for light and air. The entire cross fits into a square 111½ feet on a side.

Economy.

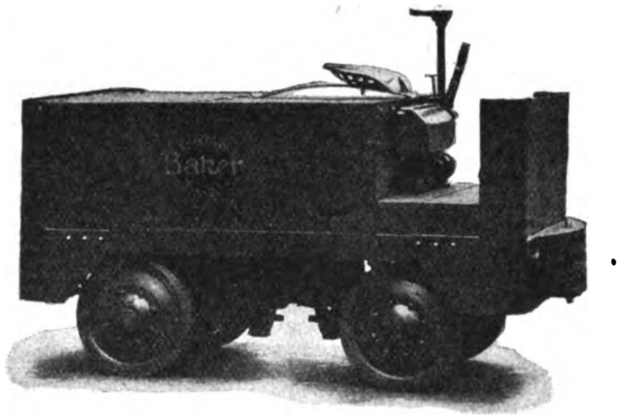
When the building was in contemplation, the cost of a structural steel frame was estimated. The difference between this cost and that for the present design was found to be about $75,000 in favor of concrete. Concrete—that is, reinforced concrete—was chosen not only for the frame, but also for the face. There are four elevator shafts each inclosed by a 12-inch concrete wall. These walls extend from the basement to the twelfth floor in full thickness, and from that level on of 8-inch thickness. The elevator shaft walls serve also as columns and thus act as part of the support of the building. They also act as stiffeners in resisting the overturning action of high winds. Solid rock was available here for the ultimate support of the structure, so that we have no serious problem in this connection.

A Big Loft Building.

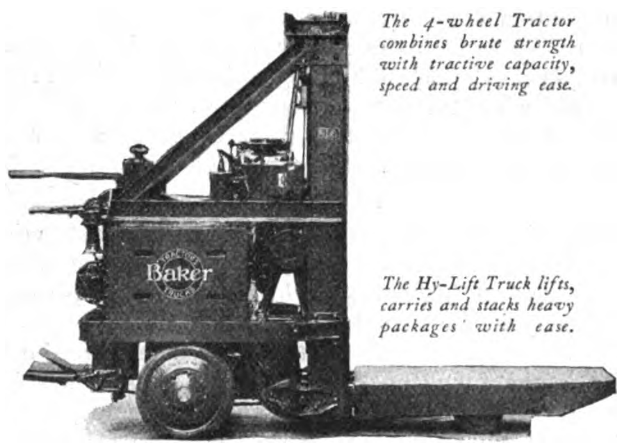
A large, nine-story building in Lower Manhattan occupies an entire block and provides quarters for various lines of business having to do with electricity. This is 395 Hudson Street. The main structure is nine stories high with basement. The size of this building may be gathered from the fact that there is a total of 525,000 square feet of floor. For the most part, the structure is of flat slab construction. The interior columns are circular in general, but because of limitations imposed by space some were made rectangular in plan. In these, the reinforcement consists of two or three spirals. The rapidity of construction may be gathered from the fact that footings were begun at the beginning of summer and the last pent house roof concrete was poured a few days after New Year's Day. It is said that runs of

(*Continued on page* 56)

Strength —Power— Economy



The 4-wheel Tractor combines brute strength with tractive capacity, speed and driving ease.



The Hy-Lift Truck lifts, carries and stacks heavy packages with ease.

LIFTING, hauling, carrying, dumping, in and out tight aisles, around sharp corners, up steep ramps, Baker industrial tractors and trucks meet a startling range of material-handling requirements.

Sturdy construction, ease of handling and freedom from trouble, combined with the saving in time and man power over hand methods, make these machines a decided economy wherever heavy, bulky material needs shifting.

The machines here illustrated include but a few of the types in widest use. There are many other models for each individual service.

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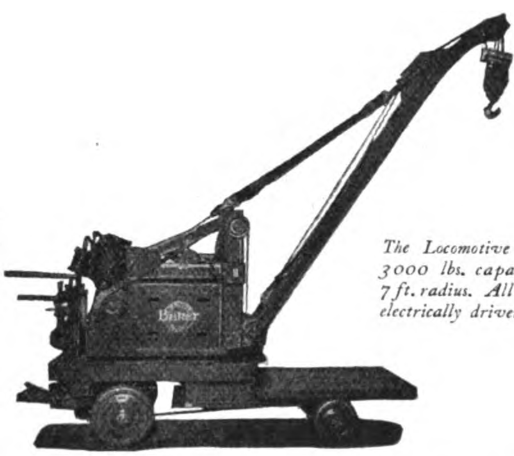
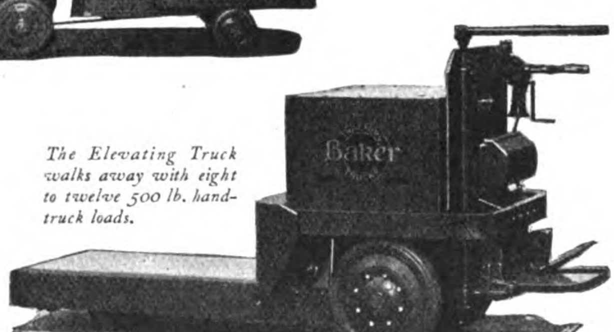
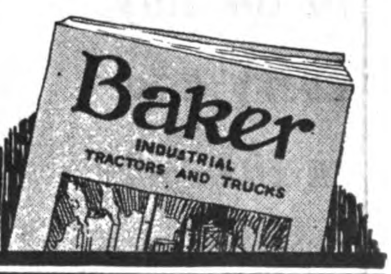


The Locomotive Crane. 3000 lbs. capacity at 7 ft. radius. All motions electrically driven.



The Elevating Truck walks away with eight to twelve 500 lb. hand-truck loads.



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(*Continued from page* 54)

over 900 cubic yards of concrete were not infrequently poured in a single 8-hour day.

A notable matter developed during construction which has to do with the progress of concrete practice. Because of the high labor rates, it was felt that a larger expenditure for plant would be justified in view of the saving in labor to be effected thereby. This means, for one thing, that concrete construction is not tied up to a certain routine, but that practice may be varied to meet different situations. Work on this job was compared with that on a similar job done before the war. Despite the fact that $6.50 per day was paid in the recent concreting, the entire labor cost per cubic yard for mixing, hoisting and placing concrete in floors dropped to $.72. This continued for two weeks at a stretch. The equivalent for concrete before the war would be $.33 per cubic yard. Perhaps the principal lesson consists in the fact that when the cost of labor rises, there is a possibility of cutting down the expense per man-hour by using more machinery.

Concrete in Gas Works.

There are quite a number of classes of construction for which gas people have already used concrete or for which they are beginning to do so. There is, perhaps, no novelty in the fact that the Greenbank Gasworks at Blackburn (Great Britain) has employed reinforced concrete in the following structures erected in connection with their new installation of continuous vertical retorts: Pile foundations for the retort house; a coal breaker pit for use with the coal handling plant; a battery of storage hoppers for coke; and a crane gantry designed to carry a steam locomotive crane having the duty of transporting coke from the retorts to the storage hoppers. All this is perhaps important, as exemplifying the utilization of reinforced concrete. At the same time, the use of reinforced concrete in such construction is perhaps almost inevitable. However, there is more or less novelty in the fact that reinforced concrete has found service as construction material for *gas-tight purifying tanks*. Let me quote Mr. B. N. Dey in connection with the use of reinforced concrete for such use: "Long after its invasion into other parts of gasworks, its importance and usefulness as a strong, durable, and economical material for the construction of gas-tight purifier tanks were recognized by gas engineers, who were interested in the facts that these tanks could be built at a far lower cost than those in cast iron, and would require no upkeep, not being affected by the gases and vapours in a gasworks, which have a corrosive action on iron and steel."

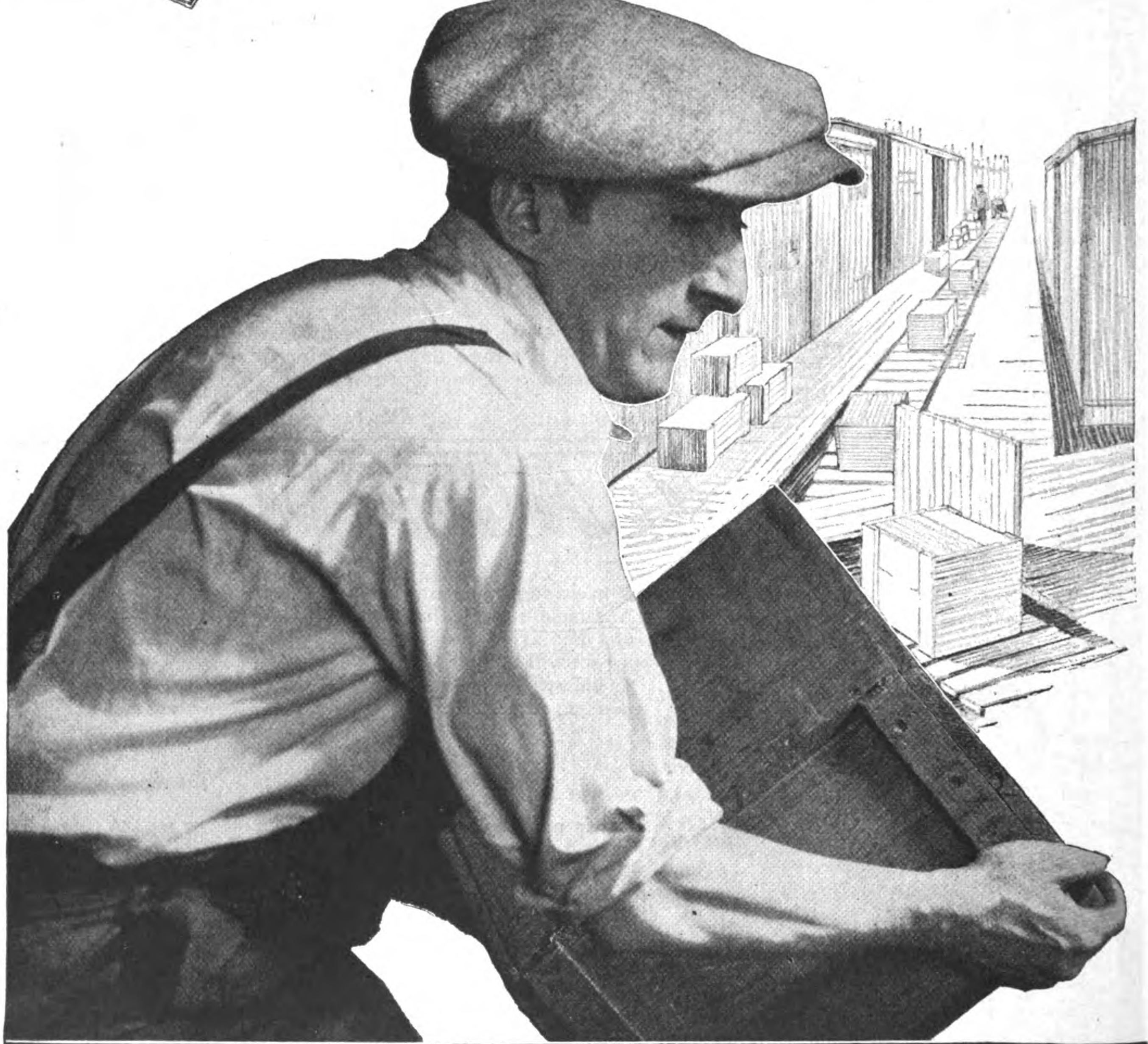
AT the Baltimore Meeting of the American Chemical Society, which will be held during Easter Week, the Division of Industrial and Engineering Chemistry will hold a symposium on Corrosion. At the present time the tentative outline of the symposium is as follows:

1. Submerged Corrosion of Metals
   a. Iron and Steel
   b. Non-ferrous Metals
2. Atmospheric Corrosion
3. Corrosion of Special Alloys

Papers relating to any of these subjects or subdivisions will be welcomed by the chairman of the symposium, who is Robert J. McKay.

In case one plans to present a paper before this symposium he should correspond at once with Mr. McKay or the secretary of the Division.

The Division of Simplified Practice, Department of Commerce, Washington, is urging industry to simplify its methods of production. Material-handling equipment, when rightly used, has the sanction of Secretary Herbert Hoover, head of this movement. *It is one of the means by which industry may help itself and help labor at the same time.* It helps carry out the teachings of this branch of your government.



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If materials are being handled uneconomically anywhere in the course of your production, competition will sometime force the correction of this waste. But why not find your own opportunities for saving? Why not get those richer profits that come with being the first to turn material-handling into a completely mechanical operation?

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Industrial and Mine Locomotives
Tipple Equipment
Mining Machinery
Ventilation Fans

The World Power Conference at London

(*Continued from page* 17)

tle that could be said. There is not enough falling water to drive a churn anywhere in England, and as for the Highlands of Scotland, even the Scottish optimistis do not estimate more than 400,000 hp., of which less than 10 per cent. is now being used.

There has been much talk in England about using the tides. The only drawback is that nobody knows how to do it. A Government attempt is now being made to use the tides at the mouth of the Severn. The project will cost $125,000,000. It will be another Muscle Shoals. Practical engineers regard it as a fantastic scheme, pushed forward merely to provide jobs for the unemployed.

For better, for worse, Britain is tied fast to coal and oil. It can have no part in the development of hydro-electric power. Not Britain, but Canada, will be the workshop of the British Empire in the near future, if water proves to be cheaper than coal. That is the fact that has made the deepest impression upon the engineers of Great Britain.

It was cheap power that made the industrial greatness of England. It was cheap fuel that built up Sheffield and Newcastle and Manchester. Plenty of cheap coal —that was the secret of England's industrial supremacy; and now this first World Power Convention has revealed the fact that there is a cheaper power than coal.

Among the American delegates present, there were Dr. Arthur T. Hadley, of Yale, Samuel Insull, Bion J. Arnold, John R. Dunlap, W. S. Murray, H. J. Pierce, Barton R. Shover, A. E. Kennelly, E. P. Mathewson, S. Z. Mitchell, Carl D. Jackson, William T. Donnelly, W. S. Lee, John W. Lieb, A. H. Markwart, and D. S. Jacobus.

There were delegates from all European countries, and from all the British Colonies and Dominions. There were several from China and Japan. There were even two delegates from the Soviet of Russian Republics, who read papers in French on the production and distribution of electrical power in Russia.

Nine-tenths of the papers were technical. But there were several by such well known British publicists as Lord Inchcape, who spoke on "Shipowners and Shipbuilders;" Major-General Sir Philip A. M. Nash, who spoke on "The Economics of World Power;" and the Right Honorable Sir Philip Lloyd-Greame, who spoke on "Government Coöperation in Power Development."

The paper that aroused the most discussion was a short one on "Low Technical Carbonization," by an English engineer—Henry E. Armstrong.

This was a very frank and outspoken paper. It was practically a confession that England does not know the most efficient way to burn coal.

"Say what we may," said Mr. Armstrong, "coal is now our master. We have been studying smokeless fuel," he said, "for 20 years. We have been spending large sums of money in developing the ideas of various inventors. Yet neither in England nor anywhere else has any process been carried to the point of complete practical and economic efficiency. A perfect solid fuel has been produced; but no one has yet succeeded in

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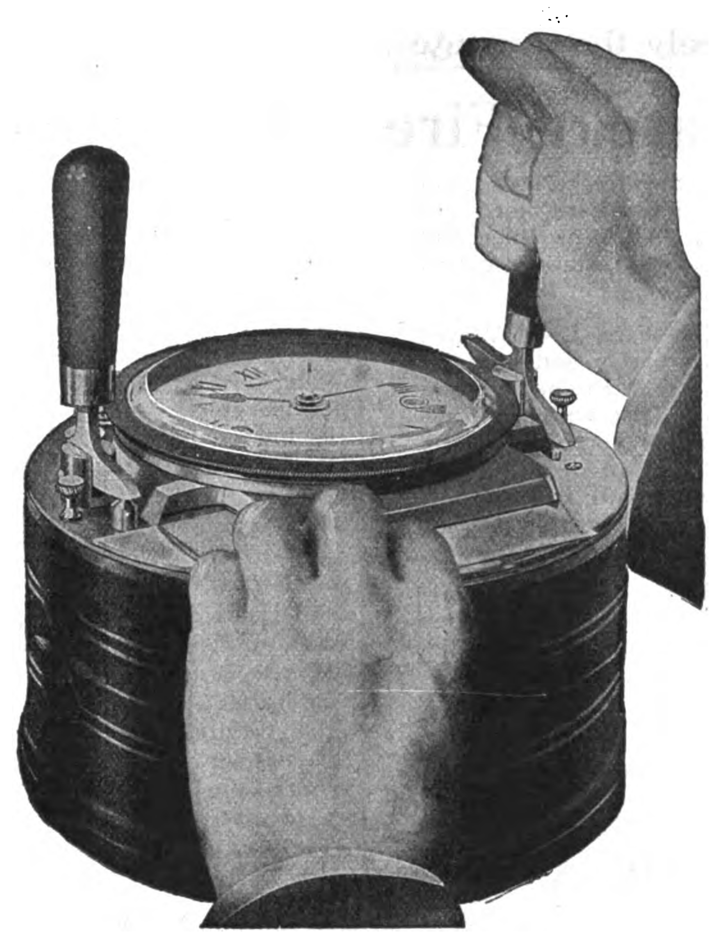

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THE ELAPSED TIME RECORDER

(*Continued from page 60*)

making a gas-tight plant from which all the products can be collected without loss and without in-leakage of air."

This paper was answered by B. F. Haanel, a Canadian delegate, who had a paper on "The Fuel Resources of Canada." To the surprise of most of the delegates, he announced that "the first attempt to carbonize coal at low temperature for the production of, first, a char suitable for burning in pulverized form for steam generation, and, second, the maximum recovery of by-products, especially tar oils suitable for refining into motor spirits, is actually being made at the Ford Motor Works, Walkerville, Ontario, on a large commercial scale."

This subject of the preparation of fuels was of especial interest to the English engineers. More than $2,000,000 has been spent on experiments in the last few years by the Fuel Research Board, without in the least advancing the solution of the problem.

The claim has been freely made that England could save $500,000,000 a year by the prevention of waste in the burning of coal. Recently, this claim was put forward by Mr. Lloyd George, a former Prime Minister of Great Britain, in a book entitled "Coal and Power." The matter is being widely discussed, even in the public press, because of the steadily increasing cost of coal and the constant danger of a stoppage on account of a strike or a lockout.

The most interesting paper, from a technical point of view, was given by L. De Verebély, of Vienna, on the subject—"A New System for Main Line Electrification." This has started a new line of thought in Great Britain.

The central idea in his paper is that for the best solution of the problem of main line electrification, a system must be considered which not only makes separate power plants and transmission systems for exclusively railway purposes superflous, but renders it possible to connect the railway load to any general standard power system with the highest degree of economy, i. e., with the least transformation and especially without using rotating machinery in the substations fed by a transmission system.

This system, says Mr. De Verebély, enables the electrified railroad to fit systematically and with the least transformation, new equipment and investment into the general power production and transmission system used all over the country, and thus offers to one of the greatest and most urgent problems of our times the simplest, safest, and most economic solution.

Another paper that deeply impressed European engineers was given by an American delegate—Mr. W. S. Murray, on "Superpower." There was very little discussion on it. No English engineer took part in the discussion. The paper was, in fact, above the heads of the majority of the delegates. It dealt with a higher degree of standardization and efficiency than is known in Europe.

Mr. Murray gave a concise definition of superpower. It is, he said, the "saving made by interconnecting generating stations whose peak loads are reached at different times, and so distributing the load among stations of different unit operating costs, as to deliver power at minimum cost."

He explained that superpower does not supplant existing systems, but supplements them. Also, he pointed

(*Continued on page 64*)

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out that the highest economy in power production is reached through coördinate development of steam and hydro-electric plants. Steam electric power comes into action on peak conditions.

Mr. Murray also threw a new light on the subject by stating that power, today, while the most important, is the least costly item associated with the manufacturing costs of finished products. On the average, its cost is about 5 per cent. of the whole. The manufacturer is not asking how much power costs, but how much power can you supply. The main thing is the actual presence of adequate and reliable power. Speaking of railway electrification, said Mr. Murray, the application of superpower principles will mean that reliable, adequate and economic power will be ready and at hand, thus relieving the railroads of building their own power stations and which will leave only their contact systems as the burden of finance upon them.

Mr. Herbert Hoover was expected, as one of the speakers. He could not come, but he sent a short paper on "Government Policies in Relation to Power Development and Distribution." This paper gave great pleasure to the members of the British Beama, as it opposed state control in the most forcible language.

"The progress of a nation," said he, "can only come by preserving on the one hand the vital initiative and enterprise of our people, and on the other hand an equality of opportunity for all. Both would be strangled by the hand of bureaucracy and politics.

"No bureaucracy with a board of directors of 580 Congressmen and Senators," said Hoover, "would have made the electrical discoveries of the last fifty years or pioneered their application." This, from a Cabinet Minister, was a novelty in Europe. The English delegates could scarcely believe their ears.

More than this, Mr. Hoover maintained that a Government is not competent enough to deal with electrical and scientific matters. "Our political system," he said, "has not yet developed, and will not be for generations to come, to a point where it will have either the capacity to choose skill or the assured probity to operate these implements."

There were emphatic "Hear, hears" when the reader of Hoover's paper came to this sentence—"it is the business of government to provide an open road for the exercise of the individual initiative of its citizens, and not to substitute its own activities for that initiative." This was the old Jeffersonian doctrine that has long since died out in Europe; and it woke up many of the delegates like the blast of a trumpet.

Here, in Britain, the entire electrical industry is prostrate beneath the Board of Trade. It can do nothing without permission, and everywhere the technical men are supervised and regulated by the non-technical men, according to the practice in all bureaucracies.

An English delegate—Mr. D. Heineman, soon after gave complete corroboration of all that Hoover had said, by exposing the wastes and inefficiencies of the State controlled electrical companies of Great Britain. Some of his facts were sensational. "The total production of the electrical plants in the British Isles," said Heineman, "is less than the production in the one city of New York.

"The price to the consumer," said he, "is twice as high in London as it is in the United States. There are 32

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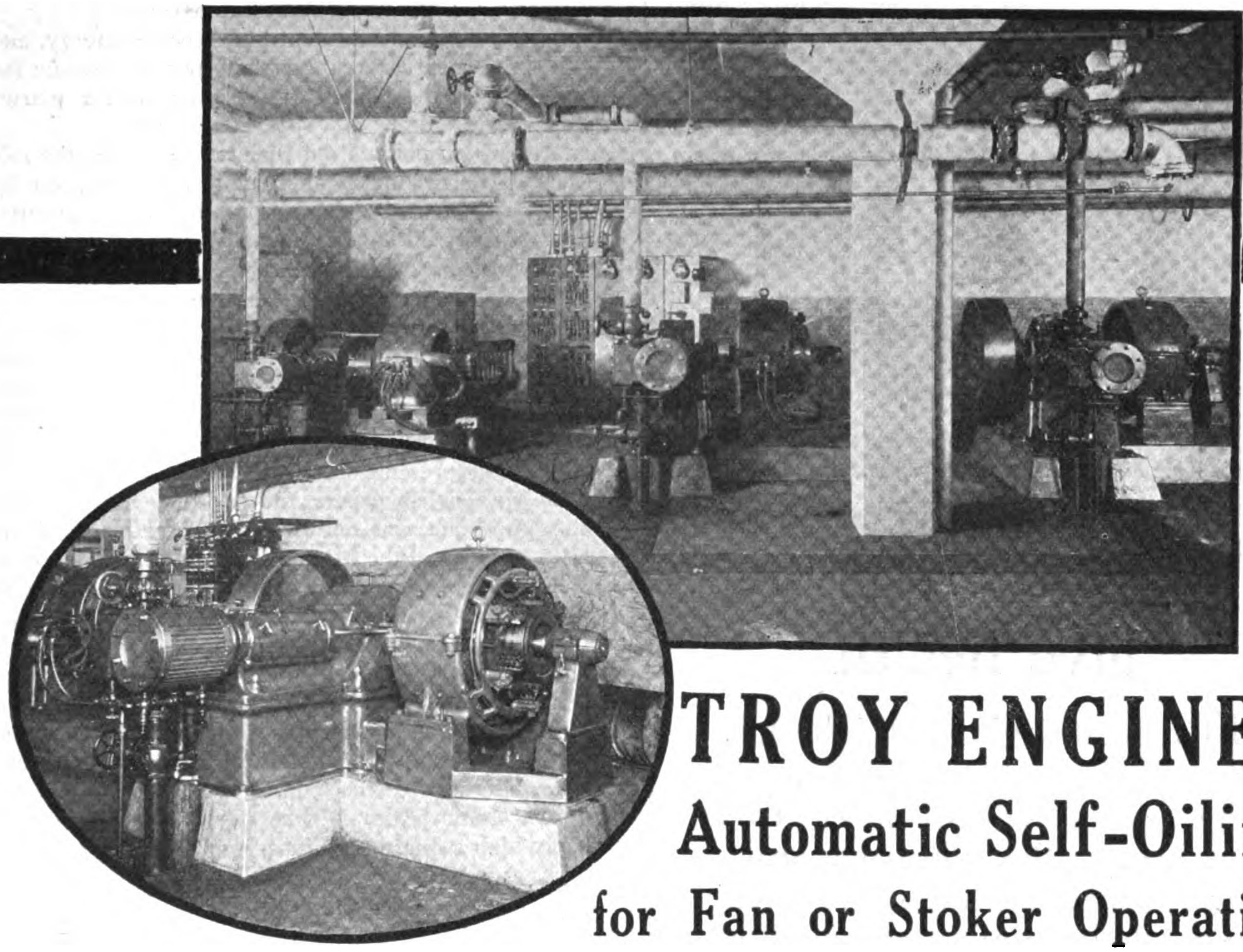

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(Continued from page 64)

companies in London that distribute electric energy, and their average price is over five cents per unit, while the average price in the United States is two and a quarter cents per unit."

Mr. Heineman pointed out that two-thirds of the sale of electric energy in Great Britain is carried on by municipal authorities, while, out of the 362 large cities in America, only 30 have municipal plants. This means that electrical companies are 33 per cent. private in Britain, and 92 per cent. private in the United States.

"The average capital invested in our London plants," said Heineman, "is $365 for kw. of generating machinery, and represents twenty-five cents for every kw.-hr. produced. In Chicago, on the other hand, the average capital invested is $210 per kw. of generating capacity, and represents six cents per kw.-hr. produced."

Of all the English papers, the one that was regarded as most important was one by Sir Robert Hadfield, on "Fuel Economy and the Measurement of High Temperatures." In the course of his paper, he somewhat casually announced the discovery of a new steel, recently invented by a group of French metallurgists. This material is not only practically non-scaling at temperatures up to or even exceeding 1050° Centigrade, but is also resistant to the action of the sulphurous products of combustion, in this respect comparing favorably with the more expensive materials of the non-ferrous type known as Nickel-Chromium Alloys. The steel also possesses remarkably high strength and tenacity at even up to about 900° C., at which, as is well known, the strength of ordinary steel is practically negligible. It is expected that the use of this new steel will lead to material improvements in the operative efficiency of furnaces.

Of all the nations that were represented, the United States was far and away in the lead, in the matter of actual development. Other nations had nothing to show in comparison with the great companies that supply electric energy to New York, Chicago, and the Pacific States.

It was an interesting fact that the one man who had accomplished most in the actual marketing of electrical energy was Samuel Insull, of Chicago, who had left London as a penniless lad, to seek his fortune in the United States. He came back to his home-land at the head of a vast new industry in which Great Britain now finds herself hopelessly behind.

Next to the United States came Canada. One Canadian delegate—Mr. J. B. Challies, gave a paper on "The Water Powers of Canada," which was heard with the most profound interest. It was replete with charts, maps and photographs. And it convinced those who heard it that Canada is a land of vast electrical possibilities.

"The water power now developed in Canada," said Mr. Challies, "amounts to 3,227,414 horsepower, and represents an investment of $688,000,000. In spite of the 750,000 horsepower of new construction, now going forward," he said, "the demand keeps ahead of the supply.

"To give the Canadian people what they want," said he, "we shall have to spend $300,000,000 more in the next ten years." The English engineers could scarcely credit this statement.

"While our population, in the last ten years, has increased only 22 per cent.," said the Canadian delegate, "the use of water power in industry has increased 245

(Continued on page 68)

(*Continued from page 66*)

per cent.; and the capital invested in manufacturing has increased 175 per cent. And," he added, "we have developed, as yet, only 8 per cent. of our available water power."

All this amazing development has been achieved by private companies, using private capital. There have been no subsidies and no Commissioners. Of the capital invested, 68 per cent. has come from Canada, 13½ per cent. from the United States, 6½ per cent. from Great Britain, and 12 per cent. from other countries.

But, as I said in the first part of this article, in the amount of electric energy used per capita, the palm had to be awarded to little Switzerland. This little nation of valley-villages has no coal. It has plunging streams —thousands of them. And it has put them to work.

About 90 per cent. of all Swiss houses are now lit by electric light. Nearly half of the Swiss railroads are electrified and 97 per cent. of all stationary motors are run by electricity. In a word, Switzerland is now in the Electrical Age, while America, France and Germany are just in the dawn of it, and Great Britain is still under the fog of the Coal Age.

But, as the Prince of Wales reminded the delegates, in his remarks at the opening meeting, the World Power Conference was not convened to study the past but to prepare for the future. "The study of power," he said, "is still in a comparatively elemental stage, and no effort has hitherto been made to find out on what foundations our present industrial structure is built and what part power plays in this structure."

It was the FIRST International Power Convention in the history of the world and it was an unqualified success.

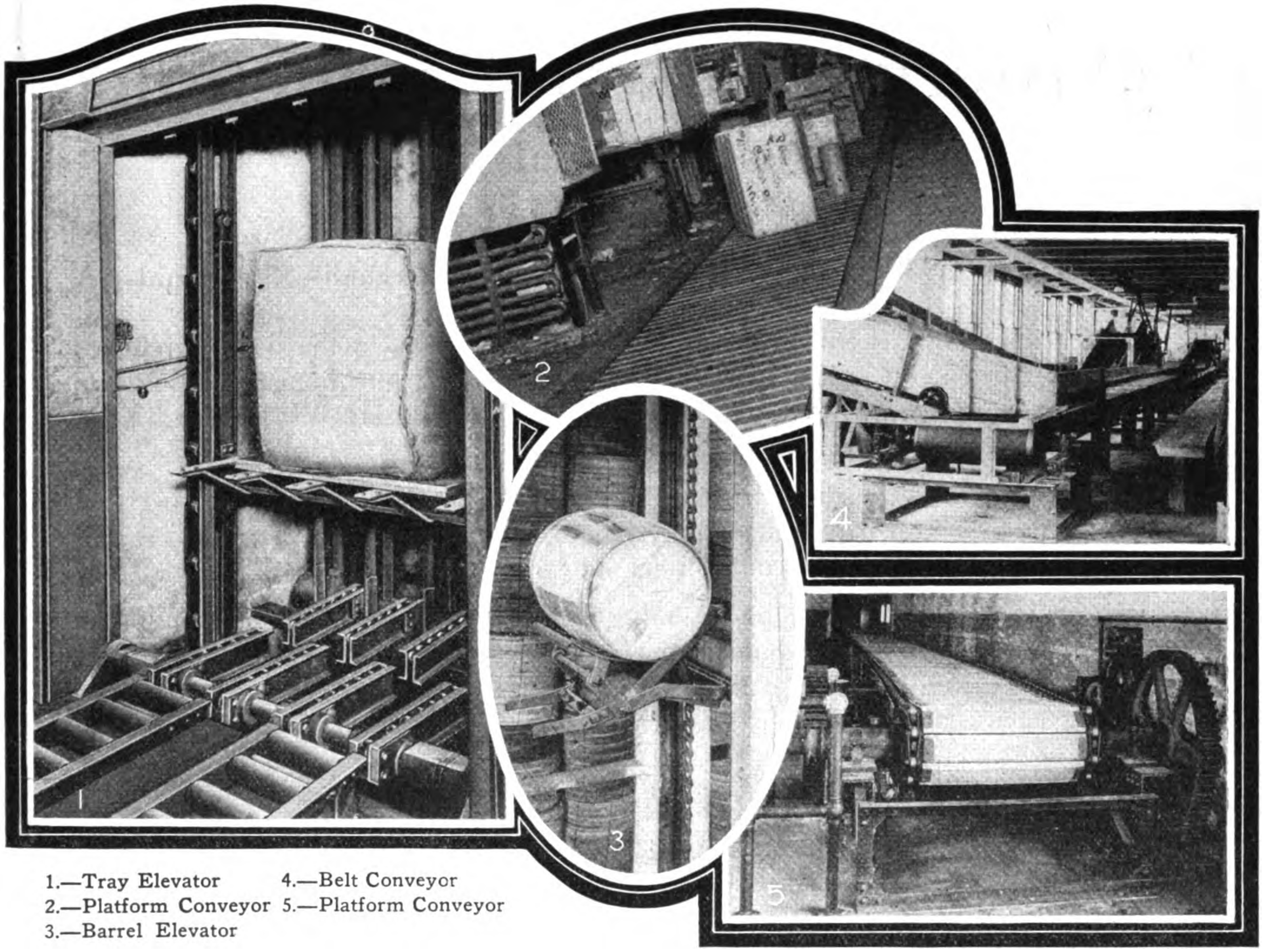
Taken in connection with the Wembley Exposition, it was an evidence that Great Britain is still maintaining her prestige in industry and enterprise. This stolid and stubborn old nation has just lost a third of her wealth on a profitless war in which she has gained nothing except a host of new responsibilities.

Her supremacy in trade after trade has been challenged by other nations. She has been beaten by the United States so often that she no longer pays any attention to a new defeat.

But the inner significance of the World Power Conference and the Wembley Exposition consists in the fact that Great Britain is still the old leader of the herd. She is still taking the initiative in lines in which she does not lead. She is still accepting the risks of pioneering from which other nations shrink.

There is no decadence in the British Isles. There are no signs of old age and decrepitude. The problem of cheaper power will be solved. The problem of consolidating her vast Empire will be solved. No one who has seen Wembley can have any doubt of that.

The British banking system, with its five great banks protected by the Bank of England, still stands as indestructibly as before the war. The ships of Britain—one half of all the ships on all the seas, still maintain the supremacy of the British race on the waterways of her Empire. And the credit and good-will of Britain, now much higher than before the war, are still at the back of all British trade and commerce. This, at least, was the sincere belief and feeling of all those who attended this notable Conference at Wembley.



1.—Tray Elevator
2.—Platform Conveyor
3.—Barrel Elevator
4.—Belt Conveyor
5.—Platform Conveyor

Increasing Efficiency and Reducing Costs with Mechanical Handling Equipment

THERE is hardly an industry today that cannot profitably employ mechanical elevating and conveying equipment for handling raw or finished products. Pushing the product from place to place with hand labor doesn't pay. It lowers the plant efficiency and keeps production costs relatively high.

Webster mechanical equipment for handling raw and finished products is the result of many years of development and experience. Today, Webster elevators and conveyors are serving profitably in many of our industries. In some of them production is wholly dependent upon the conveying system.

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High Production with a Lowered Accident Rate

(*Continued from page* 21)

sources of accidents. But the high percentage of this type of accident revealed by the survey surprised all of the insurance companies' engineers and research men. These men were not surprised to find that in the machine shop industries machinery was responsible for about 32 per cent. of the total accident costs of those industries, and that the point of operation of machines alone was responsible for 20 per cent. of the total accident cost. Contrary to all expectations, however, the analysis revealed that in many industries the cost of accidents due to machines, and particularly to the point of operation of machines, was greater than for machine shop industries.

"In quite a few industries the point of operation hazard was found to be responsible for 50 per cent. or more of the total accident cost of the industry. A few of these instances follow:

Cost of accidents occurring at the point of operation of machines as compared to the total accident costs of the industry.

Sash, door and blind manufacturing	50 per cent.
Furniture stock manufacturing	50 per cent.
Wooden toy manufacturing	60 per cent.
Woodenware manufacturing	60 per cent.
Button manufacturing	65 per cent.
Metal toy manufacturing	65 per cent.
Metal goods manufacturing	65 per cent.

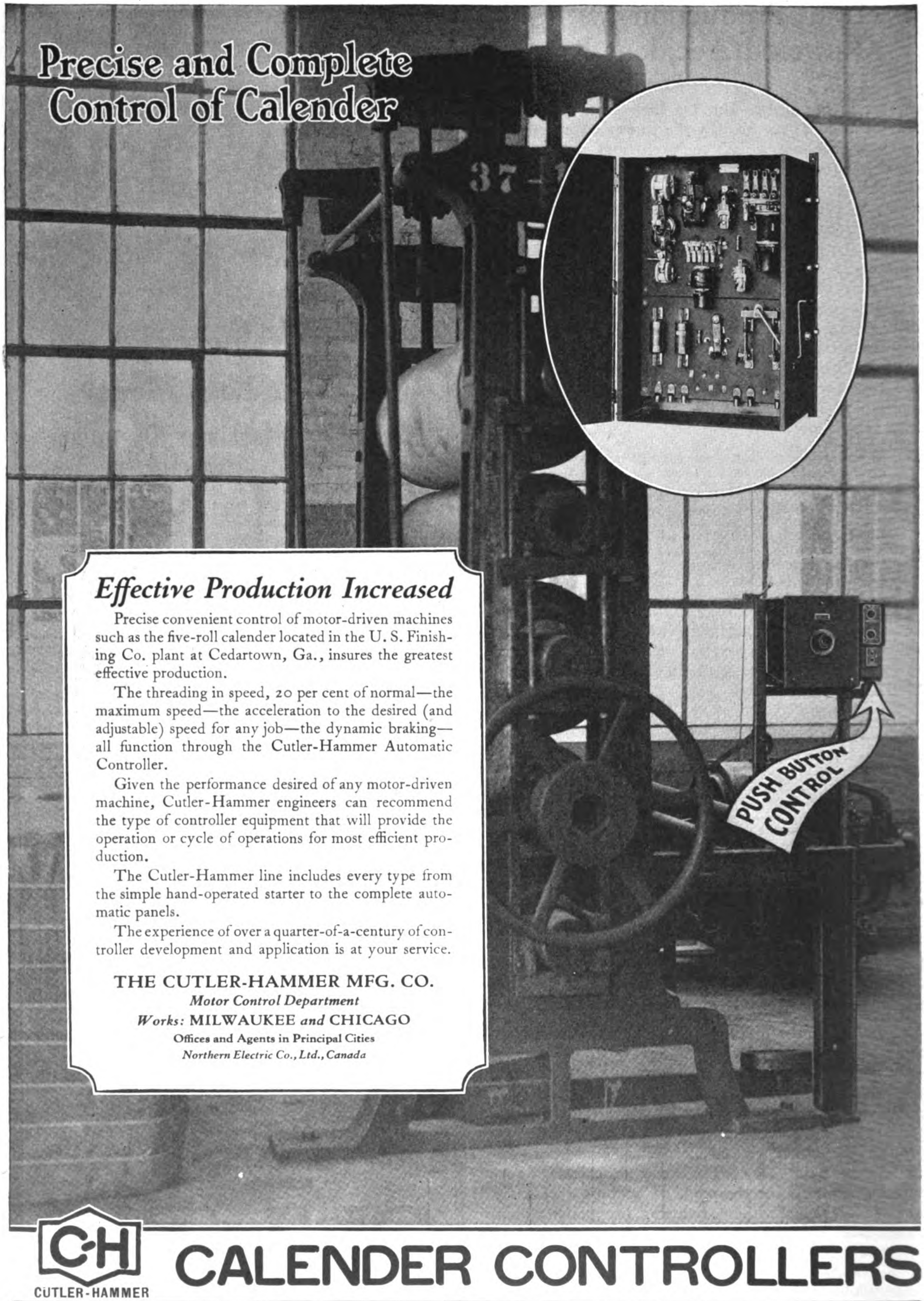
"The percentage of costs resulting from machine accidents and the percentage of costs resulting from accidents at the point of operation of machines as compared to the total accident costs of the industry as determined by this analysis, follow:

Industry	*All Machine Accidents*	*Point of Operation Accidents*
Stone	8.7	6.7
Clay	23.2	12.7
Glass	10.6	6.8
Rolling and steel mills	20.4	14.1
Metal products	38.8	29.4
Machinery manufacture	31.4	28.3
Vehicle manufacture	31.3	22.9
Lumber and wood	52.9	42.6
Leather	42.7	36.9
Rubber and compounds	47.0	35.6
Chemical industries	20.1	14.5
Paper and paper products	40.5	34.0
Printing and publishing	50.5	40.9
Textiles	43.7	29.9
Clothing	31.5	20.5
Laundry	47.2	33.6
Food	27.2	19.4
Miscellaneous	22.7	14.3

"In the opinion of the men who made this analysis, the unexpected severity of machinery accidents is accounted for by the fact that the point of operation is the accident cause to which workmen are exposed the greatest part of their time and by the fact that the point found that in the case of some machines, it is not difficult problem to be met with in mechanical guarding. They found that in the case of some machines it is not difficult to design guards for the point of operation which will prevent accidents without reducing production; on the other hand it is extremely difficult to meet both these conditions in the case of many other machines.

"Furthermore, it was recognized that there is a constant tendency in industry to substitute mechanical for

(*Continued on page* 73)


Precise and Complete Control of Calender
37
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Given the performance desired of any motor-driven machine, Cutler-Hammer engineers can recommend the type of controller equipment that will provide the operation or cycle of operations for most efficient production.
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PUSH BUTTON CONTROL
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CUTLER-HAMMER
CALENDER CONTROLLERS

(*Continued from page 71*)

manual operations, and as a result machine accidents are bound to cause an increasing proportion of the total number of accidents."

Every shop man realizes that many guards about the point of operation of a machine often greatly reduce production. There are many machines for which no universally satisfactory and safe guards have even been designed; for instance, in sheet rolling mills there are no particularly satisfactory guards for the main rolls, the nine roll flatteners, or for the various squaring shears. In fact, many mill superintendents will not allow any guards whatever to be placed on these types of machines, believing that more accidents are caused by guards than by having the point of operation in plain sight and an intelligent operator in charge, who is fully aware of the danger in operation.

It is therefore desirable to consider machines which have been designed with the idea of removing *the point of operation* from the operator. This has been accomplished in a variety of ways.

1. By special designs which make the particular mechanism a single purpose machine.
2. By dial or reciprocating feeds which often may be incorporated into the structure of a standard machine.
3. By combining special feeding mechanisms with special machine designs, thus making high production units of a semi-universal type.

Metal working machines may be divided into four main classes. These may again be sub-divided in a limited way. The classes are as follows:

CLASSIFICATION OF METAL WORKING MACHINERY

1. Rotating Tools	Drilling Machines.
	Miller.
	(Reciprocating Work Table)
	(Rotating Work Table)
	Grinder.
	(Rotating Work Table)
	Pipe Machines.
2. Reciprocating Tools	Punching Machines.
	(Reciprocating Work Table)
	(Rotating Work Table)
	Broaching Machines.
	Shaper.
3. Rotating Work	Lathe. (Engine—Turret Automatic Screw Machine Vertical Boring Mill)
4. Reciprocating Work	Planer.
	Grinder. (Surface)

ROTATING TOOLS.

In all of these classes, the designers have made notable progress in developing high production designs which are practically accident proof. In many cases the reduced accident risk has been secured simply by designing a special jig or fixture, whereas in a large number of instances a complete new design has been developed. In Fig. 1 is shown a 6-spindle drilling machine which revolves constantly about a central column. The machine is brought to the man and the actual labor of operating this six spindle machine is much less than with the spindles in a straight line. The operator is therefore not as fatigued and hence less liable to accidents. Fig. 2 shows a 36-spindle drill arranged for drilling a match plate containing 576 holes. This is accomplished in 16 operations by means of the two index dials. After the jig is filled, the operator has both hands away from the danger points.

In considering milling machines there are a large number of high production machines available. Fig. 3 is a special 8-spindle drum type miller for milling the mainfolds and water outlet pads on cylinder blocks. This is a high production two station machine requiring two operators at each station, one on each row of castings. The castings move past the cutters and are unloaded on the other side by another operator. In this way two castings are machined per fixture per revolution of the drum. The cutters are shielded and the operators are in slight danger of accident. Fig. 4 indicates a standard vertical miller with circular milling attachment. This attachment allows the operator ample time to remove and refill the fixture without danger. Where large castings are to be milled on a circular milling attachment, it is possible to place two of these fixtures side by side and work on one casting while the other fixture is being filled.

This type of fixture is adapted to both vertical and horizontal types of millers, making them over so to speak at will into high production single purpose tools. Where there is a smaller volume of work, these specially equipped standard machines often are the means of making a profit. Fig. 5 is a heavy duty vertical miller with circular table and fixture. This cut shows seven of the ten stations safe for the operator. It is possible to remove finished work and fill the fixtures in these seven positions which are away from the cutter. Fig. 6 shows a high power vertical surface grinder fitted with a rotating magnetic table at work on gear blanks. With the machine in operation practically all of the table would be covered with the water guards. The danger from accident is extremely slight and the production is a maximum.

Reciprocating Tools.

With reciprocating tools, there are many accidents, perhaps more on punching machines than on any other class of metal working machinery. Some extremely clever feeding devices have been developed for punch presses, among them are dial, roll and reciprocating feeds. Figures 7 and 8 illustrate exceptionally well the safe operation of a punch press running 60 strokes per minute forming sleigh bells. Fig. 9 is a photograph of a heavy multiple punch, the design of which was worked up with the primary idea of making a *safe machine* for the operators. A previous machine having a stationary bed had badly injured two operators and this last machine was brought out with the sole purpose of making a safe mechanism. When it was put in operation, it was found that production was also greatly increased. An operator stands on each side of the machine. The oscillating table eliminates practically all danger of injury to the operators, as there is no need for placing either the hand or the fingers near the dies, while either feeding the machine or removing the work when finished. The receiving die always comes forward to operator to be filled and retains a stationary position long enough to allow the operator to fill same. In Fig. 10 is shown a more complicated dial feed with tools for making a varnish can nozzle. The operator has very little reason for putting his hands near the danger points on this machine because work is fed in by means of slides and is ejected on to other slides which carry the finished pieces clear of the machine.

Rotating Work.

Probably the largest percentage of metal products produced by the factories of the country comes under this

(Continued on page 76)

Statement of the Ownership, Management, Circulation, etc., Required by the Act of Congress of August 24, 1912.

Of INDUSTRY ILLUSTRATED, published monthly at New York, N. Y., for October 1, 1924.

STATE OF NEW YORK }
COUNTY OF NEW YORK } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared John H. VanDeventer, who, having been duly sworn according to law, deposes and says that he is the Editor of INDUSTRY ILLUSTRATED, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, The Engineering Magazine Co., 120 West 32nd Street, New York, N. Y.
Editor, John H. VanDeventer, 120 West 32nd Street, New York, N. Y.
Managing Editor, None.
Business Managers, Harvey Conover, 120 West 32nd Street, New York, N. Y.

2. That the owners are:
The Engineering Magazine Co., 120 West 32nd Street, New York, N. Y.
John R. Dunlap, 120 West 32nd Street, New York, N. Y.
John R. Dunlap, Jr., 120 West 32nd Street, New York, N. Y.
John H. VanDeventer, 120 West 32nd Street, New York, N. Y.
Harvey Conover, 120 West 32nd Street, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VANDEVENTER, Pres.

Sworn to and subscribed before me this 26th day of September, 1924.

JOSEPH A. BURLANDO.
(My commission expires March 30, 1925.)

(Continued from page 74)

division. A great amount of lathe work requires constant attention and application of the operator. It is manifestly impossible to make a satisfactory substitute for the operator's technique and close application. However, there are a large number of machines developed for the purpose of making duplicate pieces cheaply and with a maximum safety to the operator. Fig. 11 shows an automatic forming machine equipped with magazine feed. There is but little need of the operator doing much more than act as watcher of operations. He keeps the magazine filled and inspects the work as finished by the machine. The production on a machine of this type is high and the accident rate extremely low. Fig. 12 indicates a 4-spindle automatic, which is another high production machine, economical of floor space and possessing a low accident risk in the operation. There are a variety of turret lathes available, which are semi-automatic in action. The work is either chucked individually or the finished pieces are made from bar stock. The vertical boring mill handles larger pieces and the time to finish individual pieces is much longer. This factor in itself reduces the risk from accident. The efficiency of these larger special lathes is often measured by the amount of metal removed per unit of time.

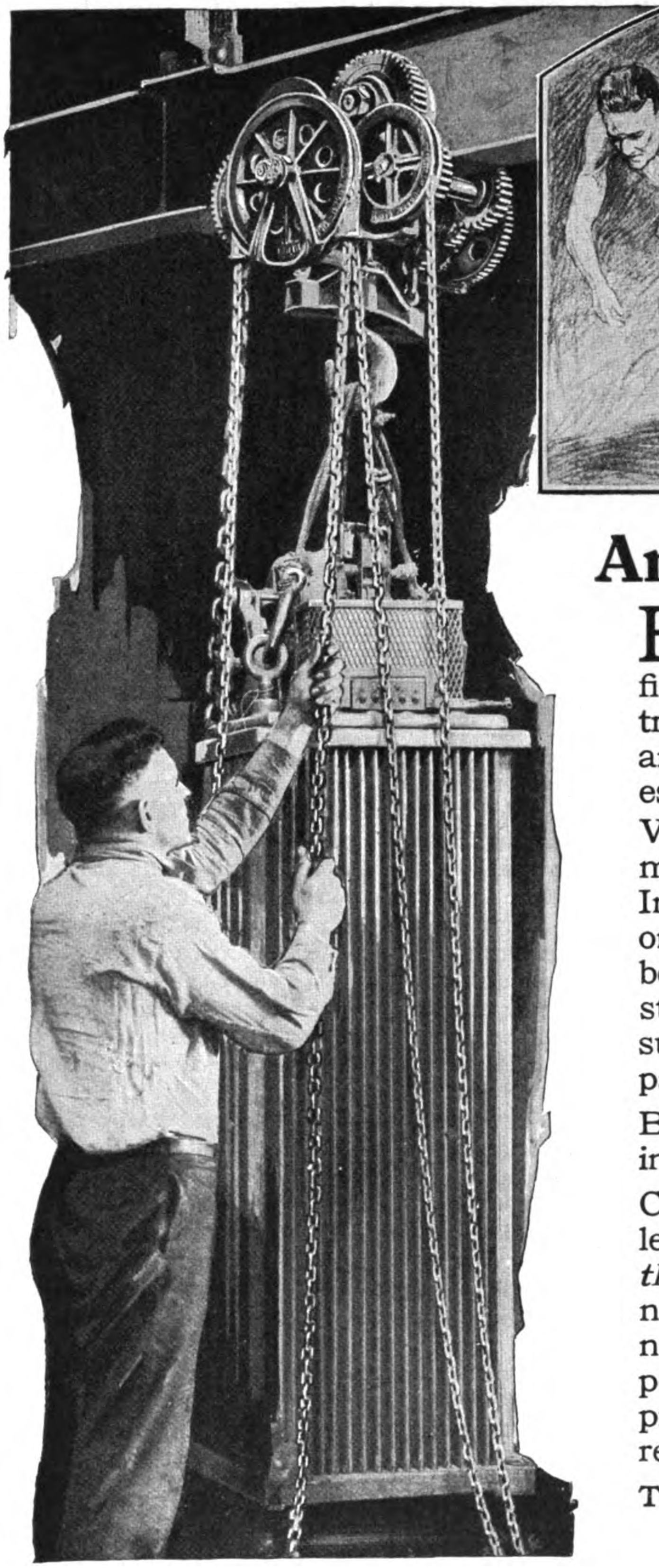
RECIPROCATING WORK.

The work handled on planers is generally much heavier than that machined on the other types of machine tools. It is on this account a type of tool which does not lend itself so well to special fixtures designed with the idea of both high production and maximum safety. Both the set up time and the machining time on a planer are relatively long. This means less liability of accident.

Surface grinders often reciprocate the work and the accident risk is low on this class of machine. The smaller flat pieces in large quantities are commonly ground on a grinder having a rotating table and this type of grinder is most satisfactory from both an accident and a producing standpoint.

It has been shown how designers, in the metal working industry, have handled the problem of high production combining with its solution the safe operation of the newer machines. In every branch of industrial activity there has been a similar solution of the ever increasing demands of higher production. It may be proven that the most modern machinery available in any given activity not only tremendously increases the output over older types of machines but also actually gives to the employer a much safer mechanism. If this fact were more generally appreciated and understood by both employee and employer, there would soon develop a better spirit of coöperation, which would react to mutual advantage.

INCREASED Japanese emigration to Mexico is foreseen by *Christian Science Monitor* (Boston, Mass.), as a result of departure of counsellor of Japanese Embassy to Mexico for study of industrial economic and immigration conditions in that country. It states: "It is expected that he will give special attention to subject of Japanese Emigration in view of the fact that voluntary restrictions placed by the Nipponese Government on emigration to Mexico during the life of the so-called Gentlemen's Agreement with the United States are now removed."



An Industrial Olympian!

EVERY four years famous athletes from all over the world meet for a final test of skill and strength. The entrees are the "pick" of the human race and the victors are acclaimed the greatest in the world.

What of an Industrial Olympic? A meeting of all the famous products of Industry? If such an event took place, one of Chisholm-Moore's entries would be the "C-M" 5-Ton Trolley Hoist installed in the new million dollar Grant sub-station of the Duquesne Light Company, Pittsburgh, Pa.

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OVERHEAD — HOISTS CRANES TROLLEYS — TRACK SYSTEMS

Machine Packaging of Food Products

(Continued from page 27)

package, folds in the end flaps, inserts an advertising slip in the package, closes the carton, tucks in the cover flap, and counts the cartons as they leave the machine—at a rate of at least 80 cartons per minute—passing directly onto an "accumulating" packing conveyor of interesting design.

The real significance of the mechanical problem, which this very ingenious machine meets and so deftly and successfully accomplishes, is something which written description cannot adequately picture.

This type of closing machine has never previously been adapted to the closing of cartons containing *any* liquid substance, such as lard is, at this stage of the process.

This whole project of development and handling of a lard carton which appeals from the standpoint of cleanliness and sanitation, freedom from spills, obvious convenience to the housewife, accuracy of weight, etc., will be further visualized by examination of the layout pictured in Fig. 6.

This marked step forward in the carton lard business has amply justified the investment in high class machinery.

Aside from the very tangible economy realized from the lower cost of the liner as compared with the bag, there is a definite labor saving, over the former practice of packaging, of 20 people, whose services have been made available and utilized at other points about the plant where they were needed.

The compactly wrapped slices of bacon—untouched by human hand—are placed in the carton by the cartoning machine shown in Fig. 7, which takes the flat cartons from a magazine or hopper, opens them, inserts the bacon in the carton, tucks in the two end flaps of the carton, and delivers the filled carton ready for wrapping in glassine paper.

This type of cartoning machine is used extensively for such work as cartoning Kodak film and intensive effort toward adaptation has shown, industrially at least, that the Kodak is kin to the hog.

The marketing of cheese in a small package involved considerable work in the design and development of the package and the introduction of various machine units to produce it economically and satisfactorily.

Some interesting development work had to be done to provide mechanical means of feeding the empty cartons to the filling machine to prevent jams or spills and also to arrange means of delivering the filled cartons from the machine in the particular relation necessary for subsequent machine operations on the package.

Here again the closing machine previously described is used. Considerable "adapting" work was necessary to make this machine handle the cheese package because of conditions peculiar to that package, but the machine, while of smaller size, is the same in principle as in Fig. 5.

This closing machine folds the paper mounted foil liner, wrapping the contents within the package, folds in the end flaps, closes the carton, tucks in the cover flap, and counts the cartons as they leave the machine, at a

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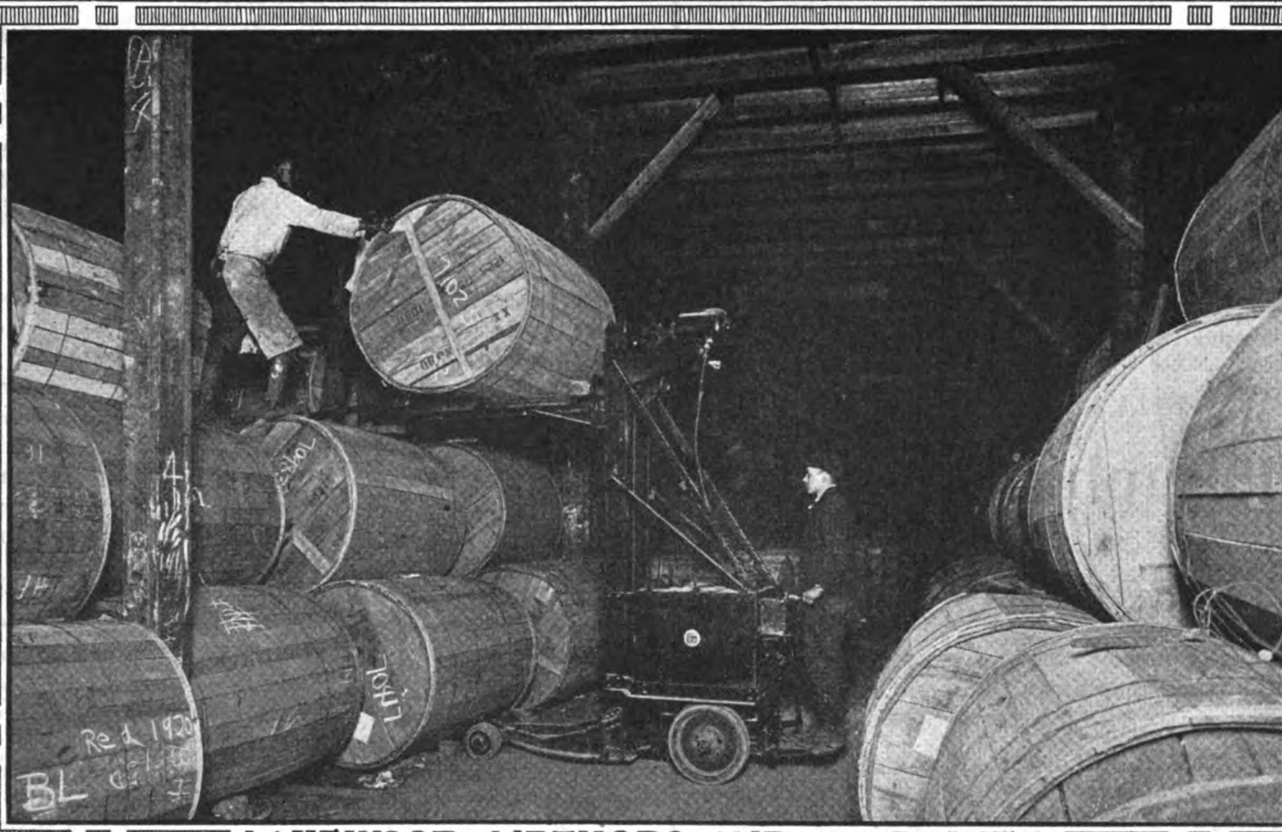


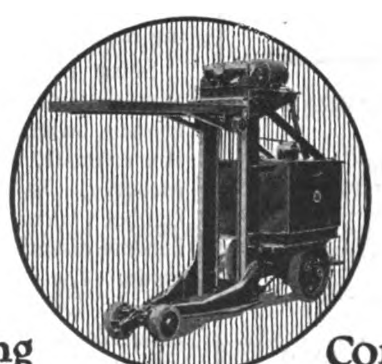
LAKEWOOD METHODS AND MACHINES

Tier- Lift Does the Boosting in Louisville Public Warehouse

HEAVY hogsheads are lifted right to the top of the pile in the Louisville Public Warehouse with a Lakewood Tier-Lift Truck. *The piles are higher—costs lower.* The Tier-Lift transports and elevates the loads so quickly and so easily that, in the words of one of the men, "There's nothing to it, anymore."

Costs can be cut, and goods piled higher in any warehouse with the Lakewood Tier-Lift. Let us show you how.

Send for a copy of our new booklet—"Snap Shots" illustrating some typical methods of handling.



The Lakewood Engineering Company, Cleveland U.S.A.

(*Continued from page 78*)

rate of 80 cartons per minute, and pass directly onto an "accumulating" feed conveyor en route to the wrapping machine.

The cartons of cheese upon leaving the closing machine go direct to, and through, the wrapping machine.

This wrapping machine is very positive and smooth in operation and quickly adaptable to either of two different speeds.

The machine cuts a piece of glassine paper from a roll, transfers it to proper position to receive the carton, neatly wraps and pastes it about the carton and applies a separate end seal to each end of the carton.

The packages enter the machine side by side on a small in-take conveyor, pass through the machine, and are discharged on a conveyor at the delivery end of the machine—in convenient position for the packers who must show considerable speed in packing into shipping containers to keep up with the production of the machine, which runs as high as 80 cartons per minute.

The various units of equipment used are properly coordinated and all combined in one continuous system—comprising machines for forming and lining, filling, closing, wrapping and sealing.

The filled cartons, i. e., both lard and cheese, are packed in fibre or corrugated containers, which are very neatly and effectively sealed with silicate on the sealing machine of the type shown in Fig. 8.

To the consumer, the progress herein outlined should appeal from the standpoint of improved appearance of packages, greater convenience, etc., and as an important contribution to the housewife's most cherished traditions of cleanliness and purity.

To the business executive, it is worthy of note that the typical instances referred to in this article have resulted in substantial economies in material or supplies —and a saving in labor of about 40 people—at the Chicago plant alone of Swift & Company without regard to the further extension of these economies to other Swift & Company plants.

EVIDENCE continues to appear showing that the low point of the depressed period in business was reached last July. In August, in September, and so far in October, the output of pig iron has increased, and more blast furnaces have been placed in operation. Industrial production, employment, and wages have all stopped falling and begun to move upward. Unfilled orders are larger and promise to continue to expand.

That present prospects are that the business improvement that is under way will continue during the remaining months of this year, and on into next year.

Some expressions of disappointment are appearing over the uneven and hesitating nature of the return to brisker business. Such expressions have always been characteristic of the early stages of periods of business recovery. As soon as men are convinced that the corner has been turned, and general business is improving, they become dissatisfied with the rate of progress that is being made. The fact is that the degree of improvement from July to October has been comparatively large, and its progress relatively rapid, as compared with previous periods of upturn.

Making the Plant Yard a Production Asset

(Continued from page 25)

will not last long. Bearings on all shafting should be oiled regularly and have dust tight covers. Conveyors for distributing coal may be belt, bucket, or scraper conveyors, each requiring attention at bearings and occasional lining up. With belt conveyors any tendency to run over to one side should be taken care of by lining up the guide rollers. Many of the newer belt conveyors have ball bearing rollers with arrangements for force greasing the bearings with a grease gun. The motor drives and gears need to be carefully maintained, especially where they are located outside without any protection. It is best to protect the power units on all conveying machinery. Motors must be oiled and the electrical connections kept in proper condition.

Ash handling equipment is very similar to the coal handling equipment. Ashes are very corrosive when wet and all parts in contact with the ashes should be kept painted. The inside of ash bunkers should be especially watched in this regard if made of steel. Many ash bunkers are now being made of concrete, as this material resists the corrosive action of wet ashes very well.

Portable belt conveyors may be used for loading or unloading or for moving materials in the yard. When used for materials such as coal or steel borings the belt is troughed. It is best to cover these conveyors at night with a tarpaulin to protect them from the weather as much as possible. While they are being used, weather should not be given any consideration, but when they are not in use, it is best to keep them from depreciating too rapidly. The power extension cords for the motor drives on portable equipment often prove very expensive to maintain because they get run over and kinked up. Automatic reels for this cable keep it out of the way and in good condition. Similar items of maintenance are present on the self-feeding bucket loaders now used for loading trucks from a pile.

Portable slat conveyors must be kept in alignment as rough handling knocks them out of line. Apron conveyors are often run out in the yard without covering, but it is best to put some kind of a housing over them to protect them from the weather. Gravity conveyors are very generally used for unloading heavy boxes, barrels, or heavy material such as pig iron. With ball bearing rollers the maintenance on these conveyors is very low. The conveyors should be at the correct slope for the class of material being handled and be well braced at curves.

The electrical contacts on cranes are one of the big maintenance items. They should be inspected every day if possible and a general inspection of the mechanical parts should also be made. When cables get frayed on cranes or other equipment they should be repaired or replaced at once to eliminate accidents. Cranes should be lined up every six months and the rails on which the crane runs should be lined up at the same time. This makes the crane travel more easily and is safer. The cab should always be enclosed to protect the control apparatus and make the operator comfortable in cold weather. There should be a housing over the trolley to protect the hoisting and running gear and motors. When the crane is not in use it is a good idea to run it under a shelter built over the craneway at one end. This protects the entire crane from the weather and saves maintenance. Craneways and cranes should be painted every two years in order to preserve them. Gantry cranes require about the same maintenance as regular cranes.

Locomotive cranes are largely used in plant yards for handling coal. For yard work, where rails are not laid, caterpillar type treads are put on instead of wheels. The machinery should not be exposed to the weather if best results are desired. Both sides and top are necessary to properly protect a crane machine and operator.

Industrial railways in the yards are used to get into places where it would be impracticable to use large cars. Various types of electric, gasoline, and steam locomotives

Fig. 23. Portable hoisting units should have all the machinery carefully guarded to keep foreign materials from falling into the moving parts.

are used, depending on the service. Storage battery locomotives are able to get anywhere in the yard or inside the buildings with no outside equipment and they are largely used. They require a battery charging outfit, but this can usually be the same equipment used for charging electric trucks. Trolley type electric locomotives are used where the overhead trolley wire is not objectionable. Cars with dump bodies must be kept in repair as the tendency is to handle them roughly in unloading. Tracks should be lined up every six months in order to make easier handling. The cars should be inspected once a month and the running gear repaired if necessary. Axle bearings should be oiled every few days unless ball or roller bearings are used, in which case they should be greased every three or six

(Continued on page 84)

(*Continued from page* 82)

months. Some cars are made with swivel axles so that they will go around a curve more easily. Switches and turntables must be kept in repair. The frog points of switches should be watched and properly maintained so that cars will stay on the track. Many turntables are ball bearing and should not require much maintenance. Tracks are usually made up in sections with rails riveted or welded to the steel ties. These tracks are easily kept lined up, as they come in about twenty foot sections.

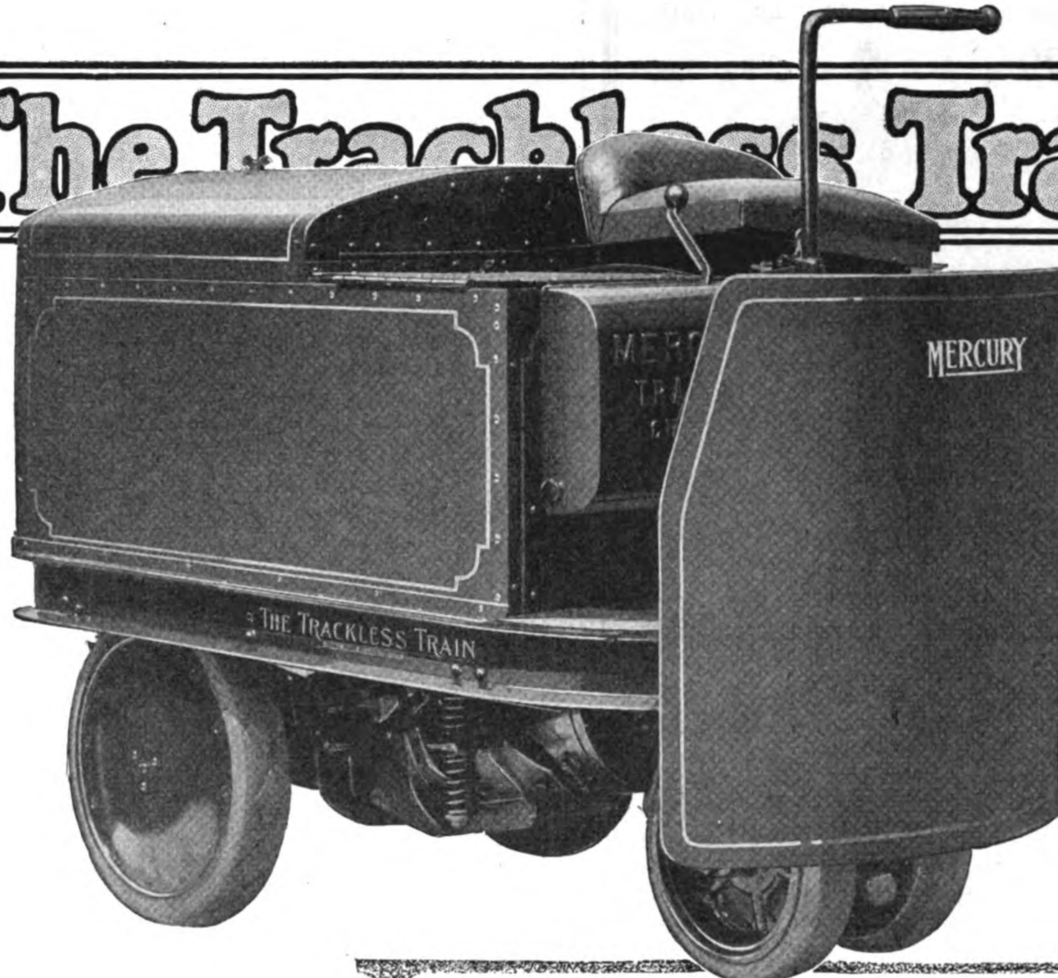
Overhead monorail track systems are space savers and a man can push a heavier load on a monorail than on a truck. By putting the wear on the rail, the plant roads are not worn out so quickly, and where loads have to be hoisted, they might as well be transported a medium distance while hanging on the hoist. When electric hoists are used they should be given careful maintenance both on the electrical and mechanical parts. The brakes and cables must be inspected regularly just like an elevator. The track or monorail switch points should be protected from the weather in order to have them operate correctly at all times. The electric feed wires on either side of the monorail beam should be kept correctly located and insulated to avoid any electric trouble; this is especially true at switches. For heavy monorail service such as coal handling in the yard the cage controlled hoists are necessary and it is best to make the operator responsible for the oiling and upkeep of his hoist, insofar as minor repairs are concerned.

Electric industrial trucks and tractors are being used more each year because of their economy over hand trucks on long runs. Storage battery electric trucks are of various kinds, such as load trucks, lift trucks, and crane trucks. The controls are usually arranged so that the circuit is open until the operator stands on his platform. Electric trucks soon shake themselves to pieces on bad roads, so in order to reduce maintenance expense a narrow plank walk for trucks should be laid between buildings, if the expense of a concrete walk is not justified. Dirt roads are usually too rough for the small wheels on electric and hand trucks, as they get stuck. The rubber tires on electric trucks and trailers are quickly cut up and ruined if the operator runs over the sharp edges of railroad tracks or other unevenness. One of the most frequent causes of breakdowns is overloading. Occasional small overloads do not hurt any truck, but constant overloading racks the truck and shortens the truck's life. Electric tractors will run in either direction and may be used for many odd jobs, such as towing freight cars besides their regular job of towing trailers. Steering or tracking trailers may be used on short curves and are easy to turn in the plant. The storage batteries in trucks and tractors may be charged at night or with a spare set they may be changed over each day. Gasoline tractors are used extensively in the yard, but only occasionally inside a building.

Lift trucks reduce the number of trucks needed in a plant as the same truck is used over and over again. There is also a great saving in labor due to the fact that no rehandling is necessary, as the load is already piled on a platform when the truck arrives. The platforms are now made of wood with steel frame or in some cases of all steel. Trains of lift trucks may be made up on long hauls to save truckers' time. The electric tractor delivers loaded or empty trucks and plat-

(*Continued on page* 86)

The Trackless Train



The Mercury "Type-H"—embodying 10 years experience building electric tractors

No other assembly stands out as strong with distinctive features as the "Drive Unit" or power plant of the Mercury "Type H" Tractor.

The most important of these is—the *Mercury Patented Internal Gear Drive*—a drive that increases work-output efficiency from 25 to 35 per cent as compared with the worm drive principle.

A positive drive of brute strength. A driven bevel gear, within the axle housing, drives the axle pinions in the rear wheels. These axle pinions transmit the driving power through three idler gears to a large ring gear mounted on the inner diameter of the drive wheel.

The "Drive Unit" or power plant is *one complete assembly* comprising the motor, motor hanger, rear axle housing, rear wheels, rear springs, and all driving gears.

The "Drive Unit" is another reason why there are more Mercury Tractors in service than any other.

Mercury Manufacturing Company
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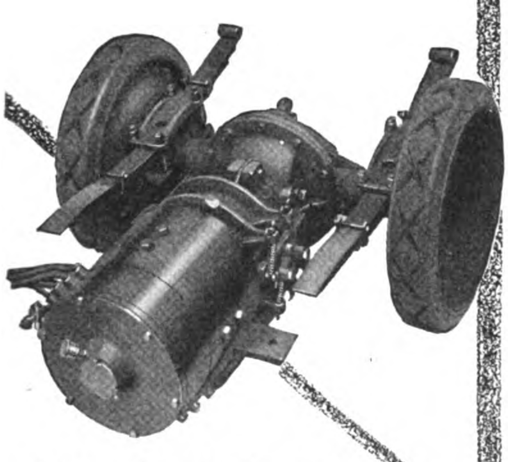


The complete assembly may be detached from the frame in five minutes. Simply remove two bolts that hold the motor suspension springs, the riding spring shackle bolts are slipped out —and the unit is free.

The Mercury "Drive Unit" is the most important of all features—there are eight others, all fully covered in Bulletin No. 106. Request a copy now.

(*Continued from page 84*)

forms to truckers at both ends. For severe service the steel platforms should stand up better than wood, as wood decks splinter and break.

In order to use lift trucks in the yards, good roads or walks are necessary, because a lift truck platform will drag if it hits some obstruction in the road. Hand lift trucks are often used as trailers behind electric trucks, and tractors, and smooth roads are necessary for this class of trucking. It must be remembered that good plant roads are an asset because they save money in trucking by making it faster and easier, and they reduce the maintenance on trucks. We all know that a truck will rack itself to pieces if it is continually dropping into ruts and holes in the road. For special light trucking, separate truckways may be built with easy grades and a smooth path all the way between buildings. These walks or truckways should be well drained so that frost cannot heave them in the winter. Often these walks are made of heavy wooden planks slightly raised above the surface of the surrounding road.

Plant roads may be gravel, macadam, tar bound macadam, concrete, brick, wood block, or other construction, depending on the locality and the conditions of traffic. For motor trucks the permanent pavements are best. Gravel and macadam roads require filling in of holes especially at curves, as in plant yards there are many sharp curves. Tar bound macadam may easily be repaired by using a hot mixture of this substance. Wood block and paving brick may be replaced in badly worn spots. The expansion joints on these two pavements are very important. These joints should be thick enough to give all the expansion necessary and they should be spaced at the correct intervals. Asphalt filler is usually used for these expansion joints. Concrete roads must also have proper expansion joints to prevent cracking. In order to repair concrete it is necessary to tear up a spot and lay new concrete in it. Patching the top surface is ordinarily not satisfactory unless a perfect bond is made with the base. A wash of neat cement usually gives a good bond between new and old concrete.

Road platform scales should be locked when not in use so that the knife edges will not become worn, and all scale pits should be well drained. Platform dial scales are easily and quickly read without any adjustments and require little maintenance. Track scales are quite hard to keep in good order due to the severe character of the service; and they must be properly maintained to be accurate. The pits on these, too, must be well drained.

The maintenance of fences is an important item in order to keep out intruders. The new types of wire netting fences with iron posts set in concrete or braced in the ground are very easy to maintain as only painting is necessary. With older wooden fences, new posts are needed every few years. Concrete posts are being used and they, like pipe and iron posts, last a long time.

Backfilling after excavating for pipes is a job that is often left unfinished, and a regular method of checking up on the settling of backfills should be followed so that the roadway may be replaced at the earliest possible moment. By puddling the backfill as it is being done, the surface may be finished sooner.

The Automobile Industry Locates for Efficiency

(*Continued from page* 30)

no rate differentials, no tariff aid, but that like the automobile industry as a whole, stands on its own two feet and led by an industrial genius builds its own divine right to dominate that large part of the auto industry that turns out the standardized car at a low price.

At Flat Rock, fifteen miles from Detroit, Ford makes his own glass, dams the river to provide power, and enables raw materials to be floated to the plant. At Northville he establishes a factory, small, and fed by surrounding agricultural labor, that makes a valve and nothing more, but a good valve at a lowering cost.

Coal and iron mines, railroads, Michigan timber lands, sawmills, wood distillation plants, are some of the other parts of the Ford large scale production idea applied to a product that for all its economy and cheapness—perhaps cheap only because of such heroic methods—must be pretty to look at, modern in comfort and convenience, readily repaired or replaced at the door of the consumer.

This is the product of one man, one idea, plus a thousand tricks of the trade. We turn to another great system, one of organization and purchase and consolidation, General Motors. Here coöperation for mutual profit is carried to a fine art. We see the Chevrolet well located, at Tarrytown on the Hudson, for New York and export markets; at Buffalo near Fisher bodies and distribution facilities; at Oakland, California, in a town of workmanship and happiness. At Syracuse the Brown-Lipe-Chapin gear plant; ballbearings at Bristol, Conn.; wheels at Jackson, Mich., near wood; drawn steels at Lancaster, Pa., near steel; Delco igniting systems at Dayton, an electrical center; and in short a national chain of plants, serving all markets, near various raw materials, each helping the other.

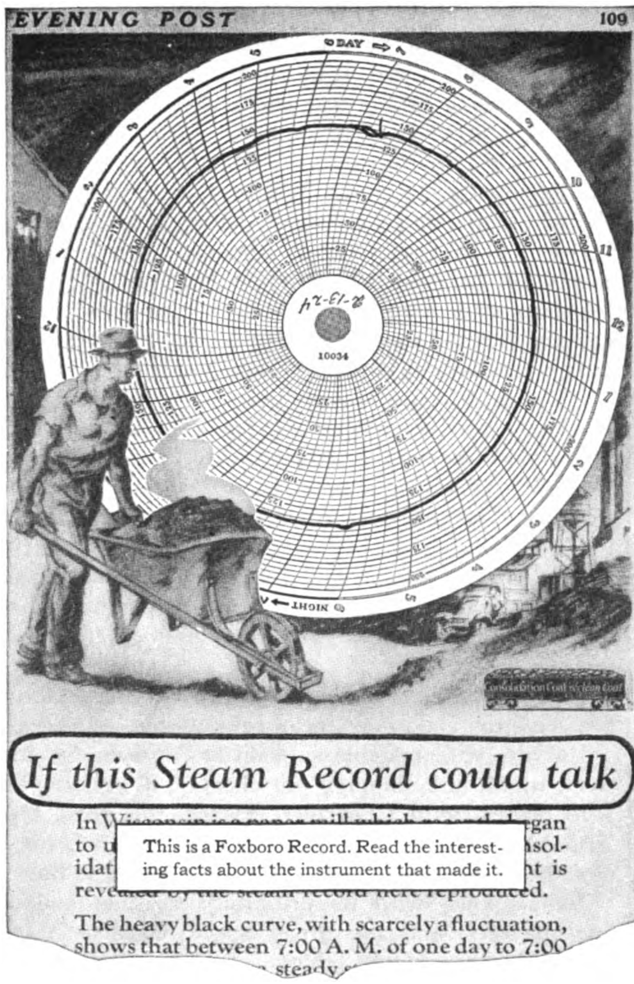
Turning from large scale manufacturing we find the high-priced car, with its emphasis on workmanship, style, design, prestige. An excellent example of how the auto industry locates scientifically is the Rolls-Royce plant at Springfield, Mass. One hundred and fifty towns and cities east of the Mississippi were closely examined before the decision was made. In its own words here is the story of a well-planned location, typical of the automobile industry:

"The Rolls-Royce plant was located in Springfield, Mass., after a careful study of possible places in the East, and a number in the neighborhood of Buffalo and Cleveland. The Rolls-Royce car is essentially a high-class production, and a good deal of the work which enters into the car cannot be performed on a manufacturing basis.

"In looking over the possibilities of the East, we selected the towns which produced workmanship of a kind similar to that which we desired. We considered Philadelphia, Newark, Bridgeport, New Haven, Hartford, Springfield, and a few others. At no place could we find fewer labor disputes, combined with such a long tradition for high class work as in Springfield.

"A further factor in determining our location was the market for our finished product. Most of the bodies fitted to our earlier cars were made in and around New

(*Continued on page* 92)



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Recording Thermometers	Recording Gauges
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CO^2 Recorders	Triplex Draft Gauges
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what its high heat value and its low ash content mean.

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If Record No. 4453 Could Talk

YOU noticed, perhaps, this striking advertisement of The Consolidation Coal Company in a recent issue of the Saturday Evening Post.

Here are some interesting facts about the chart featured in the illustration. It is the 4,453rd record made by a Foxboro Steam Pressure Recorder that has been in constant servive for over *thirteen* years.

During that long time the pen has traveled over ***one and a half miles*** of chart, yet today's record is as accurate and distinct as Record No. 1.

Will the recording instruments you install be capable of producing similar thousands of dependable records?

If they are Foxboro Instruments, you're sure of it; doubly certain since the Improved Helical Tube Movement has been perfected—the movement that is permanent in calibration. Guaranteed accurate for the life of the instrument.

If you desire accurate records by the thousands—rather than fancy instruments with special "features"—Foxboro Recording Instruments are the logical choice.

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FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

7142

(Continued from page 88)

York City, and the majority of the cars were sold there. It was, therefore, very convenient to finish the chassis at Springfield, deliver it by road to the New York coach builder and to finally test and make delivery from our Long Island service station.

"Next in importance to the labor supply was, perhaps, the supply of material. We found we could purchase the whole of our requirements as regards drop forgings between Philadelphia and Worcester. This rendered the inspection of material easy and the time required for transportation comparatively short. Railroad communications with the sources of supply of steel, such as Pittsburgh, Bethlehem, Syracuse, are good.

"The next consideration was that of housing of the workers. In this respect Springfield was found to be better than most other towns; while there was no surplus of houses or accommodation at the time we located, the town was not overcrowded and rents had not risen to the figures which obtained in most of the larger cities."

The automobile and allied industries are scattered the country over. They are by no means perfectly located, but they are better located than any others in many ways.

Detroit is the center of pleasure car manufacturing, but changing conditions mean relocations.

Buffalo, with matchless facilities for bringing in ore, steel, wood, and shipping out cheaply, is building up an auto center, with Chevrolet, Fisher, the great Dunlop Tire plant, many parts and accessories concerns, and already 35,000 workers solely devoted to these lines.

Indianapolis, with its proximity to steel and wood and markets, and the great Speedway, has Marmon, Stutz, Dusenberg, and others.

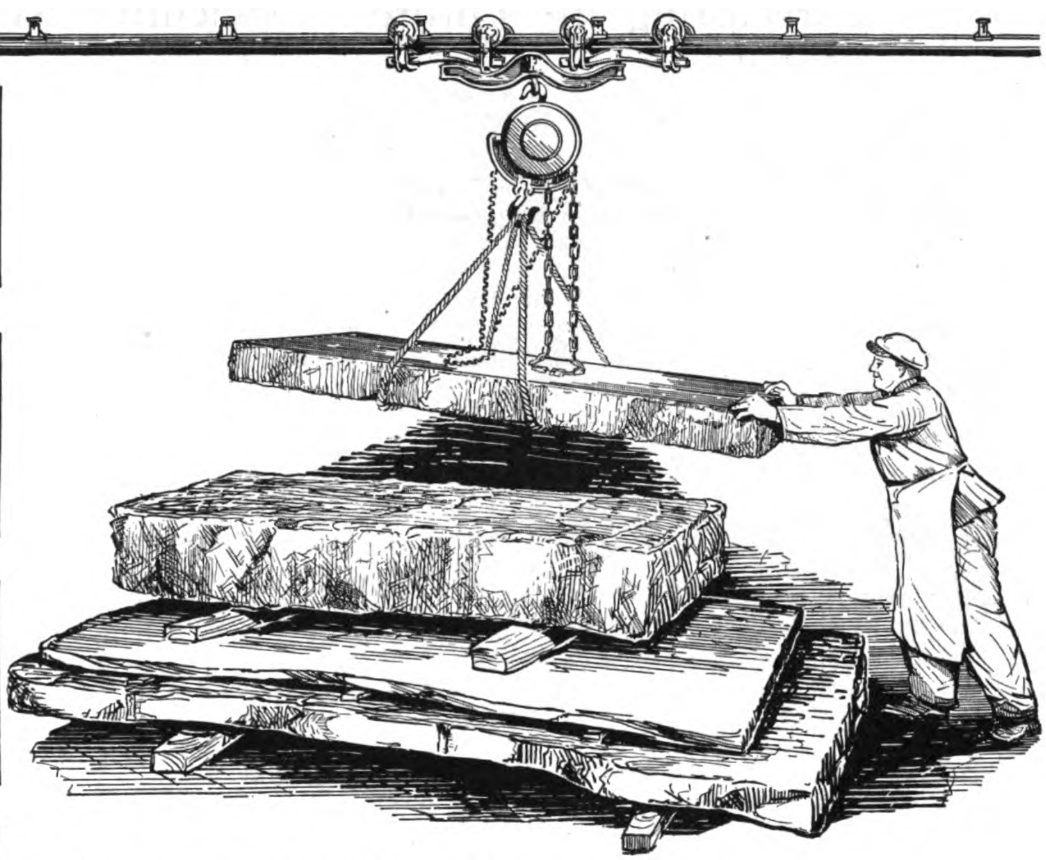
Long Island City has a flock of service and factory branch plants because of its nearness to the great New York market, Packard, White Truck, Durant, Brewster, and a hundred smaller concerns making parts and accessories.

The South, now devoid of auto manufacturing, stands to develop a fine industry in this respect. Hardwoods come from this region and are shipped north, while autos are shipped back to Southern markets. Tennessee and other south central states will see auto, body, and parts plants take advantage of wood, nearby iron and steel, cheap power, and good rail facilities.

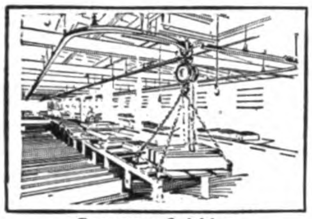
The Atlantic seaboard will find many new auto and parts plants there as the growing export trade in automobiles develops. It is most probable that America will give to the world millions of cars and trucks, and from both coasts many large plants will ship cheaply and efficiently.

Many New England and Eastern body and parts plants will establish or buy plants in the Middle West, to cover that market and be near coal, steel, and wood.

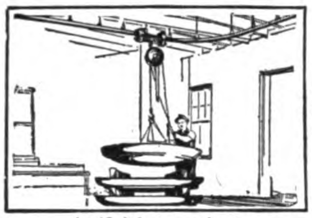
Parts and accessories factories, now bunched in the machine tool center of New England and in Northeast cities, will locate in the South and West in increasing numbers, following the trend of relocation near direct markets. The auto industry, in short, finds its larger groups well located in modern factories, and its many smaller units seeking relocations or consolidation.



A special marble grab.

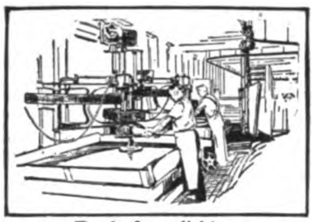


Cast stone finishing.

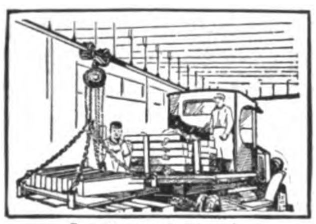


Artificial stone plant.

Supplying rubbing bed.



Ready for polishing.



Loading motor truck.

Tramrail Will Do As Much For You!

Marble polishers waited a long time for an overhead handling system that was *entirely* suitable to their needs. For years they have continued to handle heavy blocks and slabs in the old fashioned way—by rope slings in the hands of four to six men.

Every piece has to be moved at least eight times during the process of cutting and polishing. One or two handling crews are kept busy all the time and the payroll for this class of unskilled labor runs into thousands of dollars a year.

Now Cleveland Tramrail is doing *all* of the "lift and carry" work in the marble plant. Unloading trucks, storage, handling to each machine and finally to shipping room are but a few of the uses to which it is put.

Cleveland Tramrail can do the same for you. It will cut the cost of handling any size or shape of load up to four thousand pounds in weight.

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CLEVELAND ELECTRIC TRAMRAIL
DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE, OHIO.

CLEVELAND
HAND OR ELECTRIC **TRAMRAIL**

Forecasting the Future by Scientific Methods

(*Continued from page 19*)

left it and about 11,000,000 more births than deaths; but from 1900 to 1910 the births exceeded deaths by less than 10,000,000 while the net immigration was over 6,000,000. The lower rate of immigration during the last decade was undoubtedly due to the World War, and the increase in births over deaths partly due to the greater population and partly due to improvements in hygiene, and preventive medicine. With the new immigration law which has just been enacted the gain in population from this source will be very much less, probably not over 2,000,000 net in a decade. These figures for immigration are not so difficult to estimate under the laws now in force.

The question of birth and death rates, on the other hand, is very complex as may readily be imagined. Measures taken to prolong human life may result in a lowering of the death rates for every age group, but this may cause the proportion of the aged to increase and hence mean an eventually higher total death rate. On the other hand, the birth rate declines as the economic status of people is raised, but this again is greatly, if not entirely, offset by the fact that fewer and fewer children now die in infancy. It is now believed that the "natural" increase in population (due to excess of births over deaths) will average something like 13,000,000 per decade during the next twenty-five years. The study and analysis of statistics from the various census reports are of great value in securing more information of this kind.

Now comes the question of the distribution of this population between country and city and specifically what cities and what rural districts. As regards the rural communities we have to consider the improvements of agricultural methods, better breeds and varieties of animals and crops, and the substitution of farm machinery for manual labor. With such improvements carried far enough it is conceivable that even a smaller farm population than the present could produce enough food for 150,000,000 people, especially if the export of foodstuffs were discontinued and considerable amounts imported from Canada and South America. The present tendency of movement toward the industrial centres indicates something of this kind, although it will probably not be so extreme. After studying the mining and lumber industries and the like, the engineers have decided that the rural districts will increase by about 7,000,000 by 1950 and the urban districts will receive something like 37,000,000.

We have seen how the population figures for the whole country have been arrived at, so now let us see how the various units are credited. In doing this, it is necessary to recognize that, for instance, conditions on the Pacific Coast or Central West may effect the growth in population along the Atlantic seaboard.

Insofar as the cities are concerned, we have the same forces at work as for the country as a whole but with additions. That is, there is the natural increase of births over deaths of 10% to 12% every ten years, so that each city would increase at that rate if nothing else happened. But of course the problem is not so simple as that because there are many other factors. In the first place there is immigration, and a great many cities are doing their best to get as many immigrants as possible; and they are also competing to get as many people away from each other and from the country districts as they can.

The extent to which an individual city will be successful in this competition depends entirely on the advantages which it has to offer and the character of the population will depend on the character of these advantages. A certain class of people will be attracted on account of climate, cultural opportunities, manufacturing, or business prospects, etc. In making a population estimate and a "telephone market" estimate for any given locality it is therefore necessary to investigate a variety of matters. Among these would be the supplies of raw material in the territory tributory to it, which may be hundreds of miles away, as are the sources of iron ore for Pittsburgh. There may also be the beginnings of industries which are not yet important but which careful consideration and analysis will reveal to be of great importance in the future. Such was seen to be the case in Detroit when the automobile industry had been going on for a time. The engineers responsible for this kind of work must be men, it will be seen, who not only have analytical minds but also considerable imagination to look ahead and appreciate the significance of the trend of new things.

As a general thing it has been found that industrial communities grow faster than jobbing and trading centres or centres for retired people. For example, Minneapolis, which is in many ways a wholesale distributing point, and Salt Lake City, which is a centre for retired people, although, of course, there is considerable jobbing and manufacturing in both, are growing steadily but at a slower rate than, say, Cleveland, which is a manufacturing city sending its products over a much wider territory and which is consequently able to attract more outsiders.

The class of people in a district, especially as telephone users, will naturally depend on the industries which attract people to the particular city under consideration. The steel industry attracts foreigners of a low economic grade and likewise produces a number of wealthy people. This means poor tenement and slum sections with cheap stores in considerable quantity and also some very high priced ones together with the corresponding amusement activities in each case. On the other hand, in a city surrounded by rich agricultural sections, as in the Middle West, or numerous small manufacturing towns, as in New England, the conditions will be quite different.

In the last analysis people go to a particular place because they like it, either on account of the possibilities it offers of obtaining work that they know how to do or of satisfying their wants of one kind or another.

Consequently it is necessary to estimate to some extent, at least, the wholesale and retail trade possibilities of a city, the probable future prosperity of these trades, the extent of the competition which the city will suffer from other cities, and what other advantages it may present.

Forecasting studies are generally made by the telephone engineers for six, twelve, and twenty years ahead with a view to obtaining a definite idea for each one of those periods.

For the short period up to six years ahead, let us say,

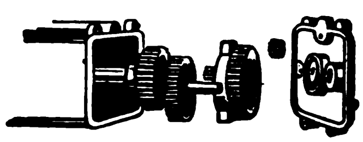
(*Continued on page 96*)

EUCLID
CRANES HOISTS
"RAISE PROFITS"

From 2 to 20 in Eleven Years—

EUCLID
for
PERMANENT PERFORMANCE

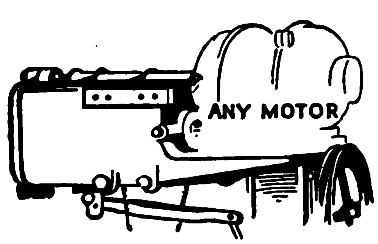
SIMPLE



3 Big Spur Gears.
No delicate parts.
Skilled mechanic not required.
Disassembled without removing hoist.

SAFE

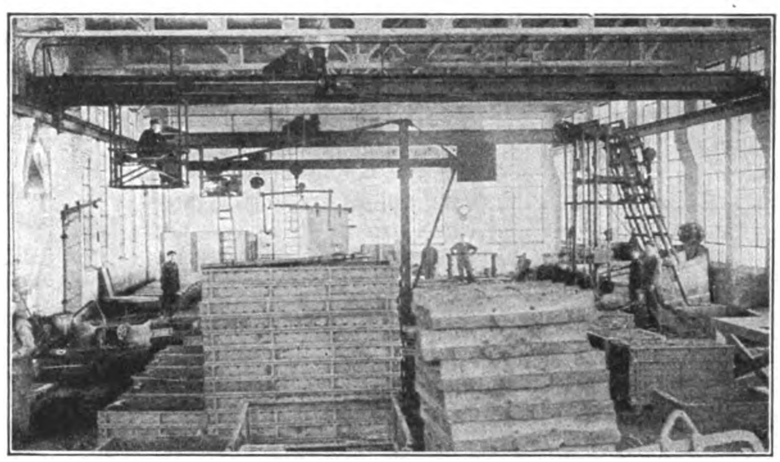
All gears wide face—coarse pitch.
Frame one piece—accurate alignment.
Dependable factor of safety.
Unfailing brakes and limit switches.



STANDARD

Any motor fits a Euclid.
Parts enclosed in oil bath.
All parts to jig—interchangeable.

LOW HEAD ROOM
ACCURATE CONTROL



SHOWING 2 OF 20 EUCLID HOISTS AND CRANES

IN one of the LARGEST FOUNDRIES will be found 20 Euclid Hoists and Cranes. They were not bought in one lot—nor placed there by chance.

Never failing, satisfactory performance of each Euclid installed led to the use of another Euclid. Now—Euclids are *standardized.*

"Though our travelling cranes are 11 years old they handle from 50,000 to 80,000 pounds of iron a day," says the customer.

Your lifting problem will be satisfactorily solved when you let a Euclid Crane or Hoist "raise Your profits."

THE EUCLID CRANE & HOIST COMPANY
EUCLID, OHIO

(*Continued from page 94*)

the forecast is quite easy to make, as it is based on the actual amount, class and density of telephone service at the time the study is made, the amount of current demand for service, and the past and present trend of increase in business. This kind of forecast enables the engineers responsible for providing service facilities, such as lines from the central office, switchboard equipment and telephone instruments, to plan their year to year operations; but in order to develop each part of the telephone plant consistently with each other part and with the system as a whole, so as to avoid radical and uneconomical replacements or revisions in operation, it is necessary to look ahead for longer periods—say from fifteen to twenty-five years.

The forecast for a large community is divided in two parts, namely: an analysis of the existing "market," and, using this as a basis together with the population forecasts already explained, a prediction as to the "market" at some future period.

The telephone market has two principal divisions—business and residence. The first step in the analysis of existing conditions is to divide the community up into small sections in which the rental values are on the same basis, and nationalities and races are to all intents and purposes homogeneous. In residential districts the family is taken as a unit and in business districts the business firm, which includes manufacturing, is taken as a unit.

With a record of existing subscribers in each section, prepared from office records, the analysis of the existing market and sales is actually accomplished by a field canvass by which each family and business firm is recorded in its proper class as to rental paid or type of business done. Incidentally, these analyses of population bring out rather forcibly some interesting facts which the average person does not think of. For instance, a survey made in a certain city in 1920 showed that out of 233,000 families 80,000 lived in flats at a rental of $40 or less per month and 46,000 in private houses of similar rental class. In other words, more than half the families in that city, which, by the way, is one of our most prosperous ones, evidently live in relatively low rental quarters. If we should include the rental class from $40 to $55 per month, which indicates anything but luxury nowadays, we would have to add about 20,000 families to each group, making a total of 75%. In other cities the proportion may run up to over 80%. This helps to explain why Ford and Woolworth and others supplying low priced articles do business on such an enormous scale. The charts shown in Figs. 1, 3, 4, and 5, although for other cities, show this point, as well as the difference in modes of living in industrial and headquarters cities, and the distribution of business in the two types.

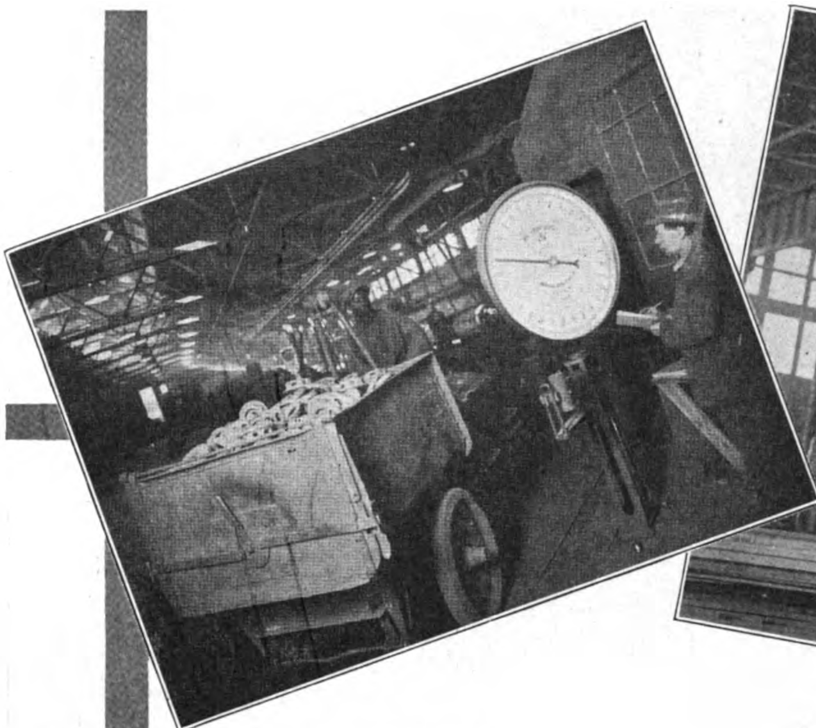
As already stated, forecasts are generally made to cover periods of 6, 12, and 20 years. It is here that population forecasts for the country as a whole come in, for in any definite area growth can be due to only two causes: excess of births over deaths and the attraction of people from elsewhere. This latter includes principally the movement from the country to the city, immigration, the migration of the negroes, and other considerations of rather less importance. The attraction of population to a community represents the most complicated as well as the most interesting part of the problem. No two cities grow in the same way or keep on at the same rate, and rarely, even due to the same causes. The proportions of the influences causing them to grow are always different. For instance, industrial expansion and the kind of industrial activity have a very important influence. Bridgeport has grown on account of its metal working plants, Akron because of rubber, and Detroit on account of automobiles and so on for almost every city in the country.

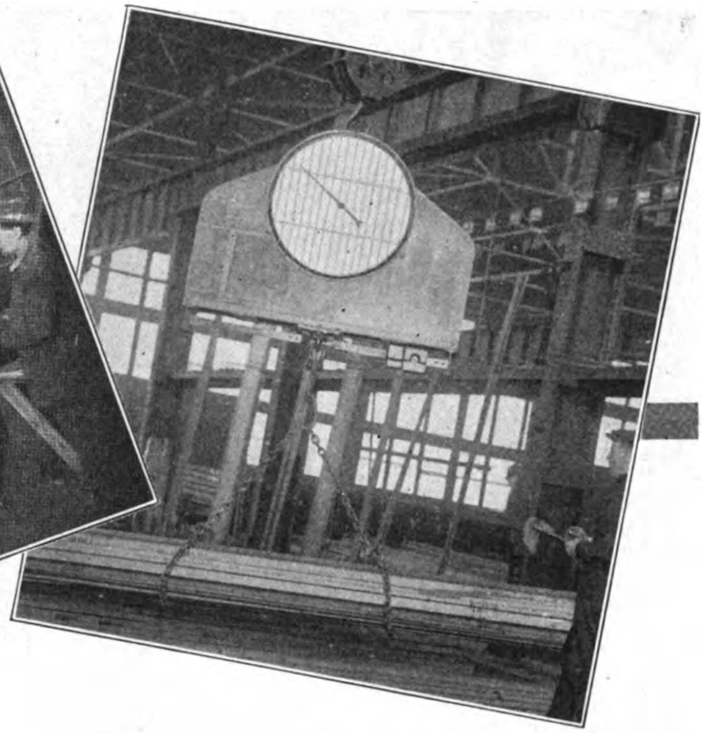
There is another interesting phenomenon which is observable in the growth of communities and that is that the growth is seldom if ever at a constant rate—no more so than the growth of most other things if taken from year to year. Bridgeport, Detroit, and Akron had a great increase during the war period but all have been through more or less of a depression since and at one time have probably actually decreased in population. Now they are going ahead again. Viewed back over a considerable period of years, the growth of these cities would appear to be steady, but, as a matter of fact, it has gone on in a series of jerks. The fact that a certain place has not grown this year does not mean at all that its growth for the current decade will not be satisfactory.

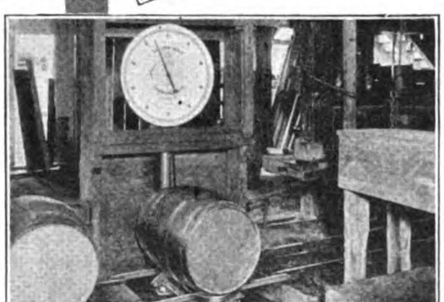
In estimating future changes in a city, more or less the same small sections, consisting of from 6 to 15 blocks, are used as in the studies of existing conditions. The forecast is based on careful consideration of real estate trends, the expansion and sifting of business and industrial activity, of apartment house, lodging house and private residential districts and finally of the growth in various directions in outlying suburbs.

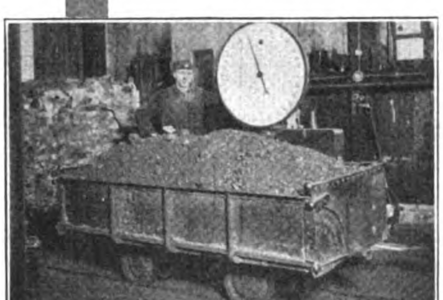
When a new forecast has been completed, the results are compared with previous studies made several years back as a check against actual past occurences and provides the broader outlook which is essential in any such work as this.

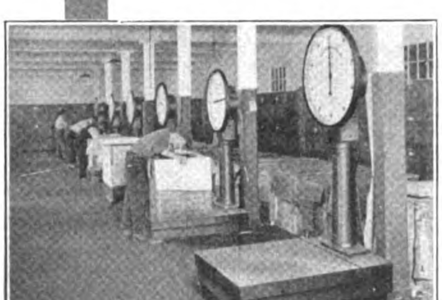
The method of forecasting the future growth of telephone business as sketched out here is of a special nature applicable to that particular activity. The idea, however, of applying the methods of scientific analysis of existing conditions carefully determined by well trained men is no doubt a practise which can be, and very likely is, sometimes, used by entirely different kinds of business, with great benefit. The degree to which it is worth while and the extent to which it should be profitable, of course, depends on the nature of the product to be sold and the broadness of its potential market. Certainly this kind of study places the telephone executives in a position not only to economically lay out and develop their plant, but also to plan on the necessary financial arrangements, as well as to provide the required manufacturing facilities, such as the new Western Electric telephone cable factory now under construction near Newark, N. J., far enough ahead of time to be ready when needed.











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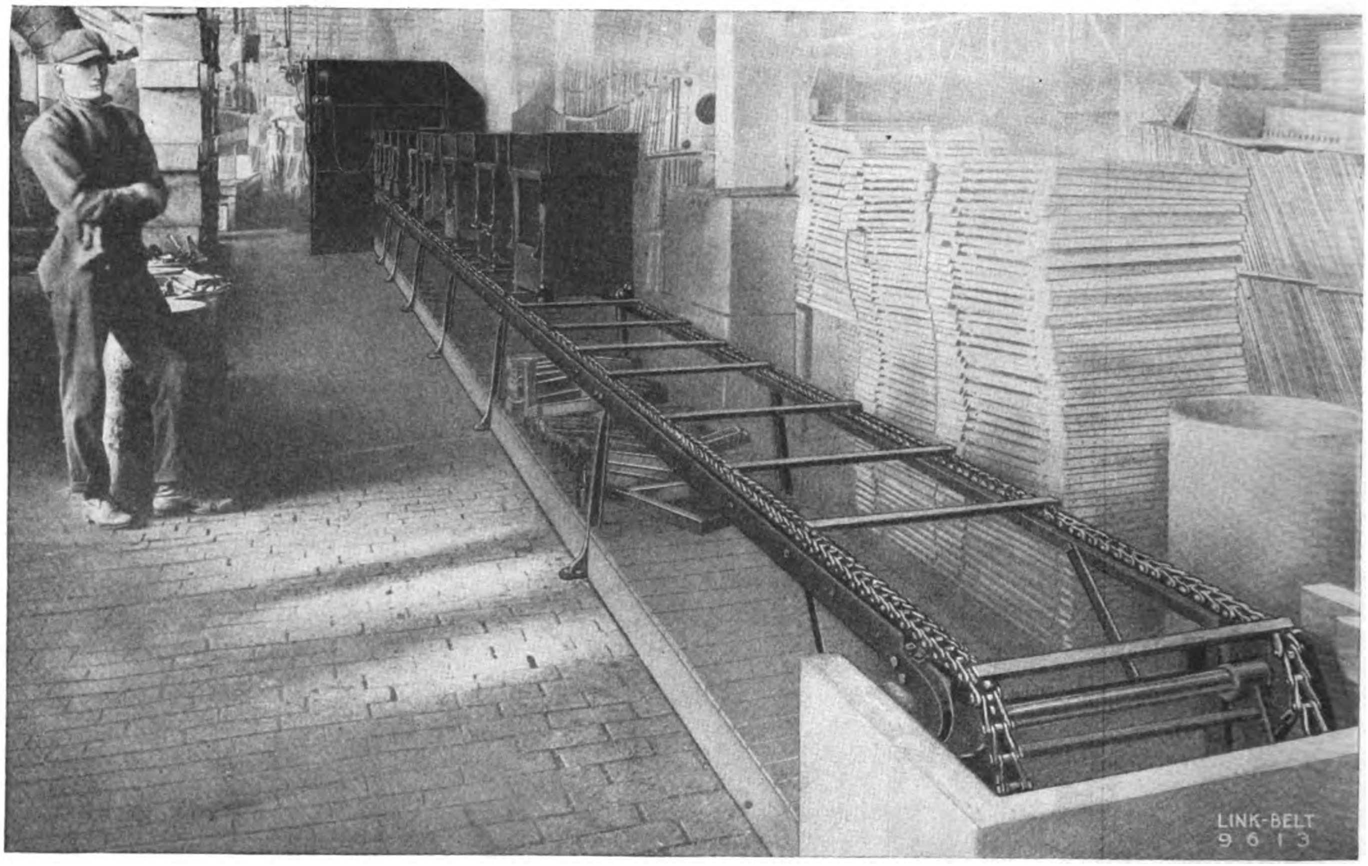

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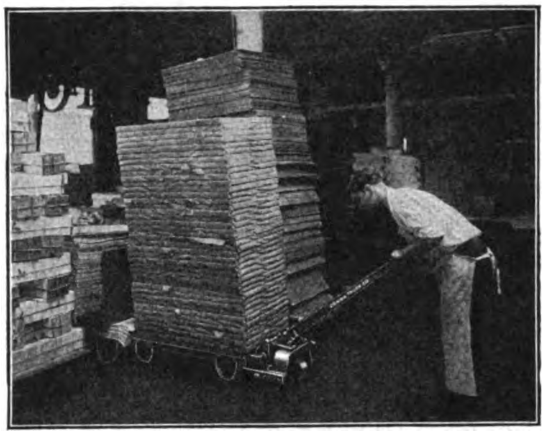

Above photograph shows Cowan System in operation in plant of Samuel Ward Manufacturing Company, Boston, Mass., manufacturers of papeteries, A-Line-A-Day Books, etc.

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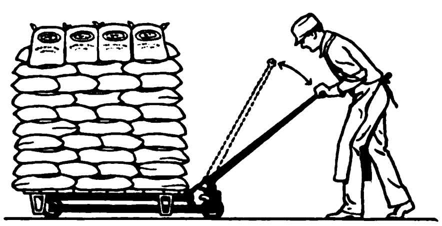
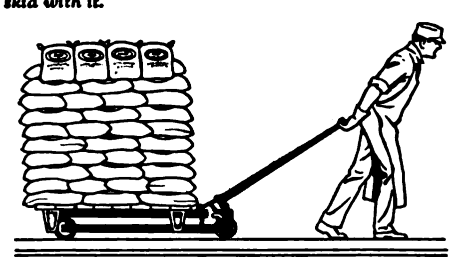


Truck backed under skid. A single stroke of the drawing handle now lifts up the truck platform, lifting the skid with it.



Truck carries off skid and load to required location. A simple foot lever releases load, and skid is lowered to floor. Truck goes off to serve other skids. No loading or unloading. No time lost.

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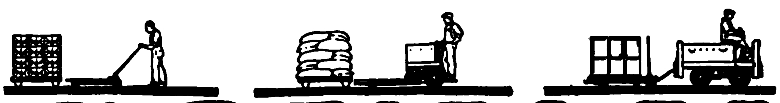

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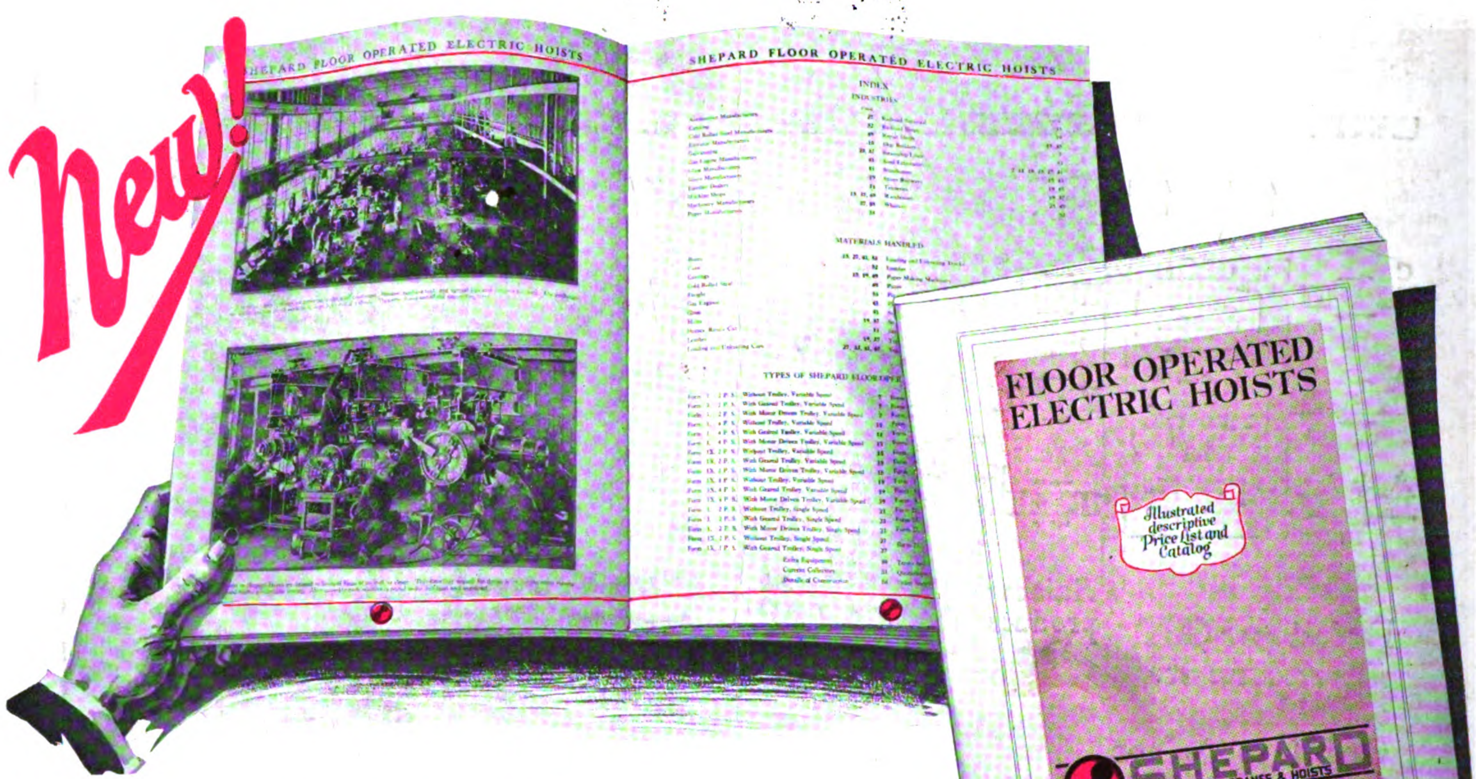

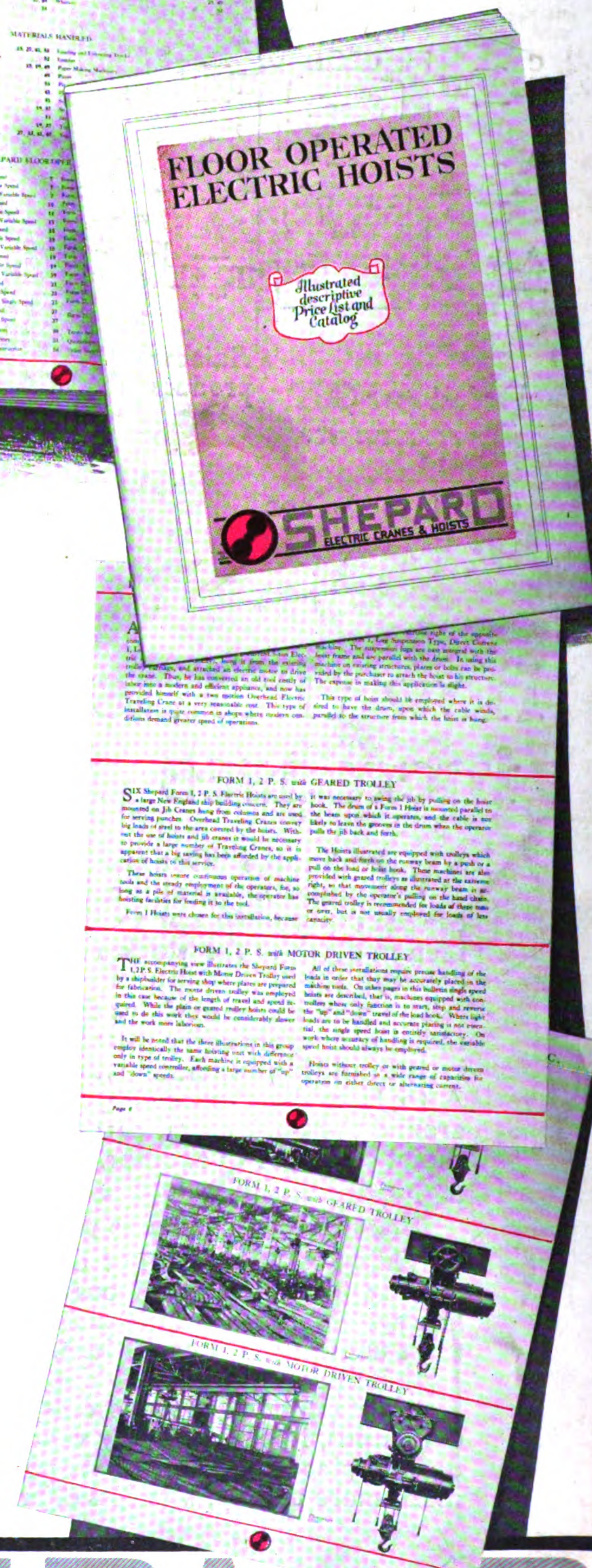

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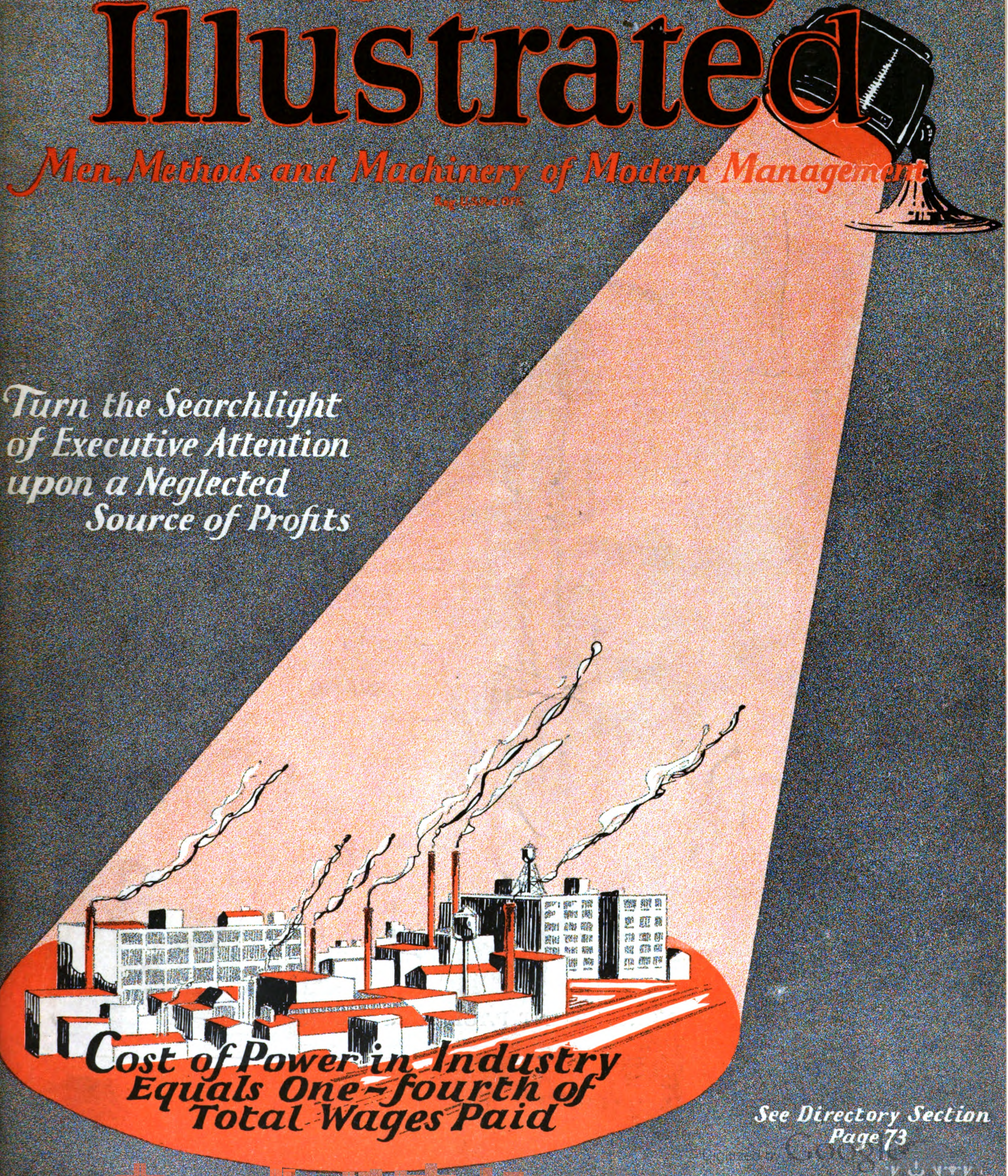
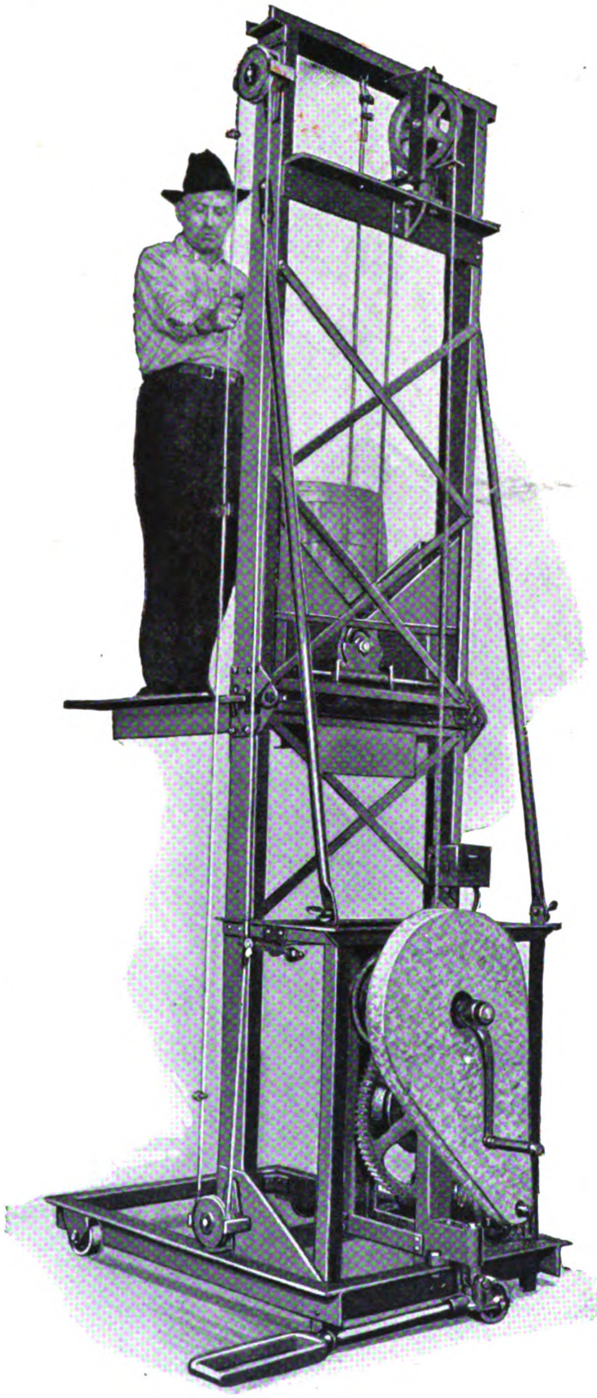


See Directory Section Page 73



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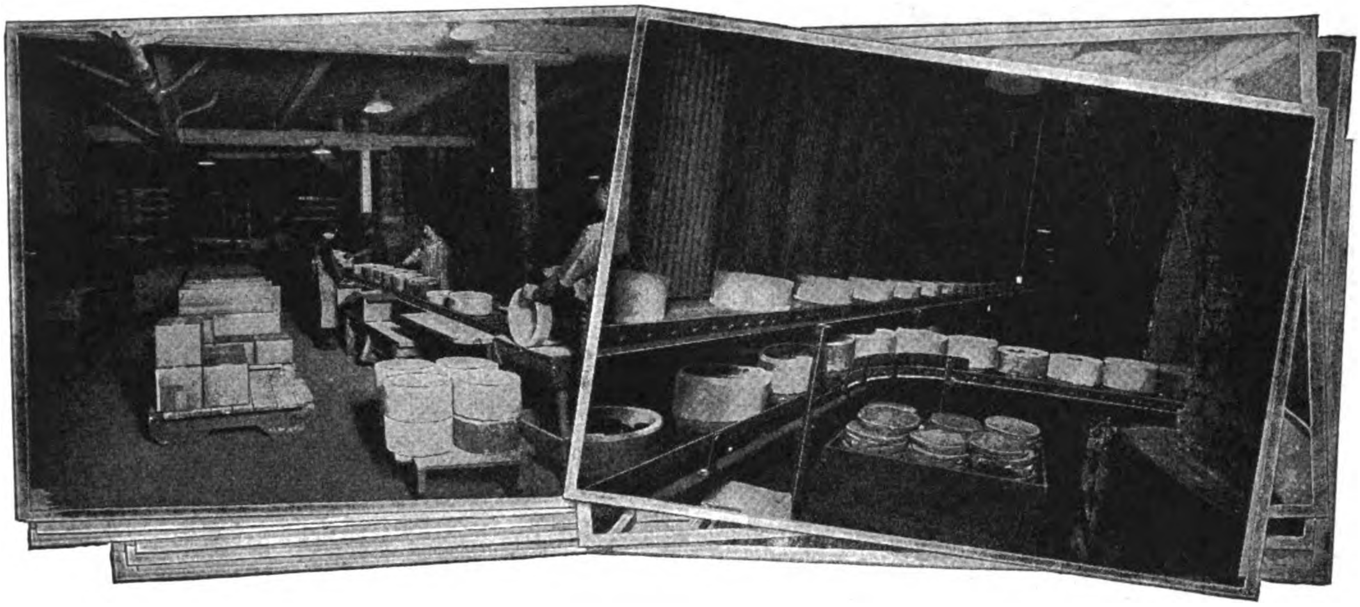

Right-hand photograph above shows Dow Belt Conveyors receiving saggers of porcelain ware from kiln after baking. Left-hand photograph shows Dow Gravity Rollers delivering saggers of finished ware to inspection and shipping departments.

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December, 1924

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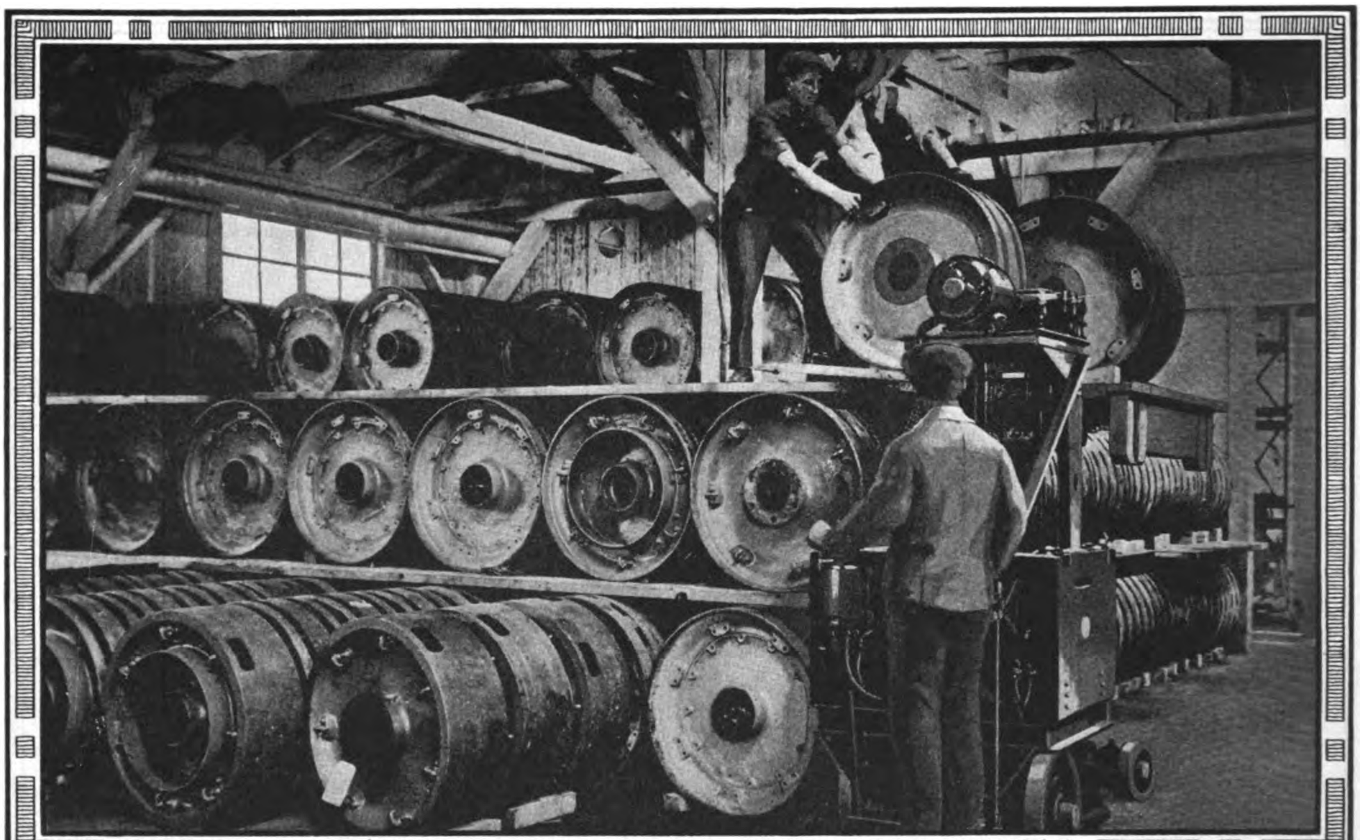
Index to Advertisers see page 134



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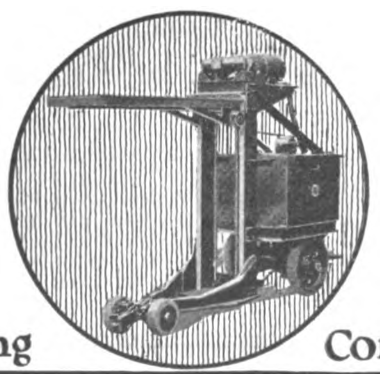

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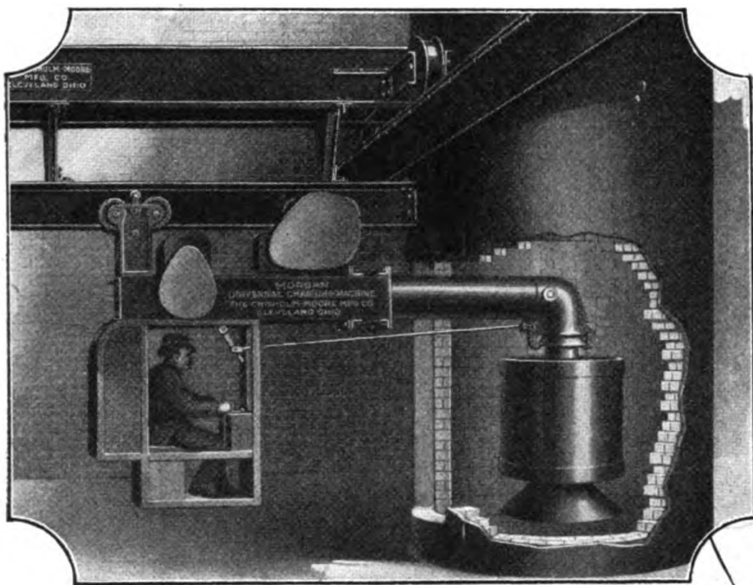

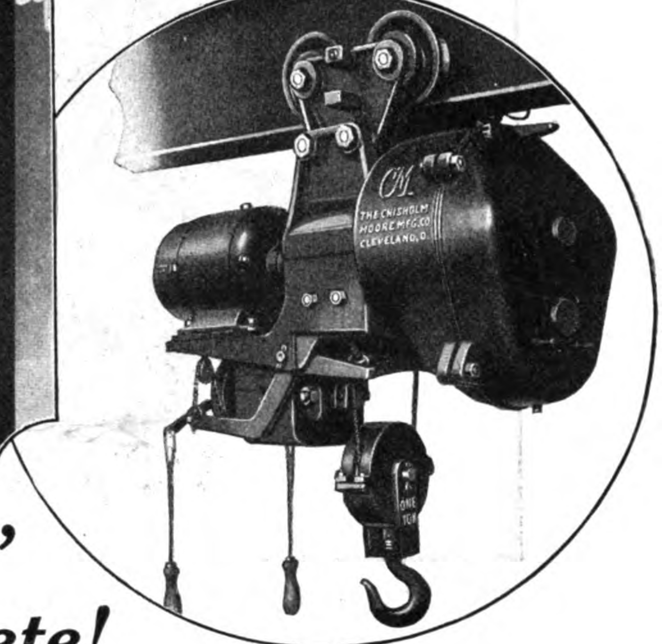

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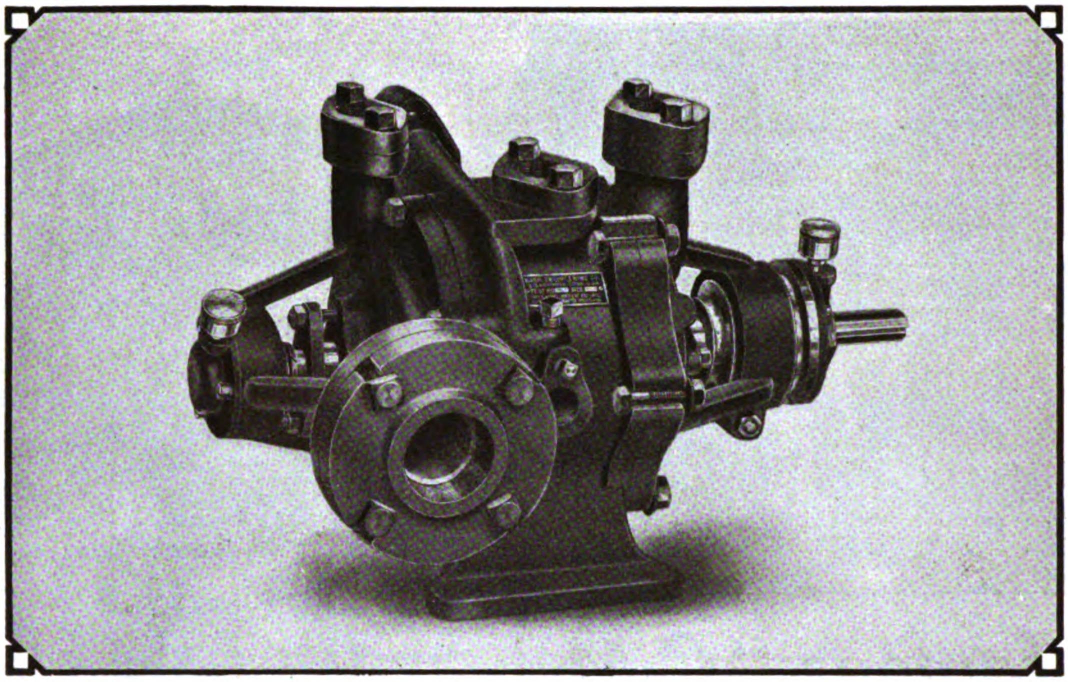

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JOHN H. VAN DEVENTER, EDITOR
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Editorial

Putting the Power Problem Up to the Manager

THE cost of power in American industries is equal to one-fourth of the total wages paid.

This surprising statement, which is demonstrated in the following pages, may be interpreted in two ways.

The first way to interpret it is that we are getting a lot of work done by power at a rather low cost.

American industries are power-using industries. We do as little as we can by hand and as much as possible by machinery. It would be hard to say just what proportion of each day's industrial work is performed by coal, water and electricity, but it is safe to say that if we were to eliminate the use of power, to depend upon muscle, our productivity would shrink to almost nothing.

In almost any industry that you can mention, horsepower greatly outnumbers manpower.

The cotton goods industry uses four horsepower for every man employed. In the lumber products industries there are five horsepower to each man. The chemical industries employ eleven horsepower to each operative. In cement plants this is boosted to eighteen horsepower per man, while in iron and steel blast furnaces we find the astonishing ratio of forty-two horsepower per individual employed.

That power should be willing to work for us and to accomplish, cheerfully and unfailingly, practically all of the lifting, carrying, making and other hard work that we have to do, and all this at a cost of about a quarter of the wages we pay to our workers, is a striking lesson to industrial executives in the desirability of making more use of this potent productive force.

But there is another way to look at this statement that power cost equals one-fourth of total wages paid, particularly when we consider that the annual payroll of American industry exceeds $10,000,000,000.

No item of cost of production has received the same degree of scrutinizing attention in the average plant as has and *does* the payroll. For years past and today as well, the executives have spent by far the greater part of their managerial energy upon the return from wages paid. Payrolls are regularly and religiously analyzed and cross analyzed in minute detail so that the manager may assure himself that the concern is getting a maximum return on wages. In the meantime, in the majority of American industrial plants which produce their own power, the cost of power, the wages paid to power for the work done, if you please, have received little or no managerial scrutiny.

Perhaps it has been because the industrial executive has had his mind centered upon Production. Perhaps it has been because of the average executive's non-familiarity with power plant operation, combined with a lack of knowledge of the returns that a dollar paid for power should produce in work done. Be this as it may, the power plant in the average American industrial concern is considered outside the realm of everyday managerial activity and judged "good enough as it is." And this same indifference to economy is found in the transmission and use of power after it has been produced.

Yet here is an item of cost equal to one-quarter of all wages paid—a big item when compared to the payroll which is given such constant and close attention.

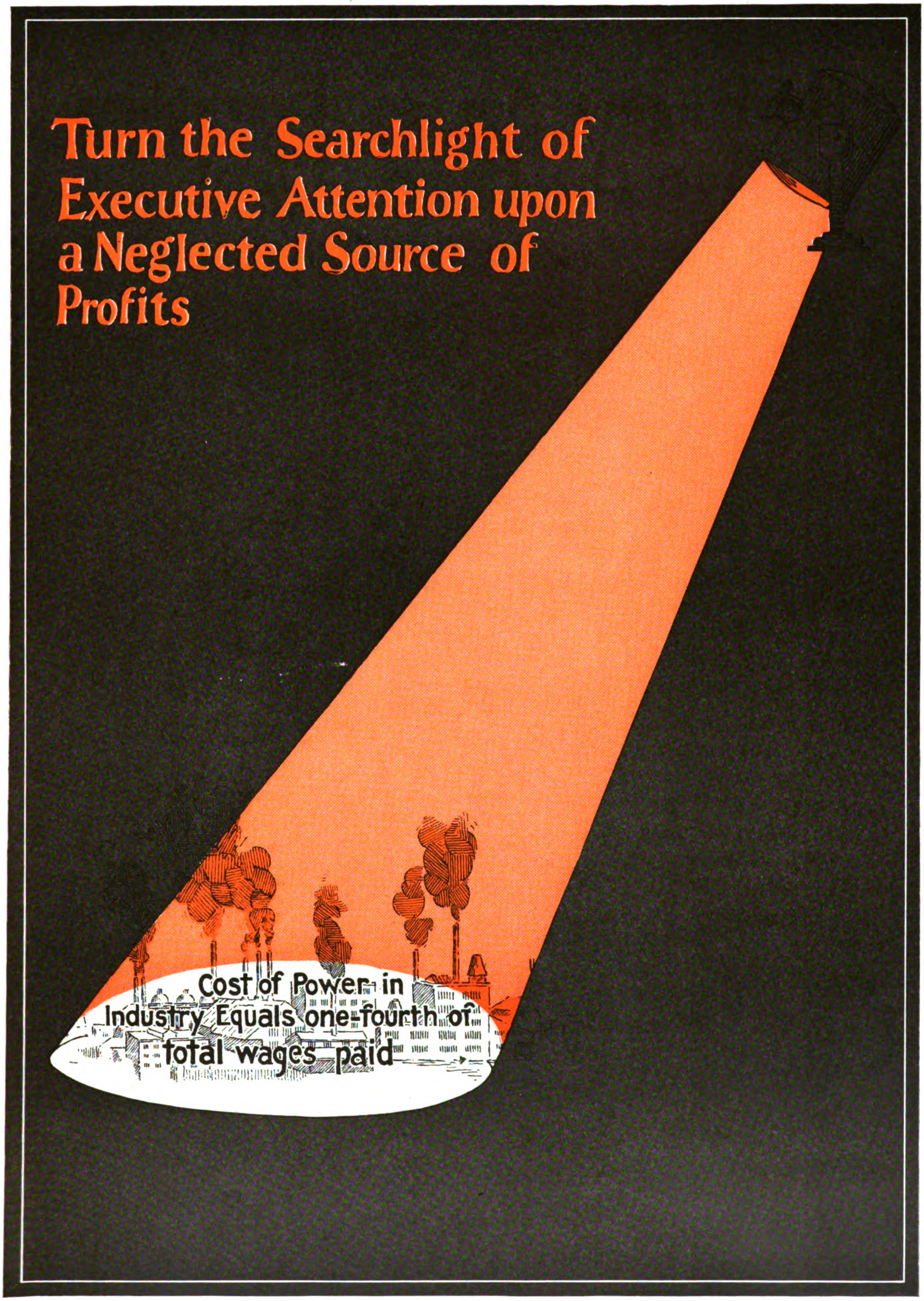
Is it surprising in view of this lack of managerial interest in power production that the cost of power in the average industrial plant is just twice what it should be?

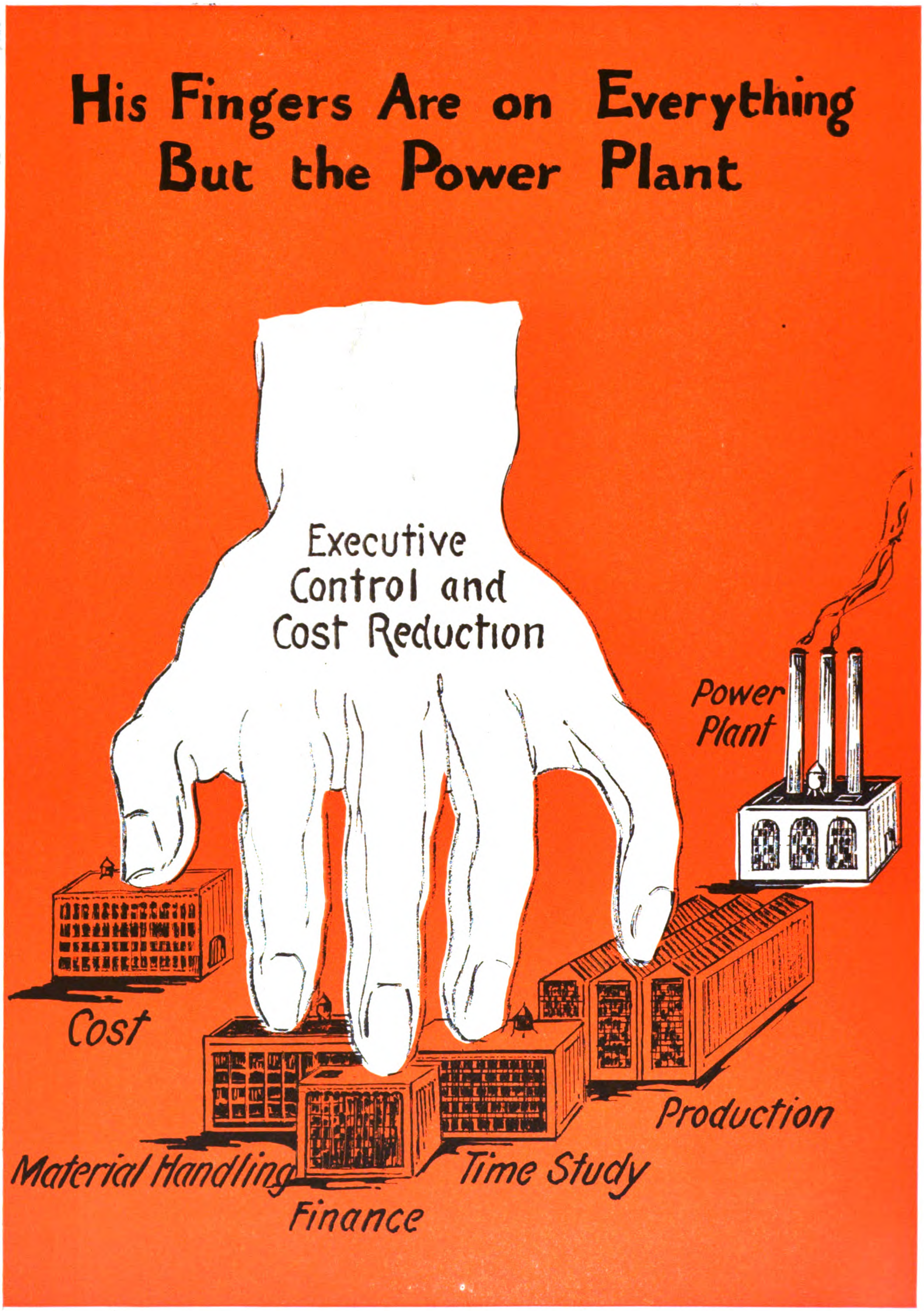
Considerably more than a billion dollars in profits and dividends in American industry are annually allowed to be dissipated because of the average plant manager's acceptance of average power plant practice.

A sum aggregating many hundreds of millions of dollars is lost to industry each year because of wasteful methods of power transmission and use.

Your share of this loss can be easily calculated. Unless yours is one of the very few exceptions, you can figure your annual loss—your preventable loss—as fully one-half of your total power plant operating costs, including fuel, wages, maintenance, supplies and overhead. On top of this is a handsome saving to be made in power transmission and use.

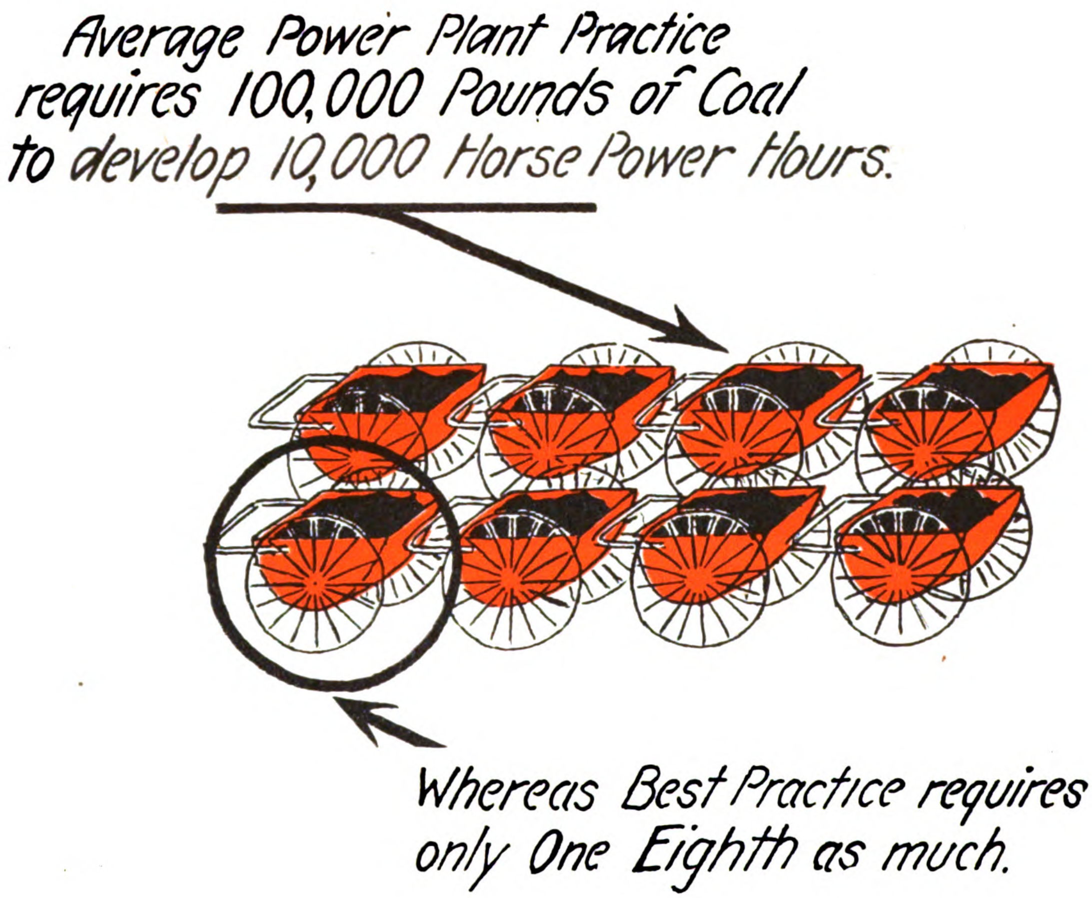
We believe that this condition exists simply because of a lack of knowledge of its existence. We do not believe that any progressive, present day manager would knowingly permit the dissipation of such a considerable amount of potential profits. And we know that the publication of the facts which follow will inevitably lead the way to substantial savings.


Turn the Searchlight of
Executive Attention upon
a Neglected Source of
Profits
Cost of Power in
Industry Equals one-fourth of
total wages paid


His Fingers Are on Everything
But the Power Plant
Executive
Control and
Cost Reduction
Power
Plant
Cost
Production
Material Handling
Time Study
Finance


Burning Up the Factory Profits
Average Factory of 500 Employees
$45,000 per annum wasted in inefficient Power Plant

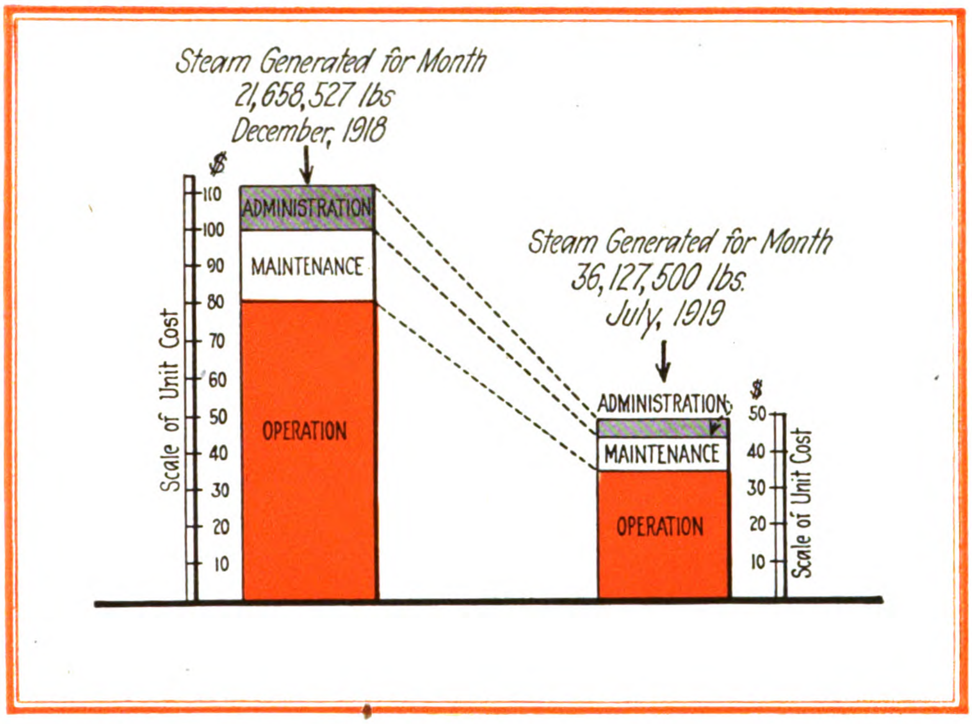
Average Combustion Practice Wastes 7/8ths of the Fuel



Data on average fuel consumption as compared with best practice

The astonishing contrast pictured above between wasteful coal consumption of average practice and the small amount required for best practice is derived from data from the Bureau of Mines and the Super-Power Survey. Best practice of course represents that secured in large electric public utility stations and cannot be duplicated in the average isolated plant. However, it is not at all impossible for good management to eliminate one row of these coal wagons from the requirements of average plant practice, thereby instituting a 50 per cent. saving in fuel. Coal is one of the big items of power plant operation and it is necessary for the manager not only to know the principles of combustion but to insist on the obtainment of proper combustion performance standards.

What Happened After the Manager Took Hold — —



Unit Costs Before and After a Systematic Cost Reduction Campaign

Walter N. Polakov, in "Mastering Power Production," cites an example of actual performance in cost reduction on which the above unit cost chart is based. This indicates the great possibility of cost savings even in a modern power plant. The remarkable reduction of over 50 per cent in operation cost was due primarily to an increase in combustion efficiency; the unit fuel cost, which was more than three-quarters the total operating cost, being reduced almost 60 per cent through the use of a cheaper grade fuel. This was only possible through the maintenance of maximum combustion efficiency which accompanied careful and persistent checking of results, together with the incentive to produce them.

Power Cost Savings That

In Various Leading Industries

(Present basis is taken

Food Products

Total Annual Cost of Power	$213,000,000
Total Number Employed	680,000
Average Cost of Power per Employee per annum	$313

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 15,600
500	60	62,200
1000	70	93,500
2000	75	156,000

Iron and Steel and Their Products

Total Annual Cost of Power	$672,000,000
Total Number Employed	1,586,000
Average Cost of Power per Employee per annum	$423

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 21,200
500	60	84,800
1000	70	127,000
2000	75	212,000

Lumber and Its Manufactures

Total Annual Cost of Power	$283,500,000
Total Number Employed	839,000
Average Cost of Power per Employee per annum	$338

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 16,900
500	60	67,600
1000	70	101,200
2000	75	169,000

Paper and Printing

Total Annual Cost of Power	$195,000,000
Total Number Employed	510,000
Average Cost of Power per Employee per annum	$382

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 19,100
500	60	76,400
1000	70	114,500
2000	75	191,000

Good Management Can Make

and Plants of Various Sizes

to be average practice)

Chemicals and Allied Products

Total Annual Cost of Power	$169,900,000
Total Number Employed	427,000
Average Cost of Power per Employee per annum	$398

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 19,900
500	60	79,700
1000	70	119,500
2000	75	199,000

Stone, Clay and Glass Products

Total Annual Cost of Power	$131,500,000
Total Number Employed	299,000
Average Cost of Power per Employee per annum	$440

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 22,000
500	60	88,000
1000	70	132,000
2000	75	220,000

Non-Ferrous Metals and Their Products

Total Annual Cost of Power	$81,900,000
Total Number Employed	339,000
Average Cost of Power per Employee per annum	$242

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 12,100
500	60	36,300
1000	70	72,600
2000	75	121,000

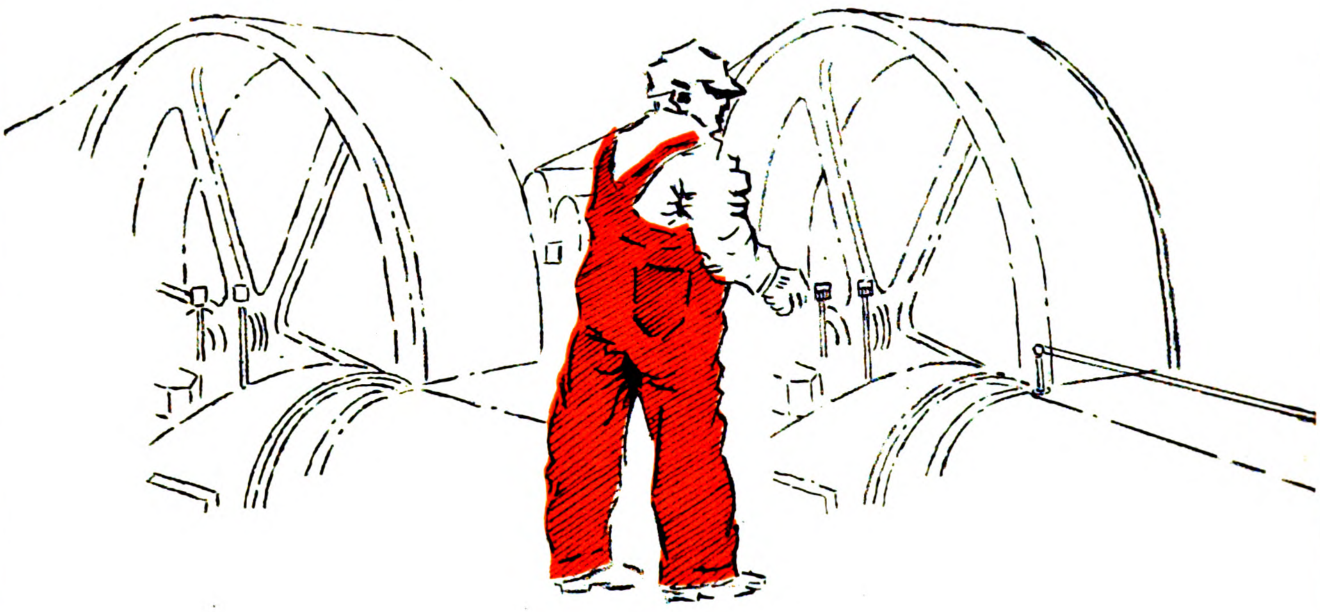
Miscellaneous Industries

Total Annual Cost of Power	$234,000,000
Total Number Employed	1,227,000
Average Cost of Power per Employee per annum	$191

Number of Workers Employed	Average Efficiency	Possible Annual Power Savings
100	50%	$ 9,500
500	60	37,800
1000	70	57,000
2000	75	95,000

He's a Good Man, but---

he needs the benefit of your managerial experience



Mr. Manager, are you playing fair with the man who runs your power plant? He is a good practical man, but he is not an administrator nor a business executive. Yet you place upon his shoulders the burden of administering an industrial investment of very large proportions.

The first cost of a power plant is no small item and the annual cost of operating it runs into big figures. This investment and these expenditures demand and justify managerial attention.

Do you know exactly what your power is costing you?

Do you know what it *should* cost you?

In justice not only to your engineer but to your profit statement, isn't it time to apply your managerial talents and experience to the supervision of this big item of cost?

Where the Facts and Figures Came From

THE Census Bureau of the United States Department of Commerce gives the total horsepower in industrial establishments of the United States as 29,507,117, for the year 1919, which are the latest available figures. The statistics for 1923 are not yet available. Undoubtedly, however, they will show an increase over the last report for there has been a consistent increase in the total reported at each successive five-year period.

In round numbers we may safely and conservatively say that there are thirty million horsepower at work today in our industrial establishments. Of this total thirty million horsepower, some twenty million are generated in privately-owned power plants—*isolated* plants as they are commonly called—and the remainder is purchased by industrial consumers from central stations.

Of the twenty million horsepower produced in privately-owned plants, by far the greater portion (seventeen million horsepower, in fact) are produced by the steam process. The remainder fall under the head of water power and internal combustion.

The predominance of steam may be explained not only because of the priority of steam power as a factor in our industrial evolution, but more largely by the fact that there has as yet been no universally accepted substitute for steam for plant heating and for general process heating. This is also the reason why isolated plants continue and will continue to be operated, in spite of the greater economy of operation of the large central station units. If it were a question of cost of power alone, the isolated plant would soon give way to central station service. The central service plan, however, provides no economical substitute for plant heating or process heating. Where steam plants must be maintained for heating purposes and where exhaust steam from engines and turbines is utilized for heating purposes, it is decidedly more economical to use this steam twice, getting the power, so to speak, as a by-product.

This fact must be clearly understood in any discussion of power costs and savings and to emphasize it we quote from "Facts About Coal Conservation" by Egbert Douglas:

"The belief has become general that boilers at low pressure take very much less coal than high pressure boilers would. By high pressure, we mean from 150 pounds up, and by low pressure, boilers built for not more than 25 pounds working pressure.

"Steam pressures are believed to have a direct and important bearing on steam costs, but in fact, have little influence on them. The fundamental laws of steam manufacture are such that steam pressure has little effect on the amount of coal required to produce it. For example, steam at the pressure of our air, contains, in round figures, 1151 heat units per pound of avoirdupois. Steam at 172 pounds pressure contains about 1197 heat units in the same kind of a pound.

"From these *facts* it will be seen that by increasing steam pressure several hundred per cent., the heat content is increased an insignificant amount. In simple language, 16 ounces of steam at 172 pounds pressure has only four per cent. more heat than the same quantity of steam contains at atmospheric pressure. Practically it would take no more coal to produce the same quantity of steam at 172 pounds pressure or higher than it would at 5 pounds pressure, as coal records in the best power plants seldom check within 5 or 6 per cent.

"This is the fundamental reason why all large power plants are designed and built for high steam pressure; as by adding an insignificant amount of heat, the steam can be increased in pressure many fold and thereby add to its capacity for doing mechanical work.

"On account of these facts, it is little short of an economic crime to blow steam into a multitude of heating systems at low pressure, without first taking therefrom the mechanical work that this steam would be capable of performing, if it was raised to a reasonable working pressure, and with no appreciable increase in the amount of fuel required to do so."*

That the minimum cost per horsepower produced in isolated plants is necessarily greater than the minimum cost per horsepower produced in large central station units, does not alter the fact that where heating is a factor it is a better plan to operate one's own steam plant and produce both heat and power than to buy power and operate one's own steam plant to produce heat.

The minimum cost of steam plant operation of privately-owned plants is far below the average. This is not a reflection on the process but on the individual practice. A careful study of statistics shows an annual cost per horsepower per annum of three thousand working hours of $100. Best practice will cut this figure in half, but best practice is found in less than one per cent. of cases investigated. Taking this figure as a conservative average cost per horsepower and applying it to the twenty million horsepower which are generated in privately-owned industrial power plants, we get an annual power cost for this item of two billion dollars.

Assuming an average cost to purchasers of central station power of two and a half cents per kilowatt hour, which is the equivalent of 0.01865 cents per horsepower hour or $55.95 per annum per horsepower (3000 hour basis), the total cost of the ten million purchased electric horsepower amounts to $559,500,000.

Adding this item of purchased power to the two billion dollar cost of privately developed power we get a grand total of $2,559,500,000 annual cost of power to American industries. This includes, of course, fuel, labor, supplies, overhead, interest on investment and depreciation, but it is exclusive of the several million horsepower generated by privately-owned internal combustion engine plants and water powers.

The total wages paid in industry during the same year of 1919, as given by the United States Bureau of Census, was $10,-533,400,000.

Thus is derived the somewhat astonishing fact that the cost of power in American industry is practically equivalent to one-fourth of total wages paid.

But this huge bill which American industry annually pays for its power production is but part of what power costs industry.

Power produced must be *transmitted* and *used*. The total cost of transmission and conversion of power into useful work cannot be measured in dollars and cents because of a lack of available statistics but it will undoubtedly run into the hundreds of millions of dollars annually. Here, again, average practice is extremely wasteful as compared with best practice and here, again, we find a leakage of profits due to lack of managerial attention.

These facts, which are indisputable and which we believe are here revealed for the first time, conclusively prove the necessity of applying managerial attention to the familiar but neglected subject of power production and utilization.

*"Facts About Coal Conservation," Industrial Management, November, 1922, page 296.

The What and Why of Power Apparatus

The Parts of a Power Plant, and How They Function

By James T. Beard, 2nd

Feed Water Systems

THE care of boiler feed water systems and the efficiency of the equipment comprising the system has much to do with operating efficiency and maintenance costs in a power plant.

Feed Water Piping.—Water is delivered to the steam boilers through a system of piping. Due to the corrosive action of hot water on metal, only high grade brass piping, capable of standing boiler pressures, can be used.

Feed water piping, in itself, does nothing to increase or decrease operating costs. But the selection of suitable piping for the service and its proper installation and anchoring has much to do with the maintenance costs over a period of time.

All feed lines should be insulated with proper material, because the water carried is hot and a loss of this heat by radiation to the air requires a definite coal tonnage to replace. Feed water insulation accomplishes a one per cent. coal saving for every ten degrees of temperature retained in the feed water.

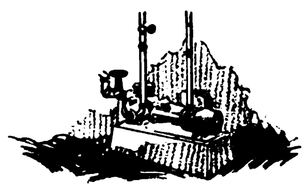
Feed Pumps.—Pumps are required to force water into the boilers against the operating pressure. They may be reciprocating plunger pumps, geared rotary, or centrifugal pumps.

The correct installation of boiler feed pumps and their proper capacity are of great importance. Improperly installed pumps may result in faulty operations, causing considerable annoyance and increasing maintenance costs. The same may be said if the pumps are too small for the job.

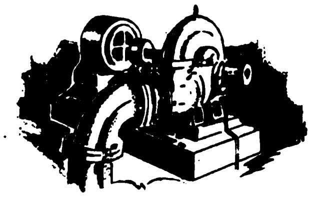
Pump governors are used in conjunction with boiler feed pumps to control its operation and the consequent delivery of water. Automatic governors make constant attention on the part of the operator unnecessary.

Injectors are also installed as an emergency means for feeding water to the boilers, in case of failure of the main feed pumps.

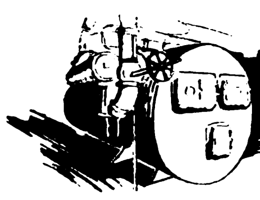
Feed Water Heaters.—Cold feed water is heated by exhaust steam in feed water heaters before it is introduced into the hot boilers. There are two kinds of heaters, *viz.*, open and closed. In the open type the water is under no pressure. Where this type is used the feed pump is placed in the line between the heater and the boilers. The closed type of heater is always under the same pressure that exists in the boilers. It is placed in the water line between the boilers and the feed pump.



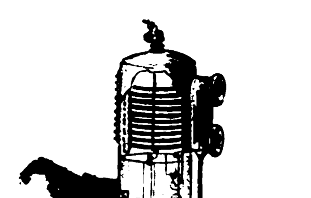
Reciprocating Pumps



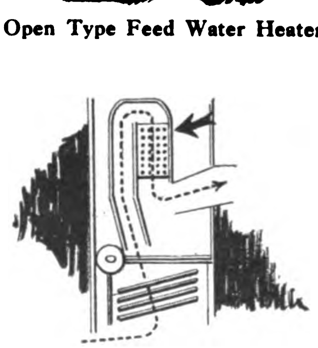
Centrifugal Pump



Feed Water Heater



Open Type Feed Water Heater



Economizer

The use of feed water heaters saves coal, because a large amount of waste heat in the exhaust steam is utilized to do work that would otherwise have to be done by the boilers. Since feed water heaters reduce the amount of work required by the boilers, smaller boilers are required to evaporate a given amount of steam.

Economizers.—Additional heating of the feed water can be obtained under favorable plant and load conditions by the use of economizers. This type of heater is placed in the smokestack breeching, so as to utilize the waste heat of the gases of combustion. Feed water circulates through the economizer just before the water enters the boilers. It is always under boiler pressure. The water forced through it by the feed pumps is raised to a very high temperature by the waste chimney gases of the stack.

Economizers save fuel costs. They involve an addition to operating and overhead costs, however, and their economy always depends upon the particular conditions found in each individual plant.

Feed Water Softeners.—The water that must be used for boiler feed is, in some localities, contaminated, or it may carry scale-forming salts in solution. If scale is deposited in the boilers it prevents efficient operation. Various methods and equipment are used, therefore, to remove these salts or to render them harmless.

Specially prepared chemicals, known as boiler compounds, can sometimes be advantageously introduced into the feed water and harmful deposits thus prevented.

In other cases a softening system, known as the "lime-soda" process, may be used. Such a system involves tanks where the water is chemically treated, where the salts are precipitated, and where they are allowed to settle out. Filters may also be used to remove suspended salts.

Continuous feed water treatment is accomplished by the "zeolite process," which also renders boiler feed water harmless. The water flows continuously through tanks of zeolite, which absorbs the harmful elements in the boiler feed as it passes to the boilers.

Scale deposits insulate the boiler tubes and prevent efficient heat transfer from the furnace to the water in the boiler. They increase, therefore, the coal consumption of the plant. Where scale is formed it must be removed regularly, thus increasing labor costs. Feed water softeners, consequently, reduce labor and operating costs in proportion to the amount of scale they prevent.

Feed Water Regulators.—In modern plants automatic regulators control the supply of water to the boilers, so that a safe and satisfactory water level is at all times maintained in the drums.

Hand regulation of feed water is intermittent, *i. e.,* large volumes of relatively cool water are introduced at infrequent intervals. Constant and uniform steaming of the boiler, therefore, is not possible. A more even steaming and operating pressure is maintained by automatic regulators. The boilers can thus absorb heavy overloads almost instantly and greater reliability of plant production is assured.

Boiler Furnaces

The design of boiler furnaces is of the utmost importance from the standpoint of efficient combustion and plant maintenance.

Fire Brick.—High efficiency of combustion involves high furnace temperatures. The limit of furnace temperature depends upon the character and quality of the fire brick used. Within recent years the development of fire brick to resist unusually high temperatures has made marked strides. The same applies to fire brick cement.

Good fire brick and cement, together with proper laying, therefore, assure long life of the furnaces and reduced labor and maintenance costs. The maintenance of high combustion efficiency and low fuel and repair costs is, therefore, possible under these conditions.

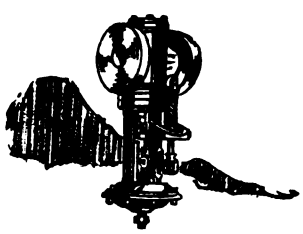
Arches.—Ignition arches, and various types of flat arches and suspended arches make rapid and efficient combustion possible, depending upon the grade of fuel burned.

Low grade fuels can be burned if proper arches are provided, thus materially reducing fuel costs. Modern arch construction and intelligent handling of fires keep maintenance costs at a minimum.

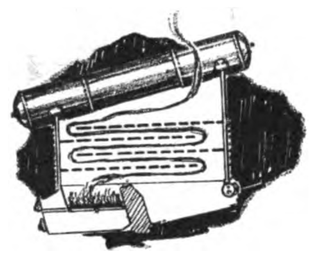
Baffles.—The purpose of baffles is to properly direct the flow of gases through the banks of boiler tubes. They consist of a wall of heat-resisting brick, built around and between the tubes.

Baffles prevent the shortcircuiting of the gases in their path through the tubes. Thus, they conserve heat and utilize in full the heat developed in the furnace.

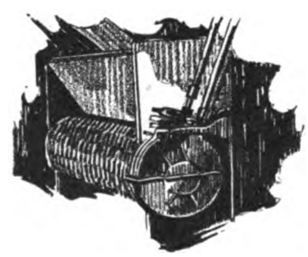
Solid and monolithic baffles offer no cracks for gas leakage and are, therefore, more efficient than the built-up brick baffle. They are easily repaired and reduce fuel and labor costs.



Automatic Regulator



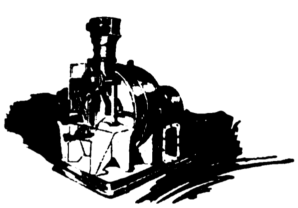
Baffles



Chain Grates

Underfeed Stoker

Overfeed Stoker



Fuel Pulverizer

Fuel Burning Equipment

Grates.—Grates form a mechanical support for coal while it is being burned under the boilers. Various types are designed for the different kinds and grades of coal available.

Properly selected grates increase combustion efficiency, decrease coal consumption and labor costs in connection with the handling and cleaning of the fires.

Stokers.—Stokers are, briefly, mechanical grates. They may be operated by hand, by electric motor or by an auxiliary steam engine. They are designed to feed coal automatically to the furnace. Means are usually provided for controlling the distribution of air to the fuel bed.

Automatic stokers materially increase the combustion efficiency; they make possible high combustion rates and maximum boiler capacity; they make it possible to burn low grades of fuel; they eliminate hand shoveling of coal. Reduced labor, fuel and overhead costs are, therefore, possible in plants large enough to utilize them to advantage.

Pulverized Fuel Equipment.—Pulverized fuel burning equipment consists of means for crushing coal, for reducing it to a powder, for mixing it with air and for blowing it into the boiler furnaces where it is instantly burned in a rapid hot combustion.

Very low grade fuels can be burned with unusually high efficiency. Material reductions in fuel costs are therefore, possible and high boiler ratings can be maintained. The burning of pulverized fuel produces no ash and ash handling equipment is not required. Provision must be made, however, for removing the fused refuse from the furnace and settings.

Oil Burners.—In localities where the cost of coal is high, fuel oil is suitable for burning under boilers. Specially designed burners direct the oil into the furnaces where it is burned with a high efficiency, not possible to attain with coal. Oil burning systems must provide for oil storage, for heating of the oil, for pumping it through the system and for atomizing it and blowing it by air or steam into the furnace.

Oil burning plants reduce fuel costs in localities where coal prices are unfavorable. The big saving in burning fuel oil, however, is in the reduction of labor. Very little attendance is required on the firing floor and there is no ash handling, coal passing or cleaning of fires to be done. The experiment has been tried, of making an interchangeable oil and coal burning installation.

Steam Boilers

Fire Tube Boilers.—Fire tube boilers in stationary plants are of the return tubular type. That is, furnace gases pass under the boiler shell to the rear of the boiler and enter the boiler itself through large tubes or flues which run from rear to front. Water in the boiler surrounds these tubes. Gases leave the boiler at the front.

Return tubular boilers are often suited to small plants where the load is uniform and no rapid steaming is required. They involve a moderate financial outlay and are economical at moderate ratings under the conditions specified.

Water Tube Boilers.—Water tube boilers consist of one or more drums, superimposed above one or more banks of tubes. Water circulates through the drums and tubes, while the furnace gases pass between the tubes.

Water tube boilers are rapid steamers and are adaptable to fluctuating loads. They maintain a high efficiency under heavy overloads and may be built in very large sizes.

Boiler Coverings.—Steam boilers are covered with insulating material to prevent radiation of heat. Boiler coverings, therefore, conserve fuel and reduce fuel costs.

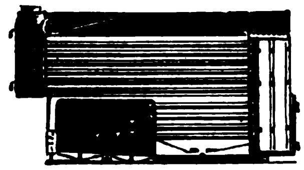
Boiler settings are often painted with a plastic coating to prevent leakage of air into the fire box. Air infiltration reduces furnace temperatures and combustion efficiency is impaired. Prevention of air leaks, therefore, assists in maintaining low fuel costs.

Boiler Tube Cleaners.—Scale deposits are removed from boiler tubes by various types of mechanical cleaners. Where feed water treatment does not prevent the formation of scale, tube cleaning at regular intervals is necessary to maintain a high rate of heat transfer and low fuel consumption.

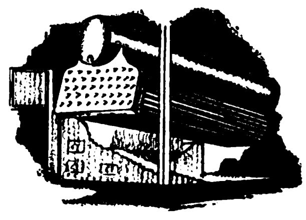
Soot Blowers.—Soot is deposited between the tubes of water tube boilers and in the tubes of fire tube boilers by the gases of combustion on their way from the furnace to the flue. This soot insulates the tubes in the same way the water scale does. Soot blowers, using steam for scouring purposes, remove this soot at regular intervals.

Soot blowers, if consistently used, maintain a high rate of heat absorption in the boiler and assure reduction in the fuel consumption of the plant.

Superheaters.—Superheaters consist of a bank of tubes (exposed to the heat of the furnace gases), through which steam generated in the boilers is passed before it is delivered to the main steam line. This superheating of the steam evaporates all the moisture and heats the steam to a very high temperature.

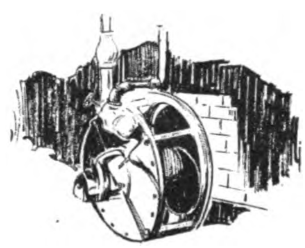


Fire Tube Boiler

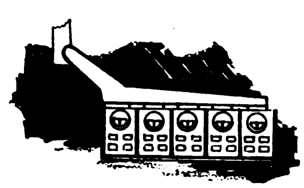


Water Tube Boiler

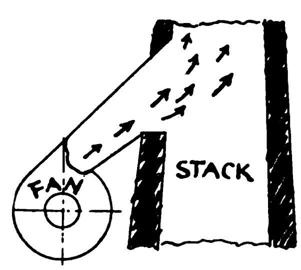
Tube Cleaner



Mechanical Draft



Breeching



Induced Draft

Superheaters prevent condensation of steam in the pipe lines, engine cylinders and steam turbines, thereby assuring a maximum amount of work done by the steam. Superheaters, therefore, save heat losses due to condensation that are unavoidable when ordinary steam is used. They result in a material coal saving under favorable conditions.

Boiler Accessories.—Water columns, steam pressure gages, safety valves, check valves, non-return stop valves, etc., are necessary safety appliances on every boiler. The water column gives visible indication of a safe water level. It may be provided with a high or low water alarm whistle, as a further precautionary measure. The steam gage gives the men on the firing floor a visible indication of the operating pressure in the boiler. The safety valve operates to let steam blow out when the pressure is excessive. Check valves in the feed water line prevent water in the boiler flowing back into the feed water system. Non-return stop valves are placed on the boiler steam line to prevent steam flowing from the main line back into the boiler when steam pressure is low in that particular unit.

Steam Piping

Live Steam.—Live steam piping is made in three weights. The weight used depends upon the steam pressure to be carried. Fittings are made to correspond to the weight of pipe used. In the matter of maintenance costs of steam piping, much depends upon the installation, as regards anchoring, proper size of bends, etc. A poorly done job can give all kinds of trouble.

Expansion Joints.—Expansion joints are provided in long steam lines to absorb the expansion and contraction in the line due to heat or cold.

If proper expansion joints are not provided the line may buckle, open up at the joints and always be in need of repair.

Steam Separators.—Before steam is allowed to enter the cylinders of steam engines it is first passed through a steam separator, which removes all water and larger drops of moisture in the steam.

Steam separators prevent accidents, due to the presence of water in a steam engine cylinder and the consequent blowing out of the cylinder head on the exhaust and compression stroke of the piston.

Exhaust Piping.—Small exhaust lines may be made up of standard pipe. For large lines, however, spiral riveted pipe is more practical and economical.

Oil Separators.—Oil separators are placed in exhaust steam lines from reciprocating engines and steam pumps in order to remove cylinder oil that may be carried in the exhaust steam.

The presence of oil in the exhaust steam fouls the heating coils of boiling and cooking apparatus and reduces its efficiency and capacity. In some processes the presence of oil in exhaust steam would contaminate the product that is being manufactured. In either case production suffers.

Relief Valves.—Atmospheric relief valves are provided in exhaust steam lines to permit steam to escape to the atmosphere, if the pressure builds up too high. This is a safety measure to prevent rupture of the line.

Pressure Regulating Valves.—Where a constant pressure is needed in the exhaust line, a pressure regulating valve is provided, which acts to admit live steam or turbine steam. When the back pressure builds up to normal, the valve shuts off the makeup supply.

Insulation.—Insulation for exhaust and live steam lines is provided in the form of a covering for the pipe lines.

Insulating material prevents condensation of the steam, enabling it to retain its heat and to accomplish more work for a given amount of coal burned.

Mechanical Draft

Forced Draft.—Turbo-blowers and forced draft fans supply air under pressure to the ashpits of boiler furnaces and literally force air through the fuel bed.

Stokers are designed to give high combustion rates and are, therefore, usually operated in conjunction with forced draft fans, which supply more air than would be available with natural draft.

Forced draft is also used with flat grate installations, making it possible to burn low grade fuels rapidly and economically.

Induced Draft.—An induced draft system comprises an exhaust fan situated between the boiler and the smoke stack. The suction of the fan draws the gases of combustion from the boiler setting and delivers them to the stack. Instead of having a positive air pressure in the furnace chamber, as in the case of forced draft, there is a partial vacuum. The purpose is the same as with the forced draft system, namely to increase the rate of combustion and secure higher boiler rating than would be possible with stack draft only.

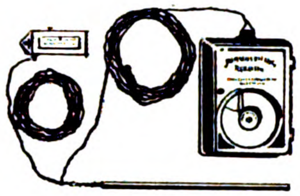
Dampers.—Dampers are provided in air ducts, flues and stacks as a means for controlling the draft and air supply for combustion purposes.

The manipulation of these dampers has a great deal to do with efficient combustion and coal consumption of the plant. Intelligent handling of the dampers reduces operating costs.

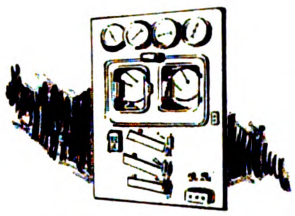
Damper Regulators.—Regulators are often provided to automatically operate the dampers, as the steam pressure or condition of the fuel bed requires it.

Damper regulators eliminates the uncertainty of the human element and when properly adjusted add to the economy of operation in terms of efficient combustion and low fuel costs.

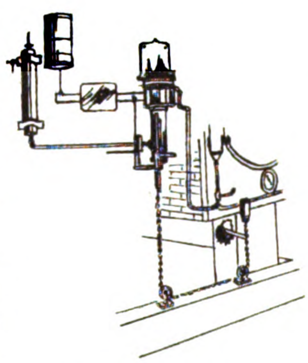
Stacks



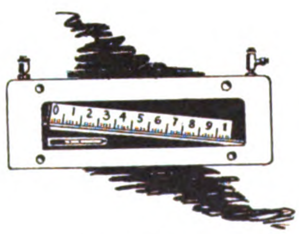
Flue Gas Pyrometers



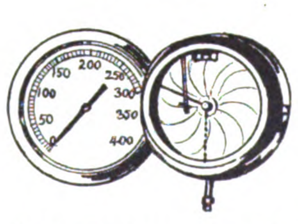
Combustion Control



Damper Regulator



Draft Gage



Indicating and Recording Gages

Ash Handling Equipment

Conveyors.—In large plants ashes are usually handled by mechanical conveyors. In small plants, a steam jet conveyor is often suitable.

In either case labor costs are materially reduced.

Sluice System.—The lay of the land and the presence of a brook or stream or other waste water sometimes make conditions ideal for a sluice system for handling ashes. Such a system has the advantages of having no maintenance costs and very little labor cost.

Ash Cars.—Small industrial cars, or even large railroad cars, can sometimes be "spotted" directly under the ash pits, practically eliminating any extra operating costs and entailing minimum labor costs.

Ash Hoists.—Elevators of the plunger type or skip hoists are frequently used to raise ash cars from the ash cellar.

Rapid handling, and moderate labor and operating costs are possible with this system.

Ash Pits and Quenching.—Ash pits are designed deep enough to prevent injury to stoker or grate parts by hot ashes. Provision can be made for quenching the ashes in the pit immediately after dumping.

Proper design of ash pits and proper handling of the ashes will materially reduce maintenance costs of coal burning equipment.

Ash Bunkers.—Ash bunkers are usually concrete. They are high enough to allow a truck or car to pass under. Suitable ash gates operate to discharge ashes at the bottom. The bunker may be filled by conveyors or hoists.

Instruments

Draft Gages.—Gages are often used for indicating and recording the draft and air pressure in the ash pit, in the furnace or in the uptake of a boiler setting.

Thermometers.—Indicating and recording thermometers read the temperature of feed water, flue gas and superheated steam lines.

Pressure Gages.—Gages of the indicating and recording type give visible indication of steam pressures in boiler, in receivers, in condensers, etc.

Hand Orsat, CO_2 Recorders.—The hand Orsat indicates the per cent. of Carbon Dioxide in the flue gases, while the CO_2 Recorder gives a continuous record of this factor over a period of time. The readings taken are an indication of the efficiency of combustion in the furnace.

Water Meters.—Means for measuring the weight of water fed to and evaporated in the boilers are frequently provided. They may be of the V-notch, orifice, venturi, or weigher types.

Steam Meters.—Meters are also provided for measuring the steam flowing in a given pipe line. They are of the orifice and venturi types.

Pyrometers. — Electrical instruments, called pyrometers, indicate and record the temperature of flue gases in a way similar to the thermometers previously mentioned.

Value of Meters, Etc.—Meters and boiler room instruments are invaluable to operating men in checking power plant losses and in maintaining a high standard of operating economy. To executives they provide a visible indication and record of plant performance, which can be compared from day to day or from week to week.

Power Equipment.

Steam Engines. — The main prime movers of a power plant are highly efficient. Engines of the Ball, Corliss and Uniflow types are designed to operate with remarkably small steam consumption, particularly when running in conjunction with condensing apparatus.

Main units usually drive electric generators. They may also drive the line shafting of the mill through a large transmission belt.

Auxiliary steam engines are not so economical as the main units. Their excessive steam consumption, however, is utilized in the heating of feed water or in the manufacturing processes of the plant. Auxiliary engines drive auxiliary plant equipment.

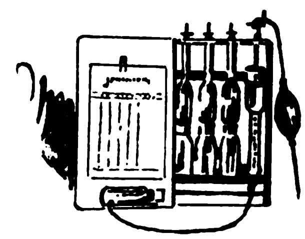
Steam Turbines.—Steam turbines drive electric generators. They may also drive fans, blowers, pumps, etc.

The large main units are exceptionally economical when operating with a condenser. The small auxiliaries like small engines are more wasteful of steam, but their exhaust is used for various heating purposes, thereby conserving what would otherwise be a loss.

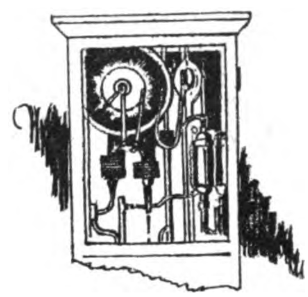
Diesel Engines, Oil Engines.—Where coal costs are high, Diesel and oil engines are often economical units, both as prime movers and also in the smaller sizes. They may be used in the same services that would be required of steam engines.

Gas Engines.—Some plants produce waste gases as a by-product. When these gases are combustible, such as blast furnace gas, they can be used to operate gas engines and thereby generate electrical power. Waste products of the plant are thus reclaimed.

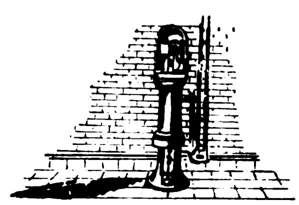
Electric Generators.—Electric generators are driven by some form of prime mover and develop either direct or alternating current, depending upon the design, for use throughout the mill. They are very efficient machines and operate with minimum trouble and annoyance. In larger sizes a cooling system, consisting of fan and air duct, must be provided for supplying air to cool the windings.



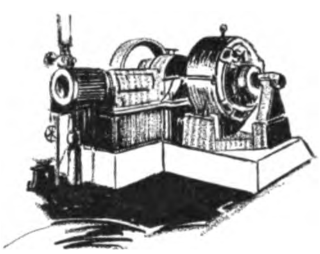
Hand Orsat



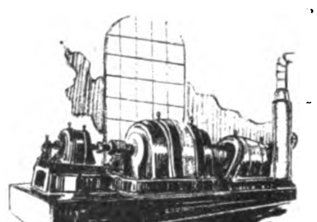
Co2 Recorder



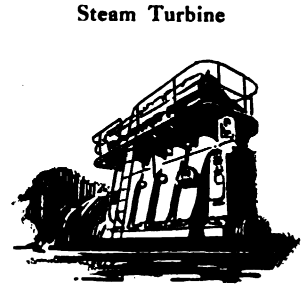
Feed Water Meter



Steam Engine



Steam Turbine



Diesel Engine

Condenser Equipment. — Condenser equipment comprises means for condensing steam exhaust from an engine or turbine, by means of cooling water. A pump is provided for circulation of the water. Other pumps are used for removing the condensate and the air that get into the system.

A condenser system lowers the back pressure on the steam prime mover and enables it to do more work with the same amount of steam. Condensing equipment, therefore, saves fuel costs.

Air Compressors.—Air compressors are required in most plants for the operation of pneumatic tools of all types. For this purpose they afford greater convenience and economy than electricity.

Compressors serve to compress air to the required pressure, delivering it to a tank, which supplies distribution pipes running to strategic points in the plant.

Intercoolers and aftercoolers are required to absorb the heat produced in the air by the compression process. Air filters prevent the entrance of dust into the system and assure its safe operation.

Air Filters.—Apparatus to filter air for the ventilation and cooling of turbo generators and other electric equipment. Increases efficiency of operation by eliminating dust deposits, thus preventing shut downs and loss through short circuits.

Refrigeration Machinery.—Refrigeration machines in stationary plants use ammonia as the refrigerant. The properties of ammonia enable a very low temperature to be attained after compression, when adequate provisions are also made for cooling and re-expansion. Low temperatures such as these are required in many processes, the most obvious of which is ice making.

In some plants, conditions are ideal for the use of an absorption system of refrigeration. This process does away with the compressor, utilizing various arrangements of pumps and pipe coils to attain the same result. This system operates on exhaust steam and is very economical.

Lubricating Appliances. — Various types of lubricating appliances are provided for assuring a continuous supply of oil to machine parts. This eliminates the intermittent feature and possible neglect which is unavoidable with hand oiling. Proper oiling appliances prevent excessive wear and influence the attainment of low maintenance cost of mechanical equipment.

Coal Handling Equipment.

Coal handling systems have for their purpose the unloading of coal from cars or barges, the delivering of the fuel to a storage pile or to the boiler

(*Continued on page 40*)

Cutting Handling Costs from Coal Pile to Ash Dump

By Matthew W. Potts

IN producing power for the industrial plant, it is necessary to start with at least two raw materials. In most plants these materials are coal and water. The water handling problem has been solved for some time. This material is handled through pipe lines and is raised to various levels under different pressures by means of pumps. The matter of handling coal, however, is different in every power house for the reason that the structure, foundations and placement of the boilers, as well as the size of the boilers, are all important factors in the selection of the proper type of materials handling equipment to be used. While all these factors seem to make the problem very complex, it is after all a simple one, regardless of the type of the power house; the one basic principle involved being the handling of coal from point of receipt to point of consumption at the lowest possible cost.

After power has been generated and the coal consumed, a third material is usually present in large or small quantities in the form of ashes. While there is a smaller amount of this material to be handled than in the case of raw material or coal, at the same time it presents a more difficult problem for the reasons that it is abrasive, useless, has a very limited market and presents a serious problem in disposal. The engineering profession will eventually find a use for all the ash and cinders produced in the generation of power, but at the present time the problem must be met by considering existing conditions.

We feel safe in saying that in power plants which are not equipped with modern handling machinery, the cost of handling coal and ashes in the production of power represents approximately 75% of the direct labor charge. Where the plants are so equipped, the

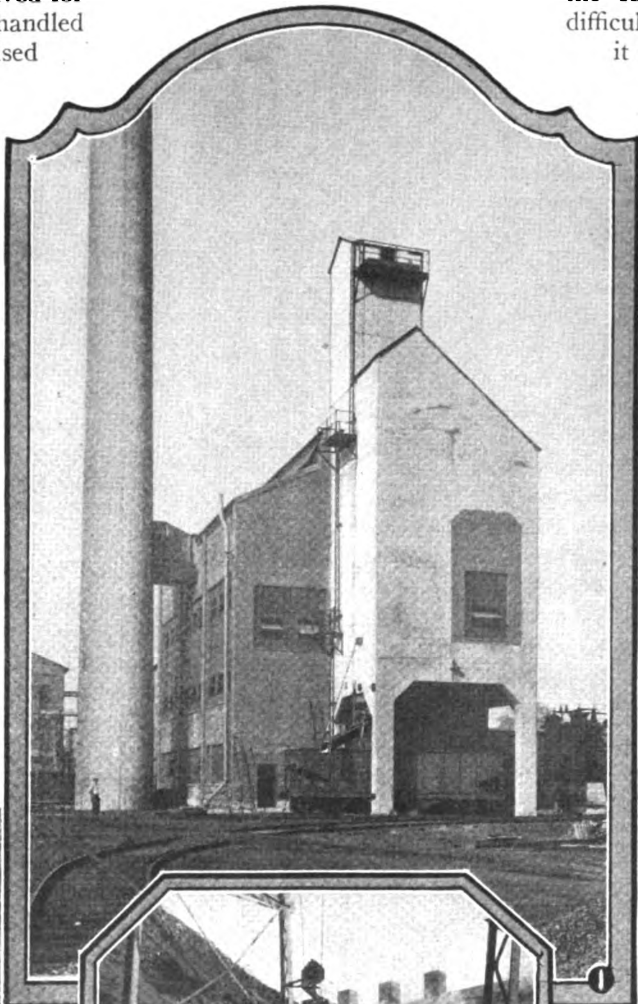


Fig. 3. Drag line scraper method of coal storage has been found efficient and economical.

Fig. 2. Discharging of coal from a bucket operating on a monorail cable storage system.

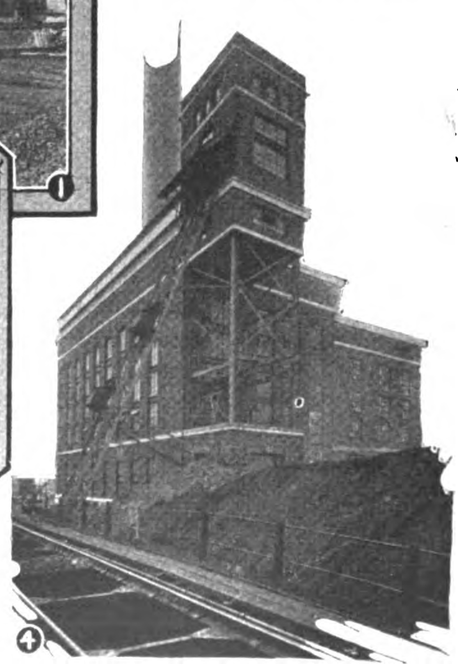


Fig. 4. Skip hoists can be used for handling both coal and ashes.

cost of labor for handling these two materials will vary according to the rate paid per man hour and the type of equipment employed.

While one man and an assistant can easily control the operation of from three to five boilers, under hand methods it requires from two to ten men to furnish these boilers with a supply of coal, and from two to ten men to handle the ashes and cinders, depending upon their ultimate point of disposal. These figures represent the labor involved in handling *where no mechanical devices are employed.* Thus we find that in such power houses the largest proportion of the direct labor charge is the feeding of the boilers and the carrying away of waste or ashes.

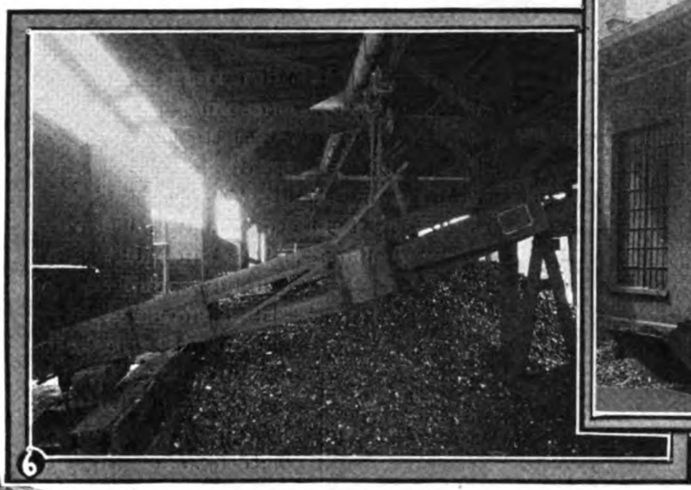


Fig. 6. This belt conveyor mounted on a monorail trolley with chain hoist provides a cheap method of handling coal from cars to storage.

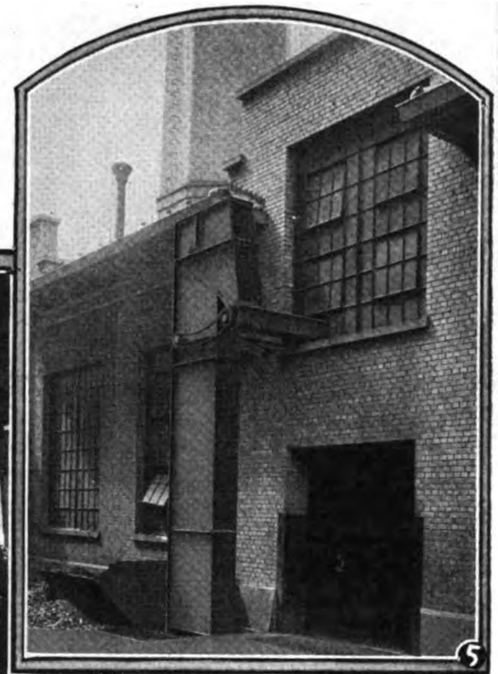


Fig. 5. Simple systems of bucket elevators and screw conveyors can be used for handling coal in small lumps.

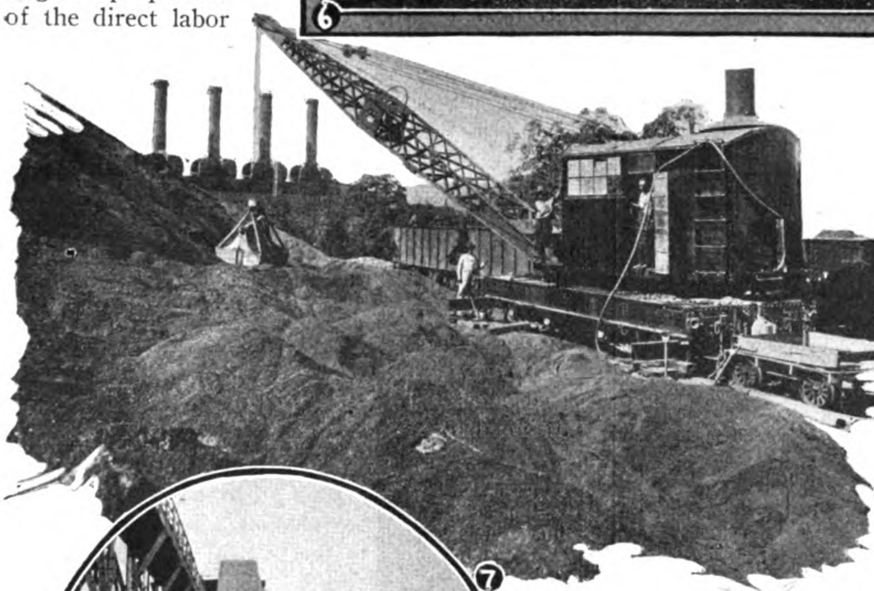


Fig. 7. Locomotive cranes for handling of coal need very little explanation, for they are installed in numerous plants throughout the country.

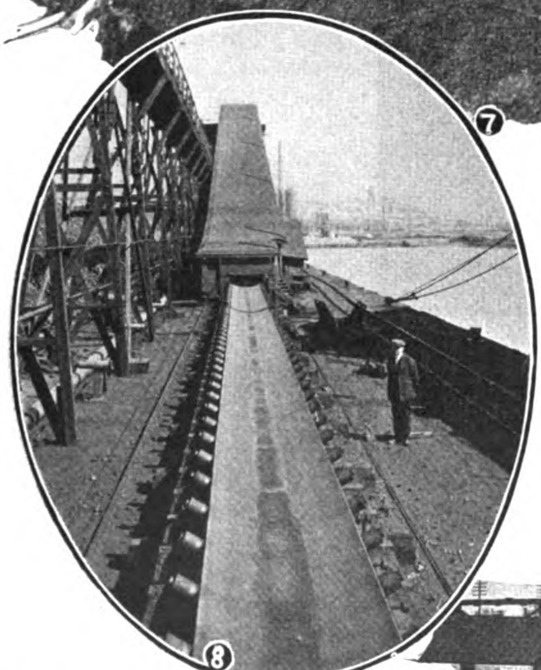


Fig. 8. Belt conveyors transporting coal to the storage pile. It is well to avoid the water streak in the center of the belt by covering it.

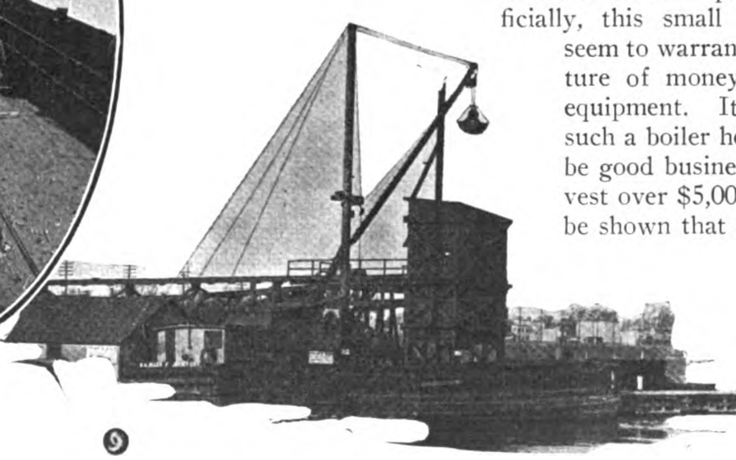
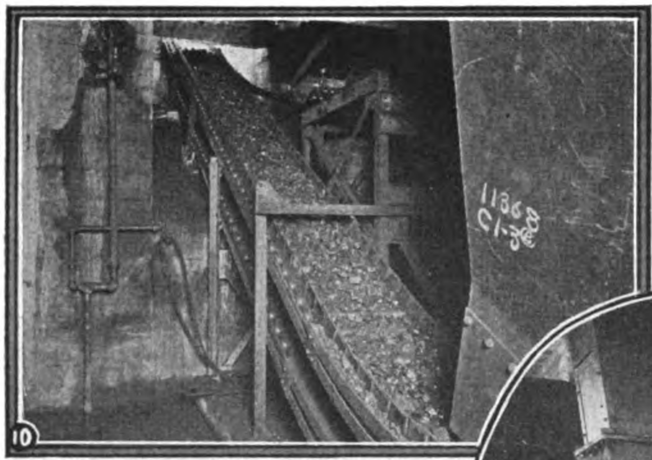
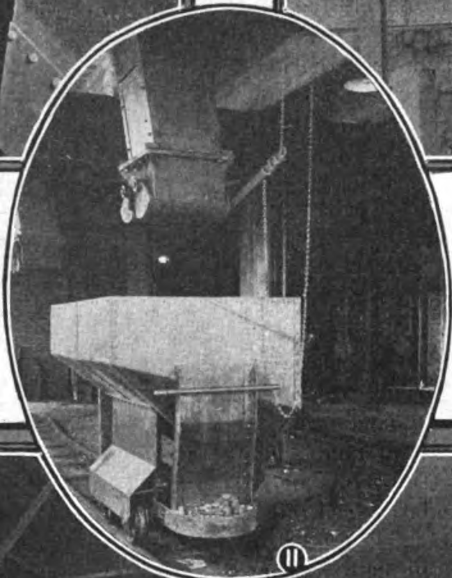


Fig. 9. Derrick hoists and industrial railways on trestles are used for unloading coal.

Small boiler houses present a place where large savings can be made in the industrial field, but in small plants the executive is often satisfied with the archaic methods which have been in use in such boiler houses for years: bringing the coal from the storage pile and dumping from the wheelbarrow onto the boiler house floor, from which it is fired to the boiler. The same wheelbarrow is then used to transport ashes to a convenient point in the yard, where they are used as fill or left until such time as a truck load is accumulated and they are hauled to a public dump. We class the small boiler house as one where from ten to twenty tons of coal are consumed per day and, superficially, this small figure does not seem to warrant a large expenditure of money for mechanical equipment. It is true that in such a boiler house it would not be good business practice to invest over $5,000, unless it could be shown that there would be a





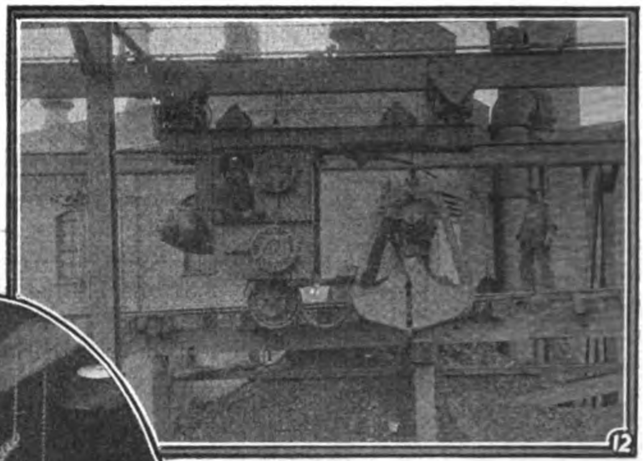


Fig. 10. This overlapping pan conveyor is transporting lump coal from track hopper to crusher.

Fig. 11. Industrial cars are extensively used for handling both coal and ashes in the power house.

Fig. 12. Monorail telphers equipped with clam shell buckets can be used for handling coal and ashes.

reduction in labor cost of at least $3,000 per year. When we consider, however, that the average common laborer is now being paid 48c per hour it is easy to see that if the mechanical equipment would replace one man—or better still, two men—it would immediately save its own cost in a very short time and would also be more reliable.

In larger power houses, where the consumption of coal ranges from one hundred to two hundred tons per day, the use of extensive materials handling equipment can be more readily justified; in fact, if this mechanical equipment were not available, such large units could not be operated, as it would require an army of men to handle the coal and ashes. The mechanical equipment of these large power houses not only conserves labor but it also conserves space. Only a small percentage of the entire power house is actually allotted to this equipment, unless we consider the coal storage bunker as a part of such equipment. Thus we find that mechanical equipment makes two direct savings, labor cost and space, and when we realize that a power house erection cost is based on the cubic foot measurements, it is obvious that great care should be taken in the proper design, layout and construction of the materials handling equipment to be installed.

Large power houses or central sta-

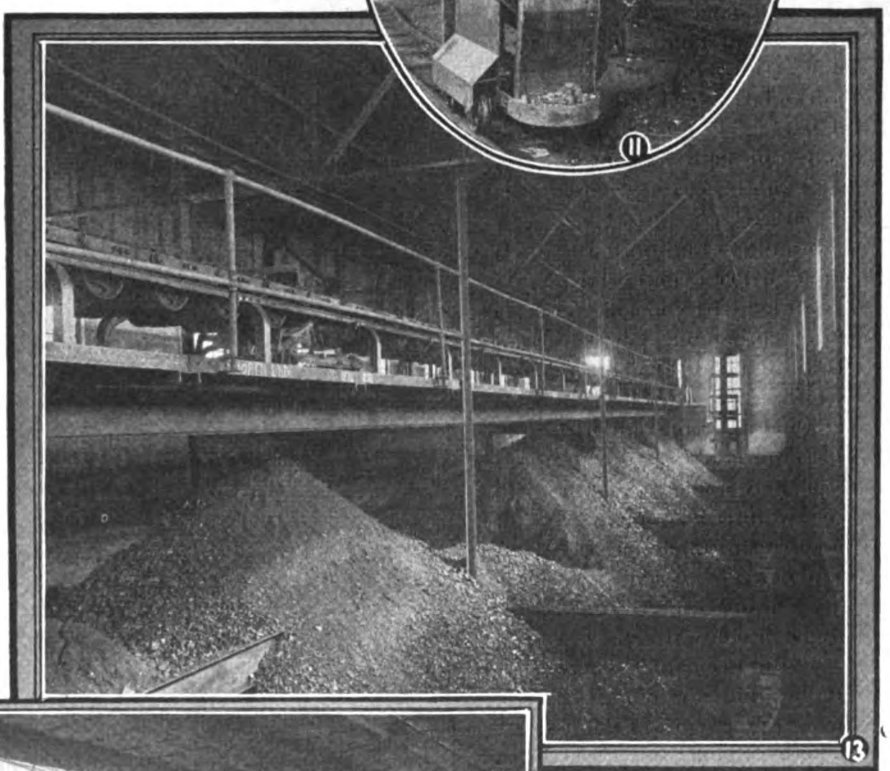


Fig. 13. Pivoted bucket elevator conveyor discharging coal to power house bunker.

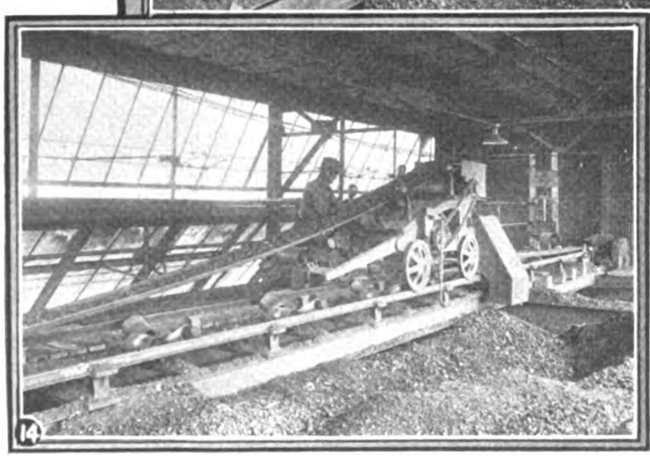


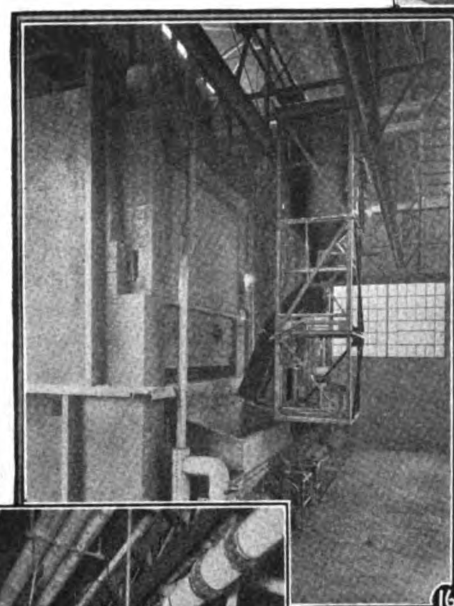
Fig. 14. Belt conveyor tripper discharging coal to power house bunker.

tions are becoming more numerous, but, at the same time, most industrial plants will always have a medium-sized boiler house if for nothing more than the production of steam for process work and plant heating. By medium-sized boiler houses, we mean those using from twenty to one hundred tons per day; a size power plant at present the most numerous in every branch of industry. Here is a particular field where the industrial executive can give consideration to the use of some form of mechanical equipment for the handling of both fuel and ashes. At the same time, this class of boiler house represents a very good market for the manufacturers of such equipment to concentrate upon in order to show the savings that can be effected by installing their mechanical devices.

For the benefit of the executive, this article shows various types of materials handling equipment for handling both coal and ashes. The illustrations are all taken from power plants where the consumption of fuel ranges from twenty tons to one hundred tons per day. In other words, we are dealing specifically with the field which needs the most education on *how to reduce power costs,* and we are presenting equipment of various types, showing how this equipment can be applied under almost

(*Continued on page* 44)

Fig. 16. Traveling weigh larrys are used for transporting coal from bunker gates to stokers.



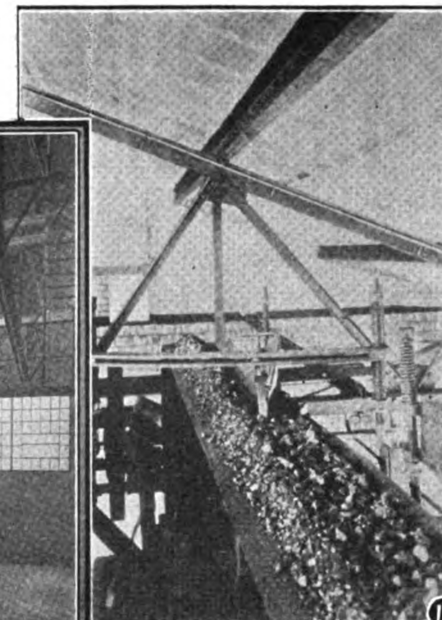


Fig. 15. Movable plow discharging coal from steel belt conveyor.

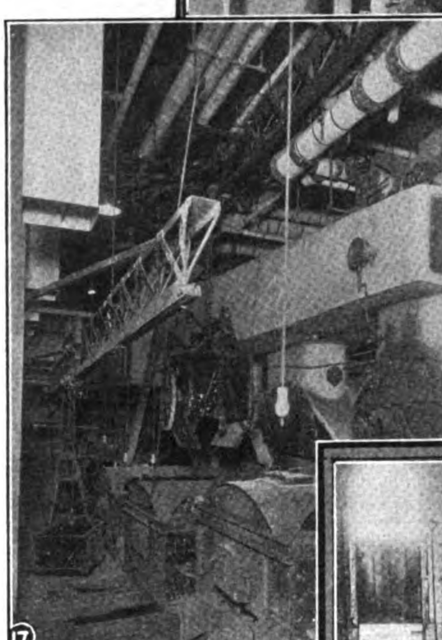


Fig. 17. Monorail trolley with special dump cart, operating in congested boiler house.

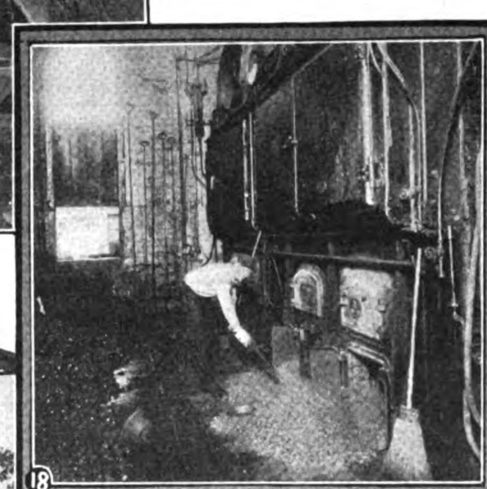


Fig. 18. Showing the method of feeding ashes direct from pits to steam jet conveyor.

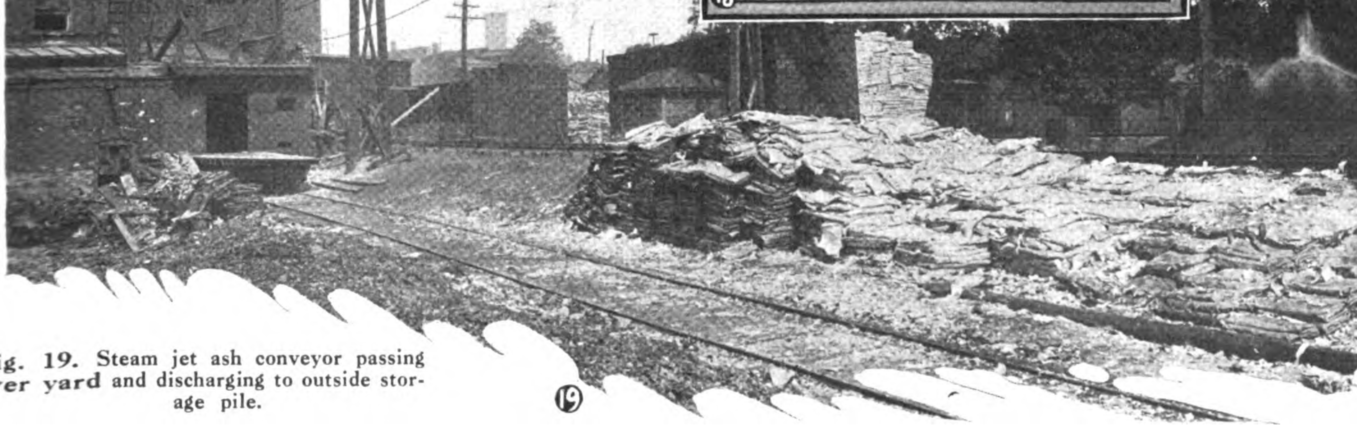


Fig. 19. Steam jet ash conveyor passing over yard and discharging to outside storage pile.

Stopping the Leaks in Power Transmission and Utilization

By Terrell Croft

Consulting Engineer, Directing Engineer of The Terrell Croft Engineering Company—St. Louis.

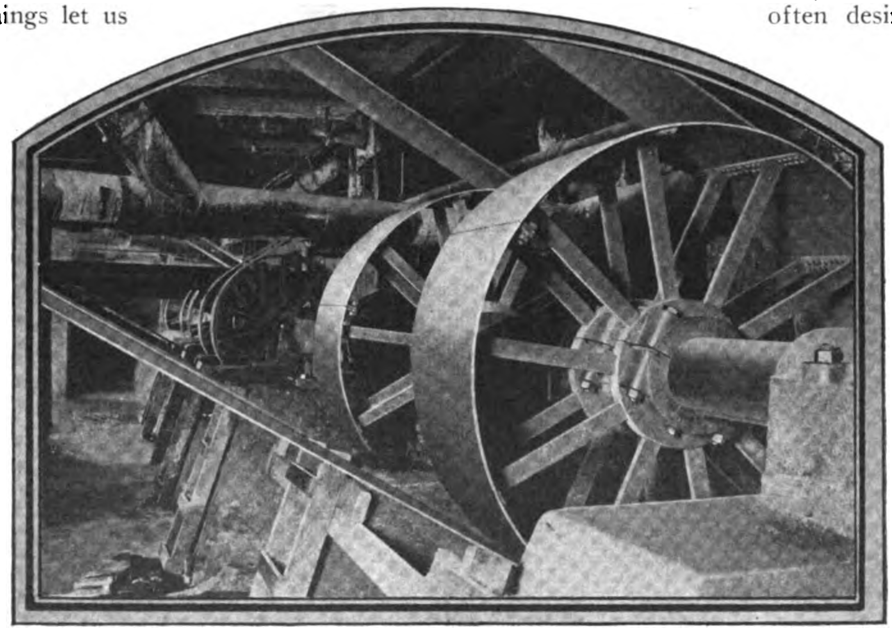
BEFORE the leaks can be stopped it is, obviously, necessary to find them. Hence this brief discussion automatically subdivides itself into two parts: (1) *The Finding.* (2) *The Stopping.*

But preceding the detail discussion of these things let us examine the general situation and determine just how much territory we will endeavor to cover: In transmitting power, in an industrial plant, from the location where it is generated or is received to that where it is utilized, there are four principal methods:

(1) Compressed-air.
(2) Hydraulic.
(3) Mechanical.
(4) Electrical.

Relatively, the mechanical and the electrical methods are by far the most important, since very much more power is transmitted by these than by the hydraulic and compressed-air methods. Hence, this brief article will be confined to a consideration of only these more important methods. It is seldom that the hydraulic or the compressed-air method competes with the electrical or the mechanical. For many applications, either the hydraulic or the compressed air method *must* be used. But the mechanical and the electrical methods are, in many cases, in direct competition. Therefore, it is often desirable that they be considered competitively.

It is a matter of record with those who have accorded the situation thorough study, that electrical power transmission has often been employed where mechanical transmission would have been more economical. The ardent advocates of individual motor drive always tend to overstress the fact that line-shafting and belt transmissions involve friction losses and upkeep expense. Obviously this is true. But these same advocates often overlook the



A well designed line-shaft transmission in the plant of the Alton Box and Paper Co., Alton, Ill.

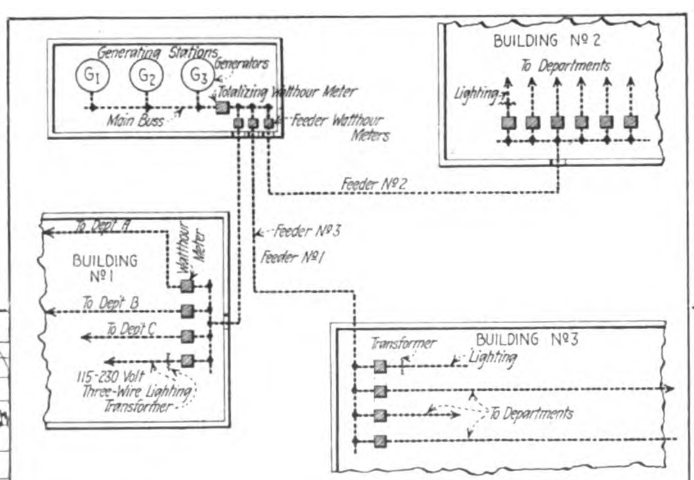


Fig. 1. Above—Typical arrangement of watthour meters in an industrial plant.

Fig. 2. Below—Section of a graphic wattmeter chart. Full scale being 40 kw., the motor is taking an average of 24 kw. Obviously, the 50 hp. motor used is too large.

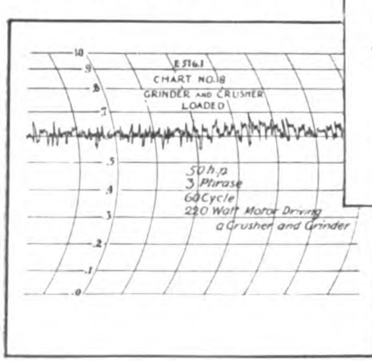
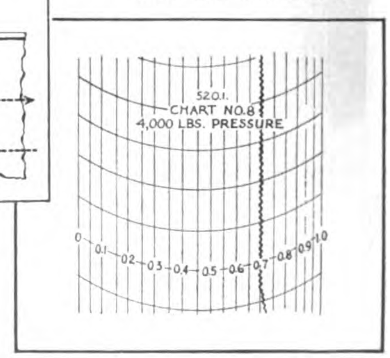
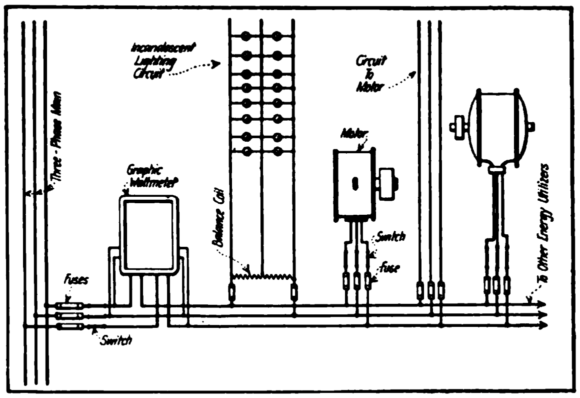


Fig. 3. Below—Here, the meter shows a power input to the motor, of 28 kw. (37.5 hp.); showing that the 15 hp. motor furnished with the machine was too small.





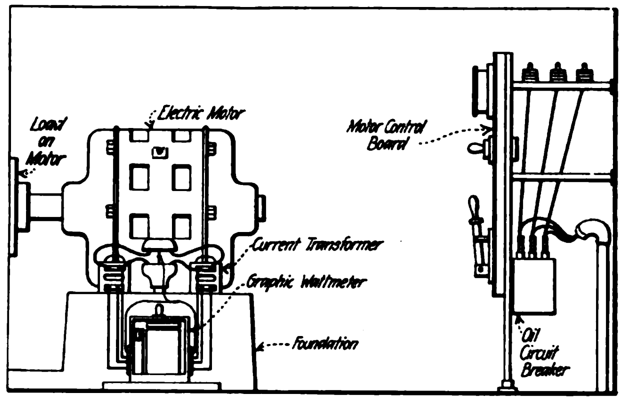
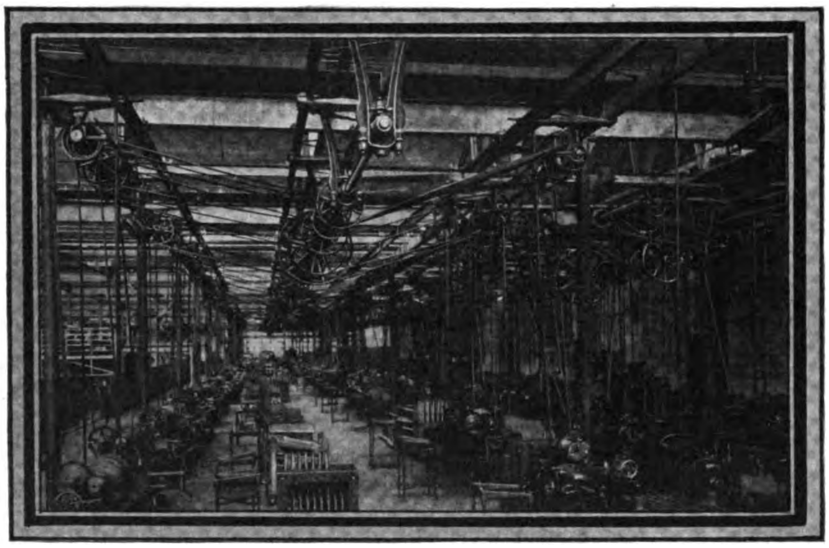


Fig. 4. Above—Layout of graphic wattmeter connection to record the power input of an electric circuit.

Fig. 5. Above—Graphic wattmeter connected to record the power input of a motor.



Above — Line-shaft and belting transmission in the lathe department of the Cincinnati Milling Machine Co., Cincinnati, Ohio.

equally important fact that electrical transmission involves electric circuit and electric motor losses and also upkeep. Actually, if all of the tangible elements are fairly evaluated it will be found that, in many instances, the annual charge for a belting-and-line-shaft transmission will be considerably less than that for an equivalent all-electric transmission. This situation will be examined further hereinafter.

Now, as to finding the leaks. There are three principal ways of doing this. (1) *By keeping and studying periodic records of energy consumption.* (2) *By systematic testing.* (3) *By comparative calculation.*

As to finding leaks from the records:—In most industrial plants where the cost of power is of sufficient consequence to be of financial importance, watthour meters are installed (Fig. 1) and periodic records of power consumption are maintained. These power consumptions, for given periods, when checked against the production for the same periods will result in a power cost per unit of production. If the power cost per unit of production increases, this tends to indicate the "leak." Also, if the power cost per production unit is greater in one plant than in another which is making the same product, this denotes that there are probably

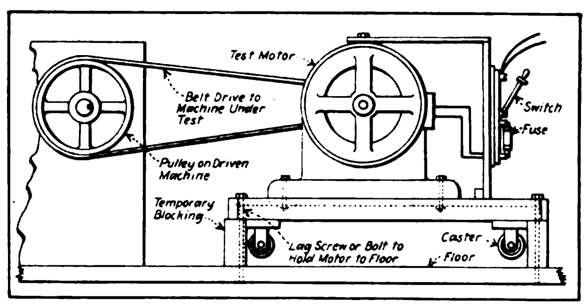


Fig. 6. Above—Portable motor arrangement for determining power requirements of machinery.

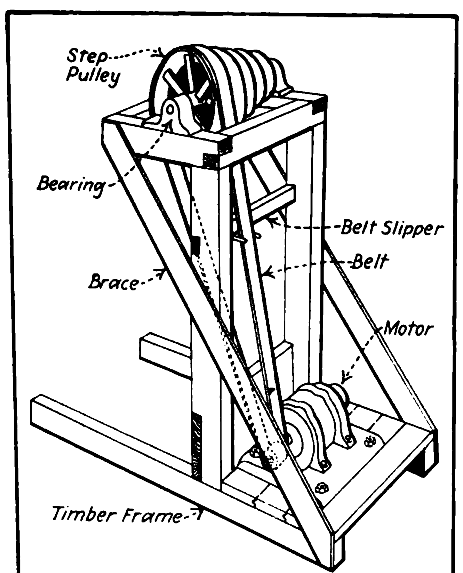


Fig. 7. At the left—A portable test motor, equipped with countershaft.

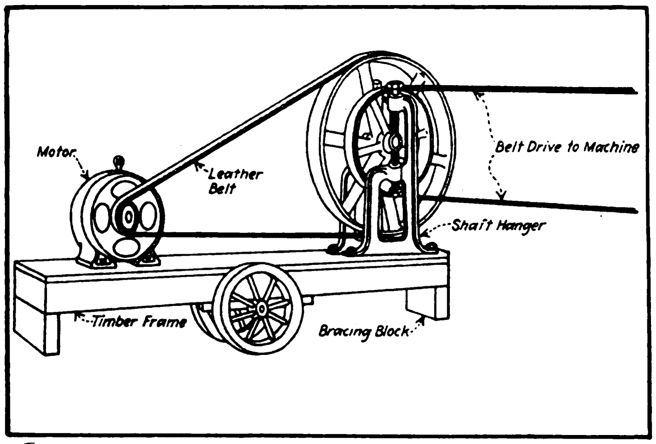


Fig. 8. Above—Here is another form of portable test motor and countershaft.

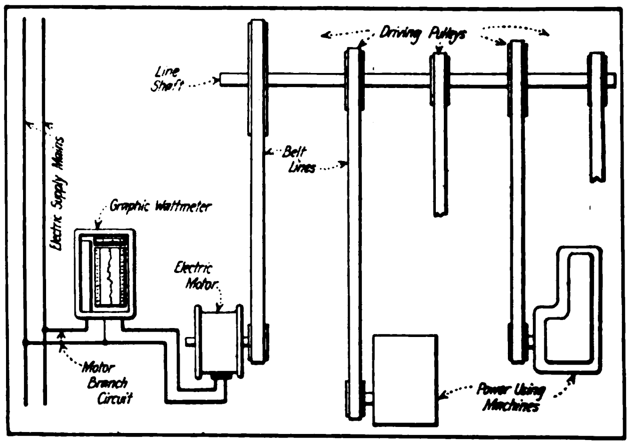


Fig. 9. Above—This shows the layout of connections for a graphic wattmeter to determine the power required by a line-shaft and belt transmission.

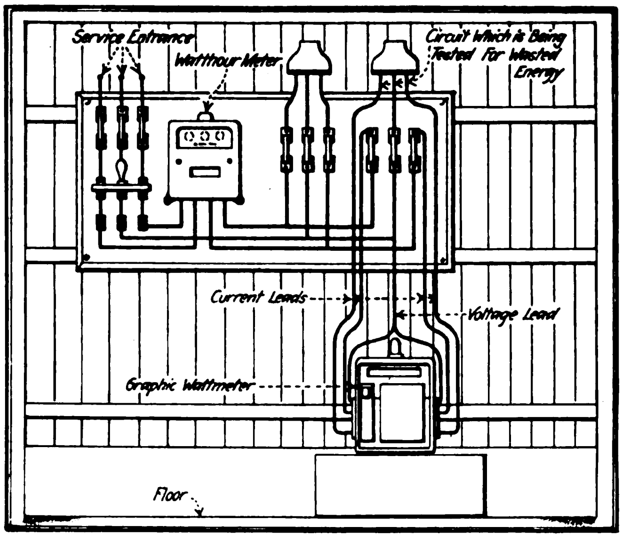


Fig. 10. Connections of a graphic wattmeter for finding wasted energy on a department feeder line.

power leaks in the plant which shows the higher cost.

To obtain the data for a *total power cost record* for a plant is simple. This cost will be the sum of all of the items chargeable to power generation (or purchase) and distribution. But to obtain the segregated cost of power transmission and utilization is somewhat more difficult. It is seldom desirable—and often practically impossible—to endeavor to separate the cost of power transmission from that of utilization; they are ordinarily treated as a joint unit.

If all power in the plant is transmitted through motors, then watthour meters or graphic recording meters can, as suggested in Fig. 1, be arranged to meter all of the energy which is transmitted within the plant. The energy to each group of buildings, to each building or to each department—the subdivision may be carried as far as the economists of the situation justify—may be metered separately. Thereby the energy cost may be accurately determined. The maintenance and fixed-charge expenses may be distributed over the same power-cost accounts as those for which the meters provide the energy expense records. Thus, the total power-transmission-and-utilization cost for each group of buildings, or each building or each department may be periodically determined. And, as before suggested, comparisons of these total costs, for different periods and for different buildings and for different departments, will give clues as to existence of transmission and utilization leaks.

But where the power is transmitted from the power generating unit or units wholly by line shafts and belts it is unfeasible to maintain accurate periodic records of power transmission and utilization energy cost. Where the power is thus wholly transmitted by shafting and belts, the cost, as entered in the periodic reports, of the energy consumed in such transmission must be estimated. There is no convenient simple device whereby energy which is transmitted mechanically may be metered. These estimates of the cost of the energy consumed may be based on tests which are made periodically and under average conditions. Then, with the periodic estimates of the cost of the energy consumed in the me-

(Continued on page 56)

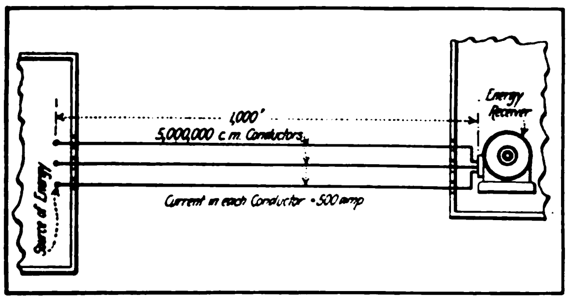


Fig. 10a. The energy loss here costs $3,168 per year; three times the loss found in each of the three conductors.

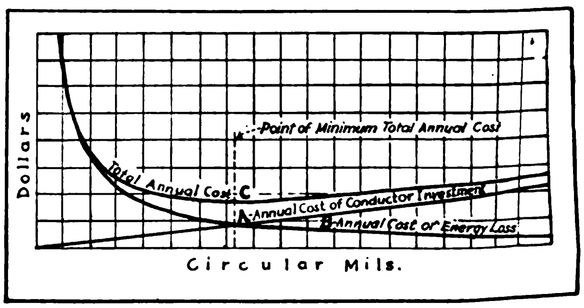
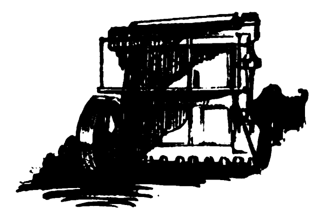


Fig. 11. This chart shows the relation between the cross-sectional area of a conductor and the annual cost thereof, for a given current in amperes.

The What and Why of Power Apparatus

(*Continued from page* 31)

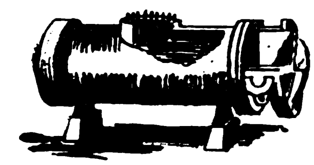
house, the weighing and recording of the amount of coal received, the crushing of the larger sizes to a size that is suitable for feeding to the furnaces, and the delivery of the sized coal to bunkers supplying the boilers.



Gas Engine

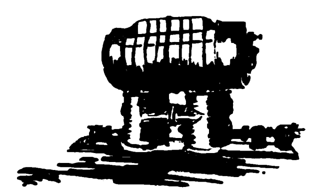
A complete system is suited only to a large plant, where a large coal tonnage is burned. Modifications of the complete system, with some of its features omitted, are suited to smaller plants, where less coal is burned.

Coal handling systems reduce labor costs because the fuel is handled mechanically. Where storage is provided a reliable coal supply is assured and interrupted production due to coal shortage is insured against.



Surface Condenser

Unloading Cranes.—Locomotive cranes consist of a hoist mounted on railroad trucks. They are easily shifted about by a switching engine and can be used where coal is delivered by rail. They unload coal quickly.

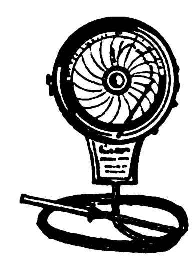


Jet Condenser

Overhead cranes of various types are used for unloading coal from either barges or railroad cars.

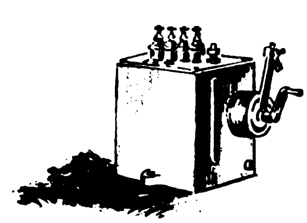
Unloading cranes and hoists increase the speed of handling coal when it is delivered and reduce the labor required in the handling.

Conveyors, Etc.—Bucket conveyors, bucket elevators, belt conveyors and, sometimes, scraper conveyors receive coal from railroad cars or delivery trucks and carry it to coal crushers, to overhead bins, to a storage pile, etc.



Recording Thermometer

A large amount of fuel is handled mechanically and continuously, and labor costs are materially reduced, particularly where any considerable amount of fuel is burned. Portable unloaders are sometimes backed up to a car or truck and the labor and time required to unload are reduced, even where the amount of coal received is small.

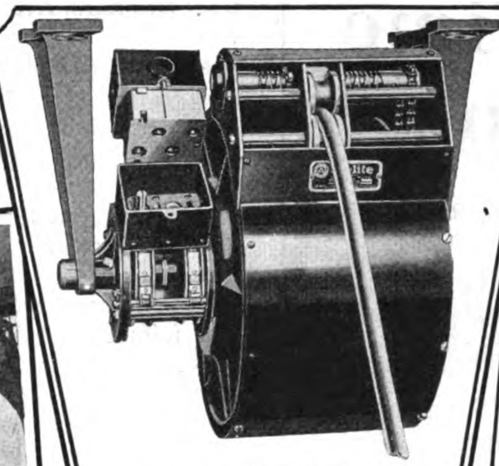


Lubricating Appliances

Coal Crushers.—Many plants, because of their location, may find it very economical to buy run-of-mine coal, which has large lumps mixed with it. Coal crushers quickly reduce the size of this coal so that it can be fed to the furnaces.

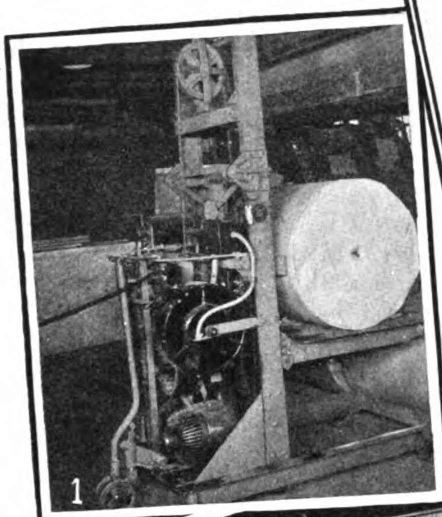
Where local conditions warrant, coal crushers make it possible, therefore, to reduce the coal bill materially.

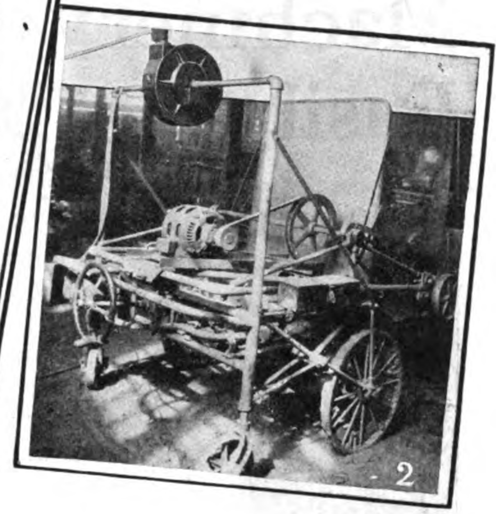
(*Continued on page* 42)

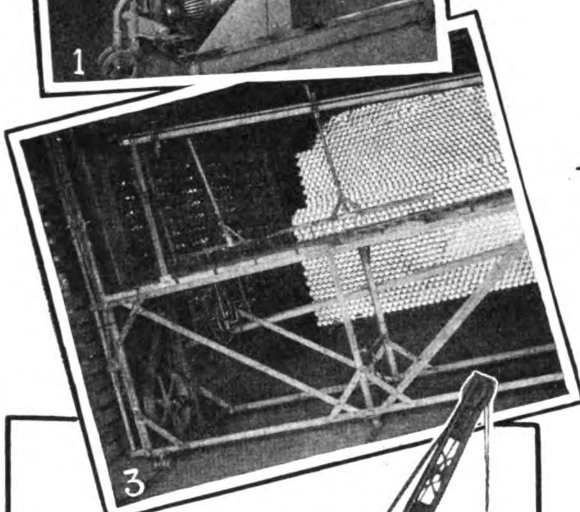


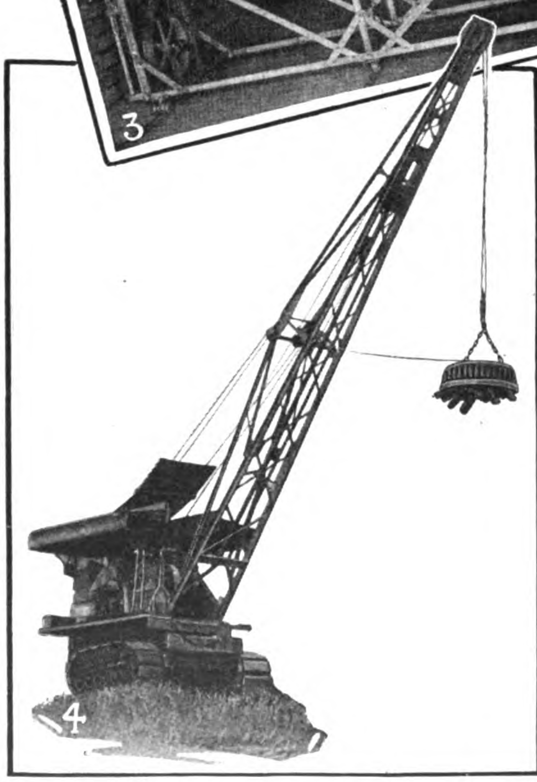
Mogul Type Reelite

There is a Reelite for every power extension requirement—the smaller sizes take care of portable tools and lights.









The Mogul Type Reelite is effecting savings on

1. Portable Elevator
2. Electric Sand Cutter
3. Can Stacking Machine
4. Crawler Crane with Electric Magnet.

A Few of the Many Uses for Reelites

THE Mogul Type Reelite finds a profitable use wherever power is to be carried to portable equipment — on all kinds of mobile machines, cranes, dredges, electric magnets, railroad and mining machinery, etc. The cord is kept coiled in a container, clean and unkinked, and is automatically unreeled and retrieved as the location of the equipment demands. This saves considerable time and trouble, and frees the cord from wear, which in turn keeps the machine in service — adding profits instead of losses.

Here are pictured some typical applications of the Mogul Type Reelite. Probably they can suggest a similar use for you.

Our engineers will gladly explain how it saves in operating costs, convenience, safety, and how it can be adapted to your requirements. Ask them.

APPLETON ELECTRIC COMPANY
General Offices and Factory
1716 Wellington Ave., Chicago

MOGUL TYPE
Reelite
REG. U.S. PAT. OFF.
KEEPS THE MACHINE IN SERVICE

(Continued from page 40)

Coal Bunkers, Etc.—Bunkers offer a temporary storage for coal in the boiler house. They are installed at an elevation that is high enough to permit fuel to feed by gravity to the furnace. Individual chutes lead from the bunker to each boiler, and a coal gate is placed at the head of each chute so that the supply can be shut off when the boiler is out of commission. Bunkers are particularly desirable where the furnaces are mechanically fired.

With mechanical firing overhead bunkers greatly reduce labor costs of handling coal in the boiler house. They also assure a reserve supply of coal that could tide over a failure of the delivery system for short periods of time.

Coal Scales.—Coal scales at the point of delivery indicate the correctness of the weight of coal received. They do not save labor. If anything, it costs perhaps a little more to weigh coal than not to weigh it. But they insure against short weight.

Recording scales are often installed on the conveyor systems which deliver coal to the boiler house. These scales act as a check on the railroad scales; they indicate losses between the storage pile and the coal bunker; and they assist operating men in maintaining the efficiency of the boiler house.

IS general business in the last stage of the old cycle or have we already embarked on the first period of a new cycle?

Since the division of business cycles into periods is an arbitrary matter, any individual can divide the business cycle into such periods as he likes. He can divide the business cycle into four periods, six periods or only two or three periods. The naming of the periods, then, is not the important thing. The immediate trend of the cycle is the primary consideration. It is helpful, however, to adopt some sort of classification for the different stages of the business cycle and the one which seems most serviceable is the division into four periods as follows:

1. Improvement—recovery in production.
2. Prosperity—production near capacity and public purchasing power heavy.
3. Reaction—production decreasing.
4. Readjustment—production below average.

Election uncertainties sometimes make for greater intensity of business depression or retardation of improvement, but they seldom change the general character of a cyclical period. For instance, the trade reaction of last spring did not occur on account of the Presidential campaign, but rather because of a condition of overproduction.

The recent trend of the business cycle has been as follows: A new cycle began in the summer of 1922. The second period, that of prosperity, culminated in 1923. The year 1924 has been essentially one of reaction and readjustment so far as the business cycle is concerned, although there has been no first-class period of business depression. The iron and steel and textile industries have sharply curtailed but readjustment has been accomplished without a depression severe enough to force economy in retail buying. Business is now in the transition phase between the readjustment period of the old cycle and the first period of the new cycle, with prospects that 1925 will witness the stage of prosperity of the new cycle.

Materials Handling FORUM

Conducted by Matthew W. Potts

This Forum provides a place for the discussion of materials handling problems of general interest. Questions regarding the best *type* of equipment for handling specific **commodities are pertinent; as are questions regarding the *adaptability* of various types of equipment for a specific problem.**

Each question published will be answered on the basis of our experience and available information. Further discussion of these problems will be welcome, and we will publish such letters as, in our estimation, contribute to a clearer understanding.

* * *

Question No. 25.

"The writer is submitting in the material below, and the sketch attached, the data concerning a coal handling problem to which he has found no real answer. The problem is, of course, to find the cheapest way in which the coal may be carried from the pile to the boot elevator, as planned, or to the boiler house floor as we operate at present.

"We use from ten to seventeen thousand tons of semi-bituminous coal per year, all of which is stored during the open months while the river is open to navigation. It is stored as shown on the sketch, where carts holding 1,500 lbs. pick it up and carry it to the boiler house, dumping it through doors on the side where the elevator is shown onto the floor in front of the boilers. There are two carts used, each with a horse and man; a Barber-Greene loader or conveyor and a shoveler are stationed at the pile to help load, and so we operate until the carts are unable to keep up and a truck is brought up to 'tide over.'

"On an average day we burn thirty tons, and on others it may reach sixty. This is at present drawn during the day so that there will be a sufficient amount for the two night shifts, a condition that will not be changed with the installation of the bunker.

"The elevator is already erected, the bunker purchased but not up, and the larry purchased. We consider the latter necessary for we wish to control more closely the operation in the boiler house.

"The elevator, bunker, and weigh larry are the only new equipment purchased. The elevator and larry were purchased from C. W. Hunt, and the bunker from Allen-Sherman-Hoff.

"The first half of the trestle was erected in 1920, and the second track with the turntable installed in 1922 to overcome the fires that started when it was all piled in one long heap. We are still troubled with fire, and on account of the necessity of frequently replacing burned-off bents, I can see no reason why the trestle should not be altered if the cost would show an economic return.

"Our 'yard' labor **costs us 48c per** hour, and electrical **power about 3½c** per kw. hr."

We assume that the elevator bunker and weigh larry are the only new equipment purchased. We also assume that the C. W. Hunt auto railway trestle has been installed for some time. Could you give us the approximate date of installations and tell us if you would object to having this trestle altered materially, providing you could reduce your handling costs?

The question of the cost per ton handled is difficult to answer without knowing the labor scale per man hour which we wish you would give us.

We would also like the name of the manufacturer who is supplying you with the new equipment.

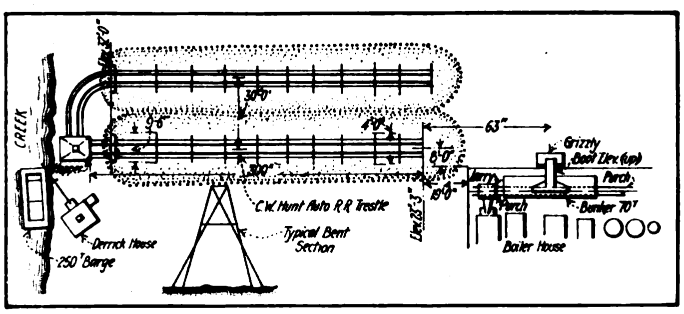


Fig. 1. This sketch was received with Question No. 25 and shows the existing coal storage system and the new boiler house equipment being installed.

Considering the layout of your equipment, as shown in the sketch, we believe it advisable for you to make a complete change in your coal storage methods.

We would recommend the installation of a drag scraper system which could be laid out as shown in the sketch herewith. The operation would be as follows: The coal would be received as at present and deposited in the hopper, from where it would be spouted to the initial pile. Here the drag scraper could reach it for storing out. This same drag scraper would be used for reclaiming and would discharge directly into the grizzly above the elevator boot of the new equipment. Storing or reclaiming of the coal from any portion of the yard is accomplished by changing the cable tail blocks from one back post to another.

It is possible that the manufacturers from whom you request bids would suggest changes in this layout to fit their particular equipment. We are enclosing a list of companies with whom you can communicate.

The advantages of this system of coal storage will be the elimination of the two carts, two horses and two men you now use, and will necessitate using a motor truck in order to take care of the peak load. We would advise buying a small size scraper which has a capacity of sixty tons per hour when handling over a distance of 100 feet. As your average haul will be more than this, the capacity will be slightly reduced. With such equipment, you can load the seventy ton bunker in from two to four hours by the use of one man who will operate the scraper. The storing out depends upon the rate at which the derrick hoist will feed the material to the initial pile. It will take about 25 hp. to operate this equipment. With this information and the estimated cost of the equipment, you can roughly figure the actual savings before purchasing.

The main drawback to the drag scraper system is the cable. We would advise getting only the best of cable as it is continually dragged through and over the coal and wears out rapidly.

As explained in last month's Forum, the use of the drag scraper system of storage will have a tendency to eliminate fires in the coal pile which you are now experiencing around the trestle bents.

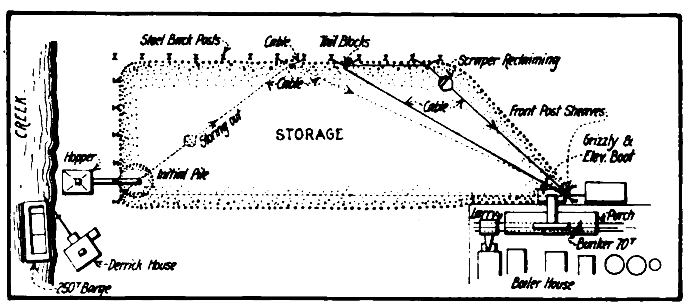
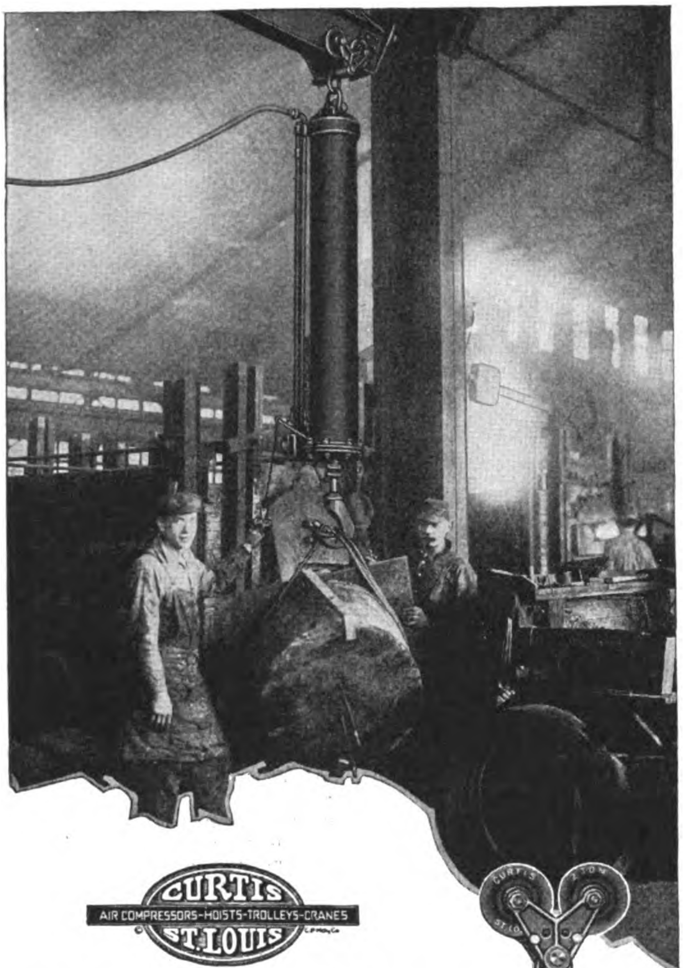


Fig. 2. The above layout is of a drag scraper system of storage to replace the present methods, as shown in Fig. 1.



Cutting Handling Costs from Coal Pile to Ash Dump

(*Continued from page* 35)

any existing conditions in some form or other. The executive should bear in mind that his problem is not an isolated one, but is of the same character and proportion as many others which have been solved successfully.

One of the first problems of handling is the proper storage of coal. There is no doubt that in the one handling operation, from cars to storage pile and storage pile to boiler house, material savings in labor cost can be made regardless of the tonnage consumed. Many executives have the idea that it is necessary to install an elaborate system of elevators and conveyors, and because of this impression many who are in a position to profitably store a limited supply of coal hesitate doing so because of the erroneous belief that a large investment would be entailed. To overcome, in some measure, this false impression, we cite the experience of one company, consuming 4,500 tons of bituminous coal a year, who because of their limited amount of space in which to store their coal kept only a few tons on hand at a time. They found that it was costing them about 35c a ton to unload the pile and reclaim this coal, by the old hand methods of cart and shovel. This they felt to be entirely out of proportion and started an investigation with the idea of installing mechanical equipment that would handle their amount of coal more economically. They eventually installed a portable belt conveyor which is capable of piling the coal about twelve feet high; although in practice they seldom pile over eight feet high.

In actual operation, by using this equipment, the following savings were effected. We are also giving an itemized list of fixed charges per year for the mechanical equipment.

Fixed charges per year:	
Depreciation of 20% (conservative)	$208.20
Interest on investment of $521.00 at 6% ..	31.26
Upkeep, repairs, oil, etc.	50.00
Power (electric) for operation	25.00
	$314.46
Labor charges:	
Two hours per car (assumed 90 cars) @ 50c per hour	90.00
Total cost of storing coal	$404.46

Compare this figure of a little less than 9c per ton with the former cost of 35c per ton; a saving of 26c per ton on a volume of 4,500 tons. Certainly more than enough to justify the purchasing of the portable conveyor.

In larger storage, a locomotive crane can be used to advantage, and will unload cars at the rate of from 50 to 75 cars per hour, depending upon local conditions. Only two men are required for the operation of such cranes, which small labor requirement makes them economical of operation. It is quite impossible, of course, to give definite figures covering the cost of handling coal with a locomotive crane. Too much depends upon conditions—how much coal is to be handled, what tonnage is to be handled in a given time, what tonnage requires rehandling, etc. However, it can be said that in handling a volume of 50,000 tons, with a twenty-ton crane

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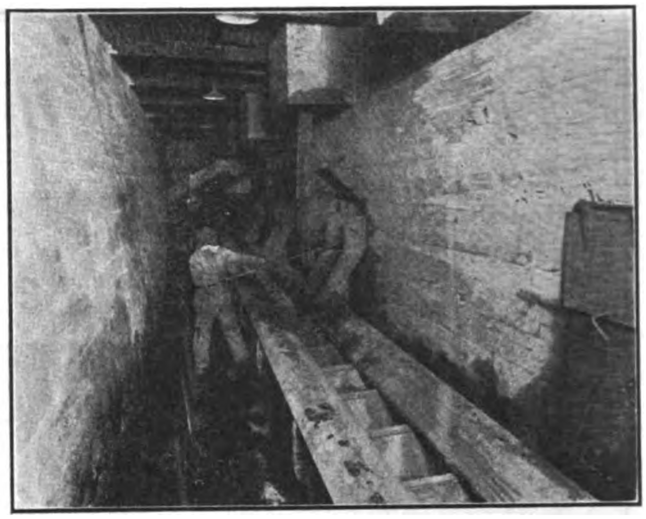


Fig. 20. Method of drawing ashes from pits and feeding them to pivoted bucket elevator conveyor. The same conveyor is used to handle coal.

(*Continued from page* 44)

equipped with a fifty-foot boom and a one-and-a-half yard bucket, the handling cost would be approximately 12c per ton after figuring all fixed and operating charges. It has been found that the same crane, if made to handle a larger tonnage, say 100,000 tons per year, can reduce this cost to 8½c or 9c per ton. Thus we find that tonnage and operating conditions have a lot to do with the cost when figured on a per ton basis.

All power plants, large or small, can profitably use mechanical handling equipment inside the power plant. This will range from the small industrial car on a track, to a more complicated system of continuous bucket elevators, skip hoists, belt conveyors, etc. In every case, the coal must be handled several times before it is consumed;

(*Continued on page* 48)

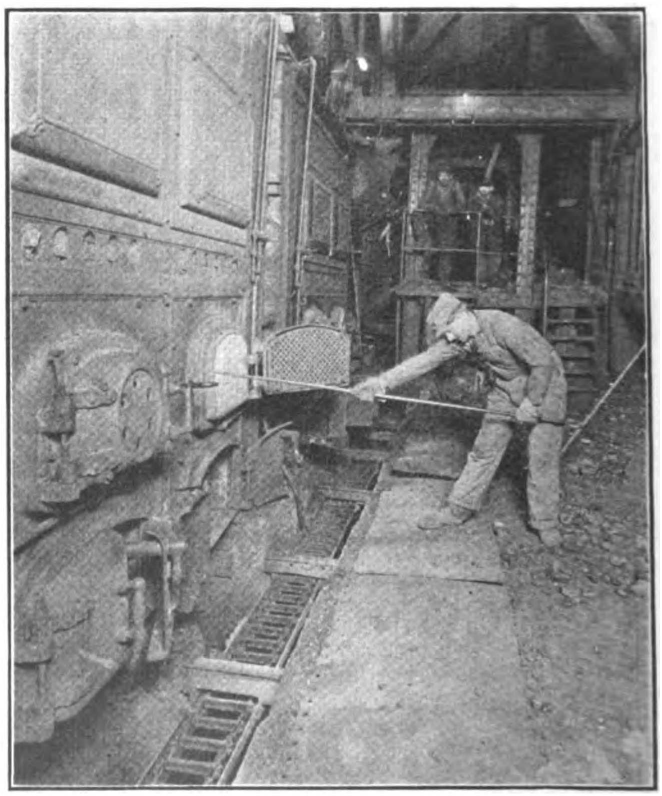
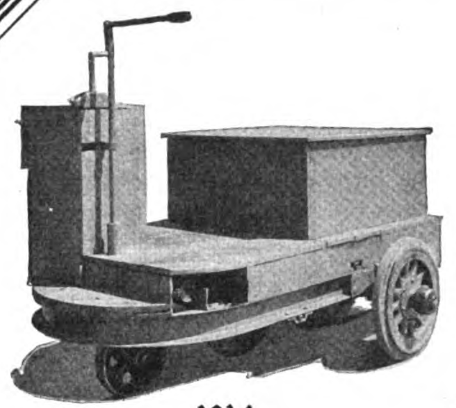


Fig. 21. Drag chain conveyor handling ashes and clinkers directly in front of boilers.



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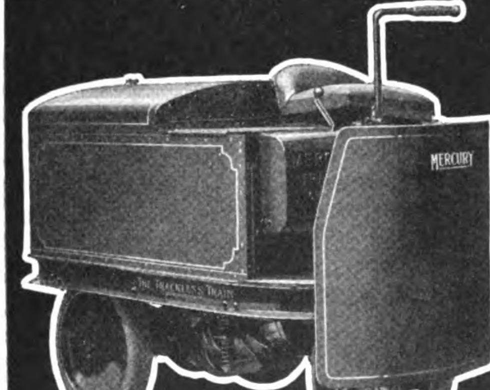

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(*Continued from page 46*)

and eventually the ashes have to be removed. This gives rise to the question: which of the many methods now more or less successfully used is the most economical, and the least likely to cause trouble? It is difficult to answer this question without specific data on conditions, but the illustrations accompanying this article show some of the methods which are now successfully being operated in plants throughout the country. Figs. 6 and 7 show a portable conveyor and a locomotive crane operating under somewhat the same conditions, as previously mentioned. Fig. 2 shows a monorail cable system for storing coal, while Fig. 3 shows a drag scraper arrangement, also operating in the coal pile.

While considerable savings can be made in the one operation of storage, costs can also be reduced in the handling of the coal to the power house, and the handling of ashes from the power house. Fig. 5 shows a system comprising bucket elevator and screw conveyor for handling small quantities of fine coal in a small boiler house. Such equipment, however, should not be used unless the size of the coal is smaller than two inch lumps; for the reason that larger pieces tear the buckets from the chain and become wedged between flights and hangers.

Fig. 22. Electric hoist and monorail trolley used for transporting and lifting ashes in cans.

Fig. 10 shows an overlapping pan conveyor carrying coal direct from the track hopper to the crusher. This type of conveyor adapts itself well to the large lumps and can be placed horizontally or in an inclined position. Generally, the coal, after passing through a crusher, falls

(*Continued on page 50*)

(*Continued from page* 48)

directly into the system, which eventually discharges to the storage bunker above the boilers. In some installations, a pivoted bucket elevator conveyor, as shown in Fig. 13, is employed for this purpose; in others, a bucket elevator discharging to a belt conveyor, equipped with a traveling tripper, as shown in Fig. 14, is used for distributing the coal. As previously stated, much depends on the tonnage being handled, the design of the building, and the preference of the particular engineer in charge of the installation.

Monorail telphers, equipped with grab buckets, have also been installed for the handling of coal and ashes; and occasionally this type of equipment is used to discharge direct to the bunkers, although more frequently it is used over the coal storage pile and for transporting the coal to the crusher.

The feeding of the coal to the stokers, after it has

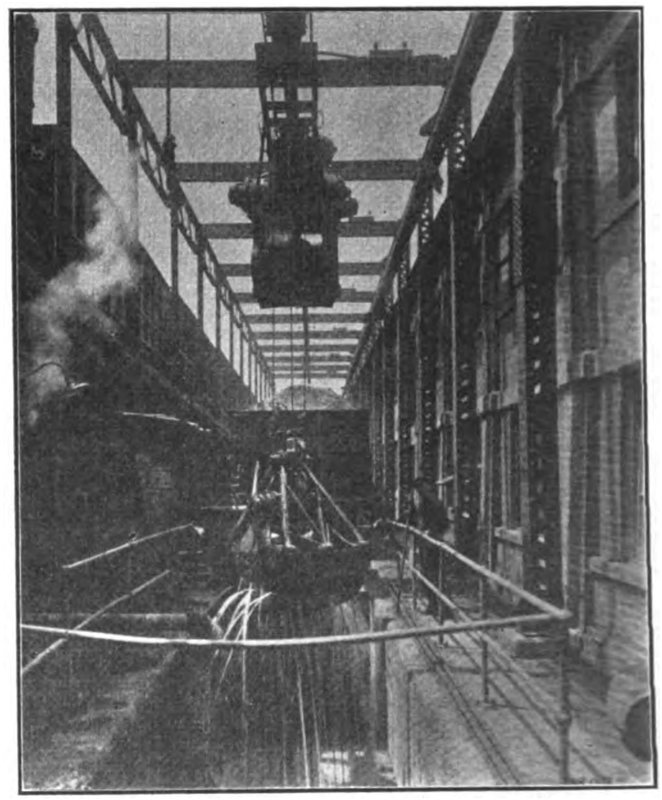

Fig. 23. Monorail telpher equipped with clam shell bucket handling ashes direct from quenching pit.

been deposited in the bunkers, is handled in many different ways: sometimes through automatic scales and individual spouts, which permit an accurate check of the weight; in other installations, one or more weigh larry hoppers, as shown in Fig. 16, are employed; and not infrequently the coal is spouted direct from the bunkers to the stokers.

Skip hoists are extensively used for the raising of coal to a level above the bunkers, as shown in Fig. 4. The skip hoist bucket lowers itself to the pit beneath the crusher where it is filled and upon reaching the higher level discharges to some form of conveyor for distribution over the bunker. This conveyor can either be a belt conveyor, a drag flight conveyor or scraper conveyor, but in each case the discharge from the conveyor must be given serious consideration. Drag scraper conveyors and flight conveyors usually discharge through

(*Continued on page* 52)

When you want a work bench here's how to build it

"Hallowell" steel bench legs are built on the same principle as "Pioneer" steel hangers, one piece from top of foot to end of leg, hydraulically riveted.

BUILT entirely of wood, with wooden legs and braces, your work benches will get wobbly in from eight to twelve months.

Built with "Hollowell" steel bench legs, your work benches will stay rigid indefinitely—"forever", one customer says.

The work bench that isn't rigid isn't a work bench; it's a work spoiler! All-wood benches quickly become rickety and wobbly. They cost more to build in the first place, and more to keep up. They increase the fire hazard. All-wood benches are as obsolete as the horse and buggy; they have no place in the modern plant.

Good plants today build work benches, assembly tables, storage tables, every kind of bench and table, with strong, sturdy, rigid "Hollowell" steel bench legs.

"Hollowell" steel bench legs are punched and assembled when you get them. All you do is to cut the planking and stringers to length and insert the carriage bolts, and you have a strong, rigid, steady bench, which won't need attention for many, many years, even though you give it exceptionally hard rigorous service.

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Don't build any benches or tables until you get our bench leg data. It will save you money.

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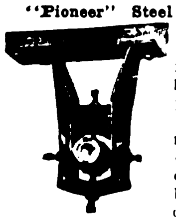
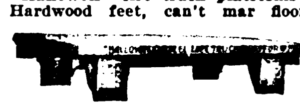


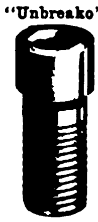
"Pioneer" Steel Hangers — Specify and insist upon the "Pioneer"—the original steel safety hanger. Legs are one piece, reinforced at bend — extremely rigid — weigh less — cost no more. "Pioneer" qualities have been proved by years of actual use.

"Hallowell" Steel collars — Highly polished — look better — are stronger and safer, and cost no more than iron collars. A quality article, sold at quantity prices. Get samples.

"Hallowell" lift truck platforms—Hardwood feet, can't mar floors



—hard to tip over—made any size or style—practically indestructible.



"Unbreako" hollow set and socket head cap screws — will stand any comparison for strength and finish, and cost less than others of equal quality. Samples sent free for testing.

(*Continued from page* 50)

openings in the bottom of the trough, while a belt conveyor requires a tripper, as shown in Fig. 14. Fig. 15 shows a belt conveyor which is not as yet extensively used in this country; namely, a steel belt conveyor. Here a plough is used to distribute the coal where desired, and this is possible for the reason that the belt is level and not troughed.

After coal is burned, the problem of ash disposal presents itself. Figs. 18 and 19 show a steam jet ash conveyor handling ashes in a medium-sized plant. With this conveyor the ashes are carried off through pipes by utilizing steam pressure. Fig. 18 shows the firemen dumping the ashes directly into the pipe opening, while Fig. 19 shows the pipe line over the yard and the ashes discharging to a storage pile, from where they are trucked to the dump. To save rehandling, these conveyors generally discharge to a storage tank from which the ashes can be drawn off when required.

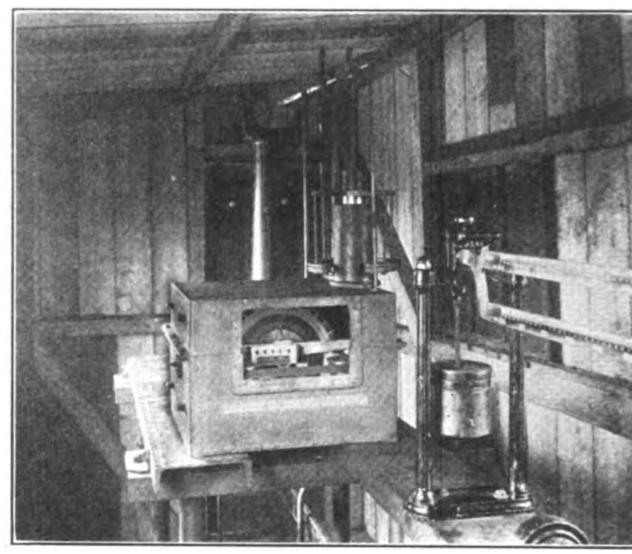


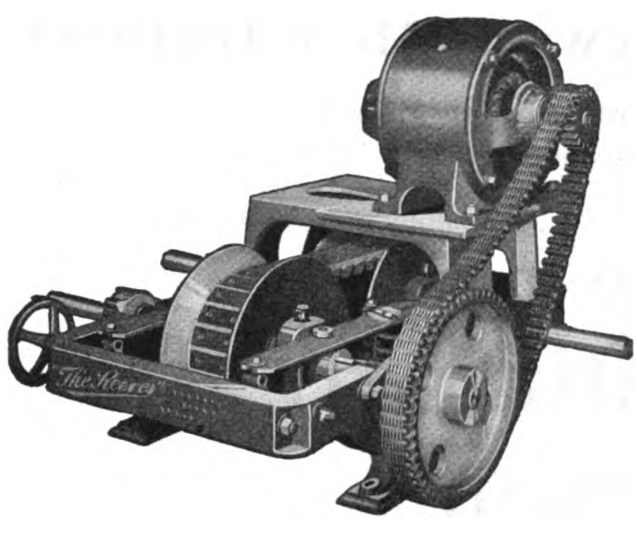
Fig. 24. By connecting a weightometer to an ordinary track scale, industrial cars can be weighed continuously and while in motion; the scale beam being used only for calibrating and checking the automatic device.

Narrow gauge industrial railways are also extensively used for handling ashes; with tracks passing in pits, directly beneath the boilers, from which the ashes can be drawn without the necessity of shoveling. These small industrial railways usually feed to skip hoists, which elevate the ashes and discharge them into storage tanks from which they can be drawn direct to trucks, or wagons, as required.

The handling of ashes presents one of the most difficult problems of handling in any power house, due to their abrasive nature which leads to a high equipment maintenance cost. While frequently the same equipment is used for handling both coal and ashes, the writer feels that if it is possible to justify the additional expense, it is best to have two distinct systems; one for handling coal and one for handling ashes, so as to reduce the possibility of a shut-down of the boilers due to a breakdown in the mechanical equipment.

The handling of ashes can be dealt with by the use of various types of conveyors, the same as the handling of coal. Fig. 20 shows how the pivoted bucket elevator

(*Continued on page* 55)



Another REEVES Achievement— Variable Speed Individual Drive!

REEVES—the world's leading builder of variable speed transmissions—now offers a Variable Speed Individual Drive!

This compact unit has been especially designed for use where individual motors are needed, or where it is necessary to conserve space. It offers the combined efficiency and accuracy of "THE REEVES" Variable Speed Transmission and a constant, high speed motor to those manufacturers who have heretofore used expensive, inefficient variable speed motors and "make-shift" speed control devices.

"THE REEVES" Variable Speed Individual Drive enables the operator to obtain any speed whatever between fastest and slowest on any type of machine or conveyor. No "steps" in speed, but any speed on the curve, even to a fraction of a revolution. Any one speed may be maintained indefinitely, or it may be changed as often as necessary. When the desired speed is once obtained, it remains positive and "set" regardless of the load fluctuation, until changed by the operator.

Undoubtedly there are many places in your plant where such a compact unit will save you time and money. Write today for copy of our bulletin, IM-3050 for details and full information.

"The Reeves"

Variable Speed

INDIVIDUAL DRIVE

consists of a constant, high speed motor mounted above and connected with "THE REEVES" Variable Speed Transmission. The connection may be either by silent chain and sprockets or by gears. Built in sizes to give from 1 to 50 H. P., and ratios of from 2:1 to 16:1. Furnished with handwheel, sprocket and chain, remote electrical, remote mechanical or automatic controls. Complete ball bearing throughout. May also be furnished with the new steel link V-belt on Transmission proper at additional cost.

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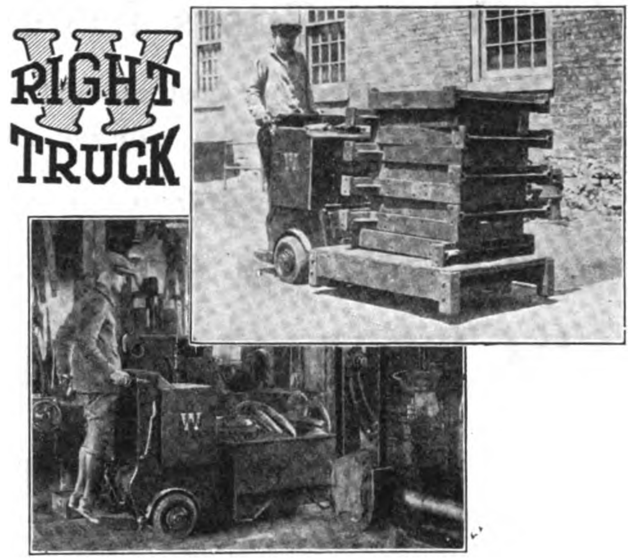

Your Hand Lift or Larger Sized Platforms Fit the Wright Electric Truck

Here is the most compact and accessible truck built. Smaller in size than the ordinary electric lift truck, it can be used with your present hand lift platforms.

And it easily handles the larger size platforms as well.

The Wright Electric Lift Truck is easily manoeuvred around short turns, through any doorway, on small elevators where other trucks cannot be operated, and has an exceedingly short turning radius (5 feet outer wheel). The Wright will go in places that are inaccessible to the average electric truck on the market. Thirteen complete lines of sizes to meet every industrial condition.

Write for booklet.

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Industrial Electric Truck Co., Inc.

Main Office and Factory

Phelps, N. Y., U. S. A.

(*Continued from page 52*)

conveyor which is used to distribute coal over the bunker is also employed for the handling of ashes from the ash pits; elevating them to an overhead bunker from which they can be drawn for disposal. Fig. 21 shows a drag chain conveyor placed directly in front of the boilers, for handling clinkers as they are drawn from the fire box or ashes as they are drawn from the ash pit. Fig. 22 shows how an electric monorail hoist transports ashes in cans from a small boiler house which is so located that trucks cannot drive up adjacent to it. Fig. 23 shows a monorail telpher equipped with a clam shell bucket, handling ashes direct from a quenching pit and loading direct to cars. This same monorail telpher system is also used for the handling of coal in this plant.

The above descriptions give an idea of the many types of mechanical devices that have already been perfected, installed and operated for the handling of coal and ashes. There is no need to worry about being able to get such equipment to fit into any power plant, but great care should be taken to insure successful operation after the equipment has been installed. No definite rules and regulations can be laid down in this connection when treating the subject generally, but each problem, if given serious consideration and placed in the hands of a competent engineering force, can be successfully solved.

Before closing, we wish to refer to mechanisms used in conjunction with belt conveyors for weighing the coal in transit. In a previous paragraph we mentioned automatic scales for checking the weight of the fuel as it was fed to the various stokers. It is also well, in new installations, to consider the checking of the weight of the fuel as it is placed in storage or transported to the bunker, and therefore a device of this character should be provided somewhere in the run of the conveyor. If a belt conveyor is not used, other forms of weighing devices can be employed. A device for continuously and automatically weighing coal in industrial cars is shown in Fig. 24.

The handling operations in the power plant present an immediate and profitable point of attack in reducing power costs, for the reason that these operations involve such a large proportion of the labor cost. While savings can be made in fuel by applying better mechanical methods and automatic devices direct to the boilers, it is also necessary to provide the most economical and reliable devices to insure a continual supply of coal to the boilers, and a proper carrying away of the ashes, so as not to reduce their efficiency.

THE Third National Exposition of Power and Mechanical Engineering will open at 2 P. M. on Monday, December 1, in the Grand Central Palace, New York, N. Y.

The exhibits of steam generating units and prime movers will be of great interest. Several manufacturers of boilers will exhibit models and the exhibits will be amplified with drawings and photographs showing modern boiler installation. Radiant heat superheaters, economizers, etc., will also be shown. Apparatus designed to increase the effectiveness and economy of combustion are numerous and will form a vitally interesting part of the exhibit. Many working models of stokers will be in evidence as well as exhibits of the recent designs of burners for pulverized fuel.

Stopping the Leaks in Power Transmission and Utilization

(*Continued from page* 38)

chanical transmission, the total periodic transmission-and-utilization costs can be determined in the same way as for a wholly-electrical transmission. So much for finding losses by keeping and studying records.

To find transmission and utilization leaks by testing, a graphic wattmeter is very effective. Although this is an electrical instrument, it can—whenever electrical energy is available—be employed effectively for locating leaks in purely mechanical transmissions and equipment as will be described. Every industrial plant of sufficient size to justify the expenditure (about $450.00) should own one of these outfits. Smaller industrial organizations may have the testing done by some consulting engineering firm which maintains one of the instruments. Such an instrument may be purchased which will, when provided with proper shunts and transformers, operate on either direct or alternating current, any voltage, phase or frequency and record any power consumption—large or small—within reason. The graphic chart (Figs. 2 and 3) may be fed at any one of a number of different speeds ranging from ¾ in. per hr. up to 1 ft. per hr.

With it, an exact graphic record which indicates the power consumption, at any time, of almost any given element of the system may be obtained. If an electric circuit is being tested, the instrument is connected into the circuit (Fig. 4). If a motor is being tested (Fig. 5) the device is connected into the motor's circuit. If it is desired to ascertain the power input of a purely mechanical device, such as a length of line shafting or a machine tool, then that device may be temporarily belt driven by a motor and the power input to the motor recorded on the graphic wattmeter. So, with one of these instruments available, it is always possible to know (and not to have to guess) the power requirements of any element in the transmission and utilization system.

To test a machine for power consumption, and thereby determine the proper capacity for the motor which should drive it, the machine may be driven by a temporarily arranged motor (Fig. 6). Different speeds may be accommodated with arrangements similar to those shown in Figs. 7 and 8. Then, while the machine is doing its normal work, the power input to the motor is recorded by the graphic wattmeter, which is connected into the motor circuit. By following this procedure it is possible to select a motor of exactly the proper capacity for the application.

The usual tendency is to select motors too large rather than too small. By thus testing for each application the investment which would otherwise be tied up in useless excess motor capacity is avoided. Furthermore, the efficiencies of all motors and the power factors of alternating-current motors are higher at full loads than at partial loads. It follows that motors logically selected by this test process will operate at maximum efficiency and power factor.

Money may be easily wasted unless such tests are made: In one case, for which there are definite records, a prominent manufacturer recommended a motor capacity for a given press that was five times greater than the capacity which preliminary tests and extended experience

(*Continued on page* 58)

A Shadowless Factory

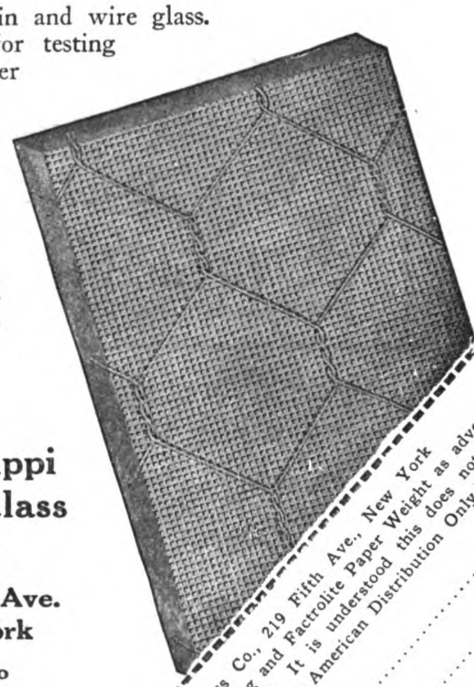
A big Government building 700 x 300 ft. was recently daylighted by over 100,000 sq.ft. of "FACTROLITE." In commenting upon the quality of the daylight *diffusion* in the big structure, engineers remarked—"You cannot see a shadow in any part of the building."

This perfect *diffusion* is a characteristic of "FACTROLITE," which was scientifically determined before we started to manufacture it. Every square inch of "FACTROLITE glass" is covered with 900 minute pyramids, each with a rounded apex and rounded fillets between.

They gather light from a wide angle and deflect it indoors—perfectly diffused. The result is that greater lighting *power* is attained, especially on dull days—and the direct glare of the sun never interferes with work. Freedom from shadows is a third result and an important one, where fine mechanical precision is required.

FACTROLITE

is made in both plain and wire glass. A sample suitable for testing or use as a paper weight will be sent to industrial engineers on request.



This coupon will bring it at once.

Mississippi Wire Glass Co.

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Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way. (For American Distribution Only.)

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Address ....

(*Continued from page* 56)

proved was sufficient for safe and economical operation. In this case the cost of the test to determine the proper capacity for the motor was very much more than justified.

To test a line-shaft and belt-drive transmission for power consumption with the graphic wattmeter (Fig. 9), a motor is arranged to temporarily drive the transmission and its input is recorded by the graphic instrument. The transmission can be driven at its normal operating speed by interposing between it and the motor a counter-shaft arranged similarly to those shown in Figs. 7 and 8. If a line-shaft is being tested, and it is desired to know what power is required to drive the shaft only, without any of the belting, the different belts which are driven from the shaft can be temporarily removed from their pulleys, suspended on wire hangers, so that they will not rub on the shaft and thereby produce friction which would tend to produce misleading conclusions.

Relative power consumption of ball-bearing or roller-bearing hangers as against babbitt-lined bearing hangers may be ascertained with such an arrangement by testing the drive when it is equipped with hanger-bearings of each of the types which are under consideration. When conducting a test of this character, it is usually desirable to first test the line-shaft by itself—that is, with all of the belts, which drive from it, removed. Then, the different belts may be placed on their pulleys successively, until all are in operation. As the belts are being replaced, the power consumption as indicated by the graphic wattmeter will increase; as each belt is placed on its pulley an identifying pencil notation thereof should be written on the graphic wattmeter chart. If this is done, any drive which requires excessive power may be readily identified.

Energy-wasting grounds may be located on electric transmission circuits with a graphic wattmeter (Fig. 10). Grounds on transmission circuits may be sources of considerable loss. Often conditions are such that a ground may continue to permit a current flow, which involves an energy loss, without blowing the fuse which protects the circuit. The resistance of such a ground will be sufficiently high that the current which passes through it will not operate the protecting fuse. But at the same time the ground will produce a "leak" which may be very expensive. It is understood that really two grounds on a circuit, each on a conductor of opposite polarity, are necessary to permit such leakage currents to flow. But in practically all installations there will be one "permanent ground." Hence only one additional accidental ground will provide a leakage path. The permanent ground is, under certain conditions, required by *The National Electrical Code*.

In one case, which was corrected by the employment of a graphic wattmeter, a ground existed in an industrial plant which was costing the concern, in wasted energy, almost $1,000 a year. This ground had probably been in existence for many months prior to its discovery.

To locate energy-wasting grounds on circuits, the graphic wattmeter can be connected into the principal circuit which serves the building or portion of the industrial plant in question. It is there permitted to remain, if feasible, for a 24-hour period, all of the legitimate energy-producing devices being disconnected from the circuit in the meantime. If under these conditions

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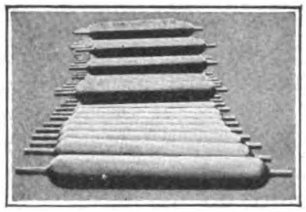

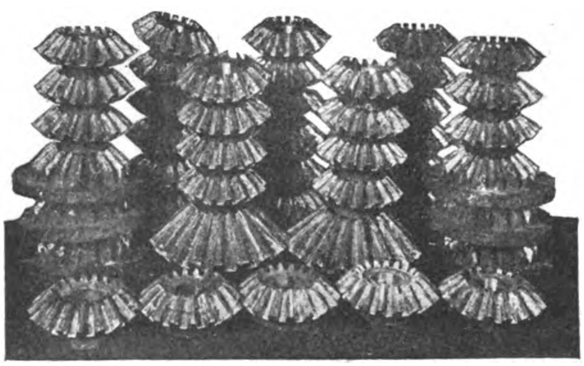

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the wattmeter records the flow of energy it is evident that a ground or some other unauthorized consumer of energy is feeding from the circuit.

Furthermore, it is often desirable, merely on general principles, to connect a graphic wattmeter temporarily into each principal transmission circuit in a plant. It should be permitted to remain so connected for a period sufficiently long that the graphic chart obtained will indicate the normal characteristics of the load which the circuit serves. Often the charts thus obtained will disclose waste of energy due to motors being permitted to run during the noon hour or at night or the useless burning of electric lamps.

To locate leaks by comparative calculation, the investigator estimates by computation the annual cost of some given transmission or utilization element. Then a similar estimate of annual cost is made for some equivalent arrangement, which will do the same work and which appears to promise a saving. In other words, two methods of attaining the same result are compared on an annual-cost basis. This procedure is likely to lead to undependable results unless it is based on trustworthy data—which data, in any event, must be ascertained by actual tests or taken from records of past performance. Hence, this method of finding leaks by comparative calculation is, in reality, a combination of the other two: *by testing* and *by records*. Conversely, it is often necessary to make tests and to keep records to obtain the data which will enable one to make the comparative calculations to determine the comparative annual costs.

Just a word as to annual costs: There is only one fair method of evaluating the respective desirabilities of two methods of accomplishing a given thing. This consists of reducing each proposition to a dollar-and-cents basis and then comparing the two costs. But often factors which cannot be readily evaluated in money must be considered in comparing such propositions. Where such factors are elements, then common sense—reasoning—must decide. But in most cases two equivalent propositions can be reduced to a dollar-and-cents basis by ascertaining the annual charge for each,—that is, by determining what the *cost per year* is for each of the methods. Then, other things being equal, the method which shows the least annual charge will be the most economical and should be selected.

In determining annual charges, the following components should be evaluated, each for a year. Their sum will be the annual cost.

(1) Interest on investment.
(2) Maintenance cost.
(3) Taxes.
(4) Insurance.
(5) Depreciation.
(6) Cost of energy used.
(7) Cost of shut-downs.
(8) Miscellaneous costs, if any.

An example of the annual cost method of comparing propositions is given below, wherein the most economical size of conductor for a given circuit is determined.

One "leak," which occurs often in plants which are not under expert supervision, is that due to selecting electrical conductors of too small a size to economically convey the currents which they must carry. Average wiremen and contractors will ordinarily install con-

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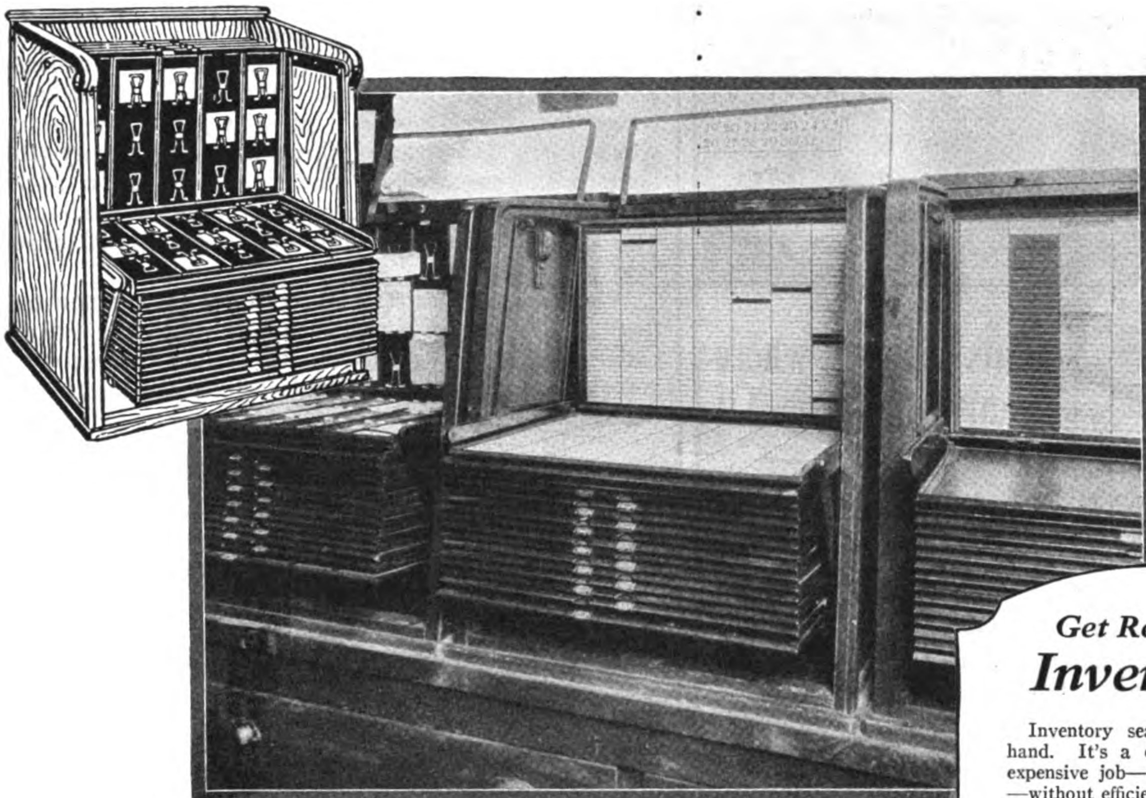


Get Ready for Inventory

Inventory season is close at hand. It's a disagreeable and expensive job—inventory taking—without efficient stock records. But the plants who are McCaskey equipped, keep a perpetual day-to-day inventory, and with less help than the ordinary system requires. Taking inventory will be a simple job to them, and they won't have to shut down their plants, lay off part of their help, or spend days of tedious cost figuring.

Save money on your inventory by installing a McCaskey System.

We will gladly send you our catalog upon request.

Write for it today

McCaskey Stopped Losses in Stock Records

HERE is another example of how a McCaskey System solved the troublesome task of keeping accurate stock records. Fritzshe Brothers, Inc., New York City, found an ordinary card system inaccurate and confusing. Finally they installed the McCaskey System. Mr. F. H. Leonhardt, Vice-President, tells how it saved them time, money and trouble.

"Our old method of keeping stock records was by means of a small card system, posted from requisition slips which people were supposed to fill out. Our stock comprises approximately 600 items of essential oils, varying in value from a few dollars up to as high as $50 an ounce. So when requisitions were not made out, as often happened, the value of the stock lost track of might be considerable.

"We had no dependable system for re-ordering, either. When the stock on a floor fell to a certain amount a re-order was made; but as our card system showed only present stock on hand, we could not tell what that really was without running around to several different departments to find out how much had been ordered by them or sold for future delivery.

"A Perfect Stock Record"

"About 18 months ago we installed a McCaskey System—two cabinets and a clerk—and now have a perfect stock record. Every purchase order is entered by the McCaskey clerk on the purchase order card and brought forward onto the top requisition slip as 'amount to arrive.' When received, the clerk deducts the amount from 'amount to arrive' and adds it to present stock. Orders sold for future delivery are entered on an 'account of contract' slip. Shipments are treated as requisitions and deducted from stock on hand. Minimum figures on the top of the present stock card automatically indicate when to re-order.

"Makes the Business Run More Smoothly"

"The McCaskey System gives us a perpetual inventory of both our own products and purchased stock, saves both time and confusion, and makes the business run more smoothly. Stopping the disappearance of oils through lack of records saves us considerable money, though we never knew just what these losses were."

Make Such Savings in Your Plant

There is a McCaskey System operating in almost every line of business. They are saving each plant hundreds of dollars. Scores of testimonials are in our files to prove this.

There is no doubt but what a McCaskey System would make big savings in your plant. We will be glad to show you how this system works. There is no obligation. Write us.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division ***Alliance—Ohio***

CANADIAN PLANT ***GALT, ONTARIO***

(*Continued from page* 60)

ductors of the minimum size permitted by the *National Electrical Code.* Often such conductors are, considered economically, far too small. This holds particularly where the energy cost is high and for transmissions which carry heavy loads throughout the twenty-four hours. In one instance recently considered a slight increase in the size of the copper conductor used—and consequently investment—saved the owner $1,000.00 per year in energy cost.

Whenever an electric current flows in a conductor, there is always a loss in that conductor which loss is dissipated as heat. This loss can be readily computed by applying the following formula which applies to any one conductor:

$$P = \frac{11 \text{ x } I^2 \text{ x } L}{\text{cir. mils.}} = \text{Watts loss}$$

In this formula: P = the power loss in conductor, in watts. I = the current in the conductor, in amperes. L = the length of the conductor, in feet. *Cir. mils.* = the cross sectional area of the conductor, in cir. mils. By multiplying the watts value thus obtained by the time, in hours, during which the current flows, the energy loss in watt hours results.

For example:

If energy costs 8c per kw. hr. what will be the annual cost of the energy loss in a 500,000 cir. mil. conductor 1,000 ft. long (Fig. 1A), which carries 500 amperes, 8 hr. a day, and 25 days per month? Substituting the above formula:

$$P = \frac{11 \text{ x } 500 \text{ x } 500 \text{ x } 1000}{500{,}000} = 5{,}500 \text{ watts.}$$

Hence, the power loss is 5.5 kilowatts. For 8 hr. a day, 25 days a month at 8c a kw., this would amount to

$$5.5 \text{ x } 25 \text{ x } 8 \text{ x } 0.08 \text{ x } 12 = \$1{,}056.00 \text{ per year.}$$

By using a conductor of a larger size the loss is decreased (Fig. 11), but the cost of the conductor—investment—is increased. For each given current density (amperes per square inch of conductor cross-section) and unit energy cost, there is a certain installed-conductor size which will provide maximum economy. Although there are formulas whereby the "most economical conductor" for any given set of conditions may be computed, their application is likely to confuse one unless he is using them continually. Apparently, the most practical method of determining the economical conductor for any given application is to estimate the annual cost—fixed charges plus the cost of energy—for the conditions under consideration for a number of different conductor sizes, until that size which gives the least annual cost has been found. These data can conveniently be tabulated as indicated below.

Table Showing Method of Determining the Most Economical Conductor Size.

The table shows the energy cost and the annual fixed charges of an arbitrarily chosen length of conductor, for a number of different sizes of wire. The cost of the energy lost is computed by applying the "watts-loss" formula which is given above.

Size rubber-covered conductor	No. 4 wire	250.000 cm.	300.000 cm.	400.000 cm.	500.000 cm.	600.000 cm.
Cost of 400 ft. of conductor installed complete	$22.50	$102.40	$118.40	$150.40	$184.00	$218.20
A -- Annual fixed charges on above cost at 10 per cent.	$2.25	$10.24	$11.84	$15.04	$18.40	$21.82

(*Continued on page* 64)

MAKING THE MOTOR DO INDUSTRY'S BIDDING

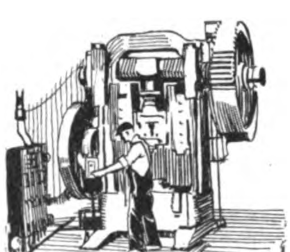
Cutler-Hammer Engineers Have Spent 30 Years Developing Control For Electric Motor Drives

INDUSTRIAL progress in America links up closely with the increased application of electric motor drive,—and the increased use of motors in their many and various ways is linked up closely with the development of control apparatus for the proper starting, speed regulation, control, and protection of motors.

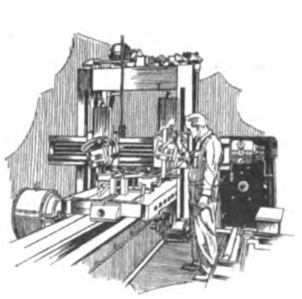
In the early days the introduction of motor drives encountered many difficulties. Because the first "Starting Boxes" were without the No-voltage Release feature, a failure of power supply (not infrequent in those days) meant that attendants had to scurry around to throw the rheostat handles back to the "off" position.

Failing in this the return of current meant enormous inrush of current to motor windings, fuse troubles, motor burnouts, and damages resulting from sudden, unexpected starting of motors.

The Blades No-Voltage Release patent owned by The Cutler-Hammer Mfg. Co., marked the first step in the progress of electric motor applications. Governing the action of the motor and protecting against all kinds of troubles were necessary before the brute force of electricity as developed by the motor was able to do the work that the factory owner and machine builder wanted done.



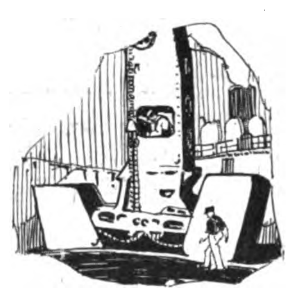
The great development of motor controller apparatus a big part of which has been done by The Cutler-Hammer Mfg. Co. during the last 30 years has made it possible to apply electric power to industry after industry, to all kinds of machines, to all sorts of operations. As a matter of fact, it is this control that has made it possible to accomplish many things automatically or with a minimum of attention, that never could have been accomplished efficiently at all.



The motorizing of industry has made possible the advance in production methods, the enormous outputs of our publishing plants, the electrification of the steel mill, the very existence and use of our skyscrapers, the manufacture of the millions of pneumatic tires, and the millions of other products needed in such vast quantities.

In the steel mill, operators in pulpits with C-H Master Controllers and push buttons at hand govern movements of the motor-driven machinery and materials as easily as if the building were a miniature one and the operator's arms long enough to reach out to all parts.

Before reaching the mills, the ore is handled under the guidance of Cutler-Hammer Control. Hidden away in the leg of the giant ore unloader is the electric brain which surely and positively controls the movements of this 45-ton unloader leg.



A throw of a lever by the operator brings into play the magnetic switches of the C-H Control Panel which safely make and break the large currents. Cautiously, they speed it up, the huge buckets open wide, then the leg is smoothly stopped as the jaws close on a 17-ton bite of ore carried in the hold of the vessel.

Every action—and the safety of the men and machinery depends upon the certainty of this electrical control.

Think of the printing of enough papers, both sides, in one hour that would cover two or three complete city blocks. The threading in, speeding up, slowing down, the protection to pressmen, are all a result of the C-H organization, whose products are found in most newspaper plants of this country.

In the factory, the conveyors, the machine tools and all miscellaneous motor drives function under the control of Cutler-Hammer controllers.

The Cutler-Hammer Mfg. Co.

Works: Milwaukee and New York

Branch Offices:

New York	Buffalo	Cleveland
Cincinnati	Chicago	Detroit
Pittsburgh	Boston	St. Louis
Wilkes-Barre	Philadelphia	New Haven

Northern Electric Co., Ltd., Canada

CUTLER-HAMMER

(*Continued from page* 62)

B—Cost of energy lost in conductor at 8 cents per kw-hr..	$66.00	$10.56	$8.84	$6.60	$5.28	$4.49
C—Total annual cost of conductor	$68.25	$20.80	$20.68	$21.64	$23.68	$26.35

For the conditions for which the above tabulation was prepared, a 400,000 c.m. conductor is the one which provides the least annual cost and hence maximum economy.

After leaks in power transmission and utilization systems have been found, possibly by one of the methods which have been sketchily analyzed in the preceding, the next logical step is to "stop" them. But it is understood that the word "stop" is here used figuratively, because in power transmission there is actually no such thing as stopping losses. All that can be done is to reduce them to an economic minimum. And it is well also to here jointly consider the preventing of these leaks because the prevention and the "stopping" are almost synonymous. That is, it is well to consider the method of initial installation, which will, from the start off, insure that the power will be transmitted with the smallest feasible losses.

So, inasmuch as his article is concerned only with the principal methods of industrial-plant power transmission—the mechanical and the electrical—what follows will be devoted to a comparative analysis of these two methods.

Where a considerable amount of power is to be transmitted, say 300 hp. or over, to many different machines whereby it is utilized, usually the electrical method is the more economical. This is particularly true if the transmission distance is great. But where the amount of transmitted power is relatively small, say 200 hp. or less, and the transmission distance is small then the mechanical method—line shafts and belting—is, if all elements are considered, very often the more economical. Thus it is almost always good economic practice for average industrial plant conditions, to transmit power electrically, from the power generating or receiving point, to departments which demand 300 hp. or more, and which contain many power utilizing machines. Similarly where 200 hp. or less is to be transmitted to many utilizers within a department or building it is quite possible that mechanical method may prove in. Often it does. Each case should be considered on its merits—analyzed on an annual-charge basis—but, in general, the preceding statements are true.

This brings up face to face with the hoary controversy: *group motor drive* vs. *individual motor drive*. Really there should be no argument at all between them because each has fields of application—into which the economics of the situation automatically force it. That there has been much argument has been because each school has had supporters who, without justification, cherished and made a fetish of their ways of thinking. Tests, records and an examination based on comparative annual charges will disclose the facts.

It is often assumed that line-shaft transmission is very wasteful. Such is not necessarily true. A well and ruggedly designed and an accurately-aligned line shaft transmission is a fairly efficient transmitter of power. Such a transmission may fairly be expected to have a full-load efficiency of somewhere around 85 per cent. An average electrical transmission, assuming a transmission circuit efficiency of 95 per cent. and a motor efficiency of 90 per cent.—which are fair average values—

(*Continued on page* 66)

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(*Continued on page 66*)

(*Continued from page* 64)

will have an overall efficiency of: 95 x 90 = 85.5 per cent. So often, on an efficiency basis, the two methods stand not far apart. And, furthermore, it often develops —this is a repetition—that the line-shaft method will show the least total annual charge. Line-shaft friction difficulties usually are due rather to the erroneous employment of shafts too light for their work, inaccurate alignment and relatively fragile hangers, bearings, belts and accessories rather than to inherent faults of the line-shaft method.

As to the employment of ball and roller bearings in line-shaft hangers: There are certain applications—particularly the high-speed ones and those for which oil lubrication is undesirable—for which ball and roller bearings are eminently fitted and for which they will prove in. But for the average industrial plant line shaft generously designed, babbitt-lined bearings continue to be very satisfactory. Field tests often fail to show the considerable friction-loss decreases which might reasonably be expected due to the substitution of ball or roller bearings for babbitt bearings. In fact, in ordinary transmissions, where the line shaft serves many counter shafts, tests will ordinarily show that most of the friction (possibly 85 per cent.) occurs in the counter-shafts and their belting. Only a relatively small part (about 15 per cent|) is due to friction which is directly chargeable to the line shaft. Hence, it is evident that it is not logical to confine friction minimization efforts to the line shafts alone.

Now to compare group motor drive against individual motor drive. As was intimated in an opening paragraph, it is certainly a fact that individual motor drive has been employed in many applications for which group drive would, on an annual-charge basis, have been the more economical. The reverse is also true but not to so great an extent. In what follows, attention will be directed to the logical applications of drives of each of these types.

Tests combined with economic analyses show that individual motor drive is usually the most economical in cases:—

(1) Where the machine must operate at such a high speed as to render belt-driving undesirable.

(2) Where a single isolated unit, which is located at a considerable distance from a line shaft, must be driven.

(3) Where group drive would interfere with crane operation.

(4) Where the load on the machine exceeds, say 30 hp., and is always practically the same.

(5) Where the driven machine must be portable.

For most other applications, group drive is ordinarily the logical solution; some of the reasons for this will now be given.

First of all, it should be understood that even with individual motor drive it is not by any means always economical to eliminate belting. Experience has shown that for individually driven machine tools and similar machines—machines which may be subjected to load variation—it is desirable to interpose a belt between the driving motor and its load. Machine-tool builders recognize and recommend this practice. Where the belt (rather than gears or chain drive) is thus interposed it acts as "cushioning safety valve." When a sudden ex-

(*Continued on page* 68)

(*Continued from page 66*)

cessive overload is accidentally—or intentionally—thrown on the machine, the belt thus interposed will slip off. This will protect against a motor burn-out.

And really there is no objection to belting for transmitting power under the conditions for which it is suited. If the belt sizes are selected amply large, the belt speeds are maintained at somewhere around 4,000 ft. per min. and the drives are properly designed, belt transmissions are very economical and reliable.

Investment is ordinarily, much less with group than with individual drive. Total installed motor hp. capacity will be from three to five times as great for individual drive as for equivalent group drive. This is partially because each individual drive motor must be sufficiently large to pull the maximum load which will be imposed on its machine, whereas the group drive motor does not have to have excess overload capacity. With a group drive motor, individual machine load excesses will average out within the group. Also individual motors must, ordinarily, operate at a lower speed than group drive motors. And, furthermore, the total installation cost per horsepower is about three times as great for individual as for group drive. Hence, the total motor and wiring cost will be about 9 to 15 times as great for individual drive as for group drive; that is possibly $22.00 per hp. for group drive as against $198.00 to $330.00 per hp. for individual drive.

Group drive motors operate at more nearly full load than do the individual drive motors. This means that the operating efficiency and the power factor (for alternating-current installations) will be higher for the group than for the individual drive. These elements are reflected in the respective investment costs.

In the above concerning investment, the cost of additional generating equipment investment was not considered. But in alternating-current installations—and nowadays most installations are designed to principally employ alternating current for a number of good reasons—additional generating equipment will be required for individual drive, because of the lower power factor of the individually driven outfit. For a good group drive layout, the power factor may be 80 per cent., while for an equivalent individual drive arrangement, it may be 50 per cent. The relative generating and power-factor corrective equipment investments will, roughly, be in the ratio of 80 to 50.

If energy is purchased from a public-service company, the purchaser will, probably, be penalized in his rate contract for low power factor. This low power factor will, ordinarily, cost the owner money whether he generates his energy or purchases it. This matter of correcting power factor will receive further consideration later. Another important feature is that, with group drive, the number of different motor capacities and speeds which are required in a plant can be maintained at a minimum. This is of vital importance because it affects investment (as reflected in spare motors and spare parts) and also maintenance cost. The belted group drive motors provide flexibility as to speed—the belt drive can be arranged to give the required speed. And also it is a fact that the maintenance cost per horsepower is considerably greater for individual drive motors than for the group drive ones.

However, there are applications—even in otherwise group driven departments—for which individually driven machines may prove in, due to speed or production requirements. If they do prove in, they should be employed.

Now as to correcting low power factor: The fact that low power factor does not require the burning of an appreciably greater amount of coal is generally understood. But low power factor does cause a larger current to flow in the conductors and electrical generating apparatus than would otherwise be necessary. This requires that larger conductors and larger, and hence more expensive, apparatus be used where the power factor is low than where it is high. Hence, low power factor necessitates additional investment.

Low power factor can be largely corrected by installing synchronous motors, if suitable drives for them are available. But often it is more economical to install, at the outset, the electrical generating equipment and conductors of sufficient capacity to handle the low-power-factor excess currents than it is to endeavor to correct it with synchronous motors or synchronous condensers.

A recent development is the unity-power factor alternating-current motor. This machine will drive its load, operating at 100 per cent. power factor and also furnish some corrective effect. These motors cost more than the ordinary alternating-current machines. Motors of this type may prove in in plants where electrical energy is purchased under a contract which stipulates a penalty for low power factor and in plants where the electrical generating equipment is overloaded due to low power factor.

RECENT figures of the Department of Commerce indicate that productive activities in nearly all lines are steadily increasing, and this carries with it the employment of more workers.

In 587 representative plants in New Jersey, Pennsylvania, and Delaware, the number of workers employed increased 2.8 per cent. between August 15 and September 15. Textile workers and coal miners showed special gains in August and September.

Increasing employment is naturally reflected in greater purchasing capacity. The figures of the Department of Commerce for practically the entire country gave the percentage of wholesale trade in July to August, relative to 1919, as 78 to 83, and of retail trade as 69 to 74 for the same months. A like rate of progress has been noted by the Department of Labor in a general survey in September.

Official figures on sales of mail-order houses and chain stores show substantial gains, as follows:

DISTRIBUTION MOVEMENT	AUGUST 1924	SEPT. 1924	SEPT. 1923
Mail-order houses:			
Total sales....thous. of dolls..	23,809	31,448	26,052
Sears, Roebuck & Co....do......	13,476	17,905	16,103
Montgomery Ward & Co....do......	10,333	13,543	9,949
F. W. Woolworth & Co....do......	16,927	16,526	14,775
McCrory Stores Corporation....do......	2,060	1,903	1,668
S. H. Kress & Co....do......	3,000	3,123	2,431
Number of stores operated..........	158	158	149
J. C. Penney Co....thous. of dolls..	5,276	6,863	6,010
Number of stores..........	544	560	460

LaSalle Extension University

Safety and the Maintenance Department

By William G. Ziegler

SAFETY in its broad sense as applied to industrial plants covers the whole matter of equipment necessary to make the plant safe and also covers the men directly engaged in safety work. Managers have had impressed upon them the importance of safety work and accident prevention by the compensation laws adopted by many states. Even if we disregard the humane side of accident prevention, the fact is that accidents are expensive, and if we consider both of these facts, the wise manager will give this subject careful attention. The modern method is to guard all dangerous machinery and equipment, to prevent accidents. The arrangement of buildings in the plant yard has an important influence on the general safety. If extensions or new buildings are being built, the question of safety should be borne in mind so that danger from explosion or fire will be minimized.

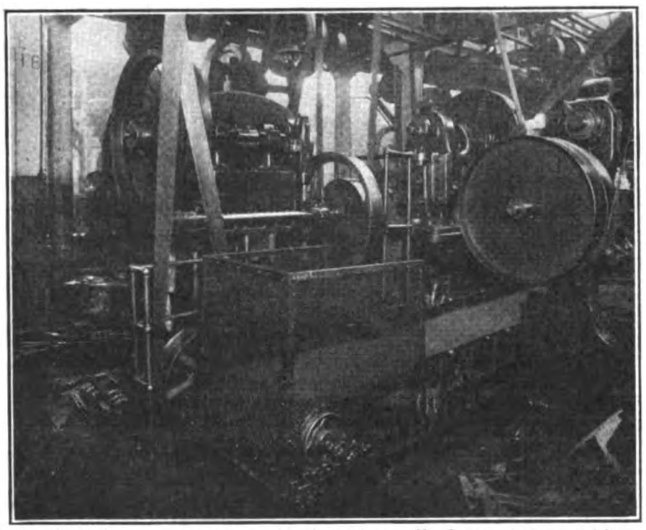


Fig. 1. When state laws require that all dangerous machinery **be guarded, it is best to do the job properly, as inspectors in most states are empowered to shut down improperly guarded machines.**

When all possible mechanical safeguards have been installed there will still be accidents which cannot be prevented by this means. However, with the proper kind of safety education, the men will gradually take more care to avoid accidents to themselves and to their fellow-men. It has been pretty thoroughly established that more than half of our accidents are preventable. This prevention is made up of two things, the mechanical safeguarding, and the safety education which should be carried on. The economic waste in men and money is gradually being recognized and employers are becoming more interested in safety work.

One of the most important factors in the prevention of accidents is good housekeeping or orderliness in the plant and yards. A great many accidents are falls over obstructions on the floor or ground. Slippery floors, holes in the floor, projecting nails or loose pieces of wood and metal all cause accidents in numbers larger than most of us realize. Passageways and aisles should be kept absolutely clear of obstructions. In many plants it has been found advisable and necessary to paint dead lines on the floor to mark the limits of the aisles. The men soon learn to walk in the clear aisles rather than go through narrow passages between machines where there are likely to be piles of stock or parts that they might trip over. Floor space should be used economically, especially when it is high priced as in most cities. However, crowding too many machines into a space is dangerous, both on account of one operator causing an injury to another, and also because truckers, in delivering and taking away parts that must necessarily be piled near the machines, are likely to pile them where they are in the way of other men. With narrow trucking aisles the truckers must push one truck out of the way to let another pass; this delays them and trucks are likely to collide, causing damage or injuries.

Most accidents can be prevented. There are many that will happen after every possible precaution has been taken but the number will be much smaller if safety education is carried on patiently year after year. Safety education must start with the management who must impress their convictions on the foremen so that they may gradually train the men in using care on dangerous operations. Safety committees formed among the men themselves are very effective, because the men will gradually bcome interested in looking out for their own safety and their fellow-workers as well. Safety bulletins showing safe methods of doing work are excellent aids in safety education. These bulletins should be posted on the bulletin boards. Safety talks are very good, especially if they are illustrated by pictures or movies. The foremen are the key to safety education, for they are the ones who train the new men the safe way of doing

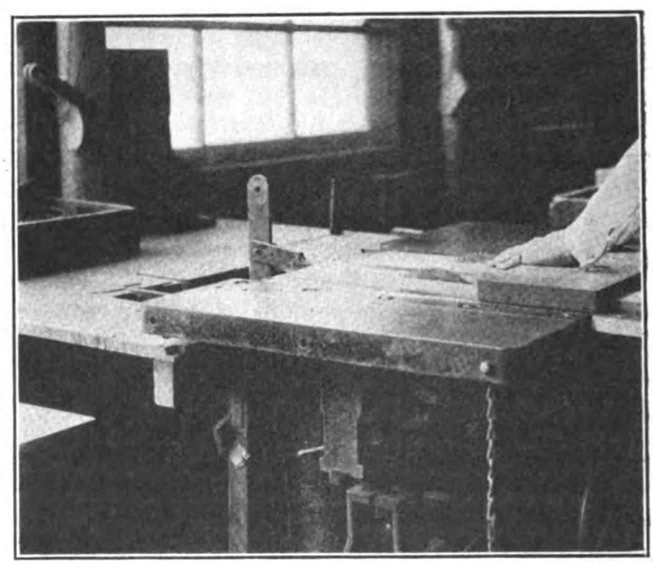


Fig. 2. "Monkeying with a buzz-saw" can—and should—be made impossible by safety guards.

things, and their attitude on the safety of the men in their charge is an important factor. A safety organization that functions correctly is a paying proposition because it reduces the compensation insurance rate.

The correct guarding of belts, pulleys and gears is one of the most important safety jobs in most plants. Many machines are now furnished by the manufacturer with all gears guarded to standard. However, it is not possible for the machine builder to furnish guards for the driving belt as he does not know where the machine will be installed. If guards are placed within four inches of the belts, they must be of solid material or of wire netting, or expanded metal of one-half inch mesh or smaller so that no one can get their fingers through the mesh. Guards should be at least six feet high and be securely fastened in place. If loose pieces are necessary to get at parts of the machine, it is best to hinge them so that they cannot be removed. Many men regard guards as being a nuisance and in the way rather than a safeguard for them. Dangerous points of operation on machines should always be guarded. There should also be guards on chain drives, sprockets, clutches and shafting, and safety hoods over grinding and polishing wheels. Set screws in revolving shafts should be headless.

When state laws require that all dangerous machinery be guarded, it is best to do the jobs right, because three different inspectors have to pass on each guard. The state factory inspector orders guards to be put on any machines that he considers dangerous and in most states he has power to tag and shut down any machine not guarded in a reasonable length of time. The insurance inspector is really a consulting safety engineer who may make recommendations to make the plant a better risk for his company. The rating inspector follows a set of rules approved by the state insurance department, allows credits when safety work has been completed and makes charges when standard requirements have not been met. This survey is the basis for the rate paid to the insurance company.

Elevator cables and safety devices should be carefully inspected to see that they are in good condition at all times. After six strands of a nineteen strand cable are broken it is unfit for further service and should be replaced. The safety devices are rarely needed but they should be kept in working order for an emergency. If freight elevators are not closed in with solid doors that cannot be opened from the outside, it is best to have safety catches on the starting cable so that it may be locked while loading or unloading. In order to prevent men from being injured by the moving elevator or falling into the shaftway, it is best to have solid doors that can be opened only from the inside at each entrance. Cars should be well lighted to avoid tripping. Cranes should be given the same rigid inspections as are given to elevators, and special attention should be paid to cables, drums and brakes. All electric switches should be locked open when the crane operator leaves the cab so that the crane cannot be started accidentally.

The best way to reduce eye injuries is to insist on the use of goggles for chipping and grinding or for any other job where the men's eyes are subject to injury. During the past few years the designs of goggles have been very much improved and several types of excellent goggles are now available. Glass lenses may be laminated or plain heavy glass according to the job. Colored lenses are also available for welding and furnace work. If goggles are made so that they are comfortable, most men will be satisfied to use them if the safety of their eyes is properly explained to them.

Many accidents are the result of slipping on stairs either because the treads are worn or because the persons did not use the handrail. Handrails should be complete, that is, there should not be gaps in them, and for wide stairs, a center handrail is a good thing. Stair treads should be of a material that will not wear smooth or slippery. Several kinds of safety treads are available that make use of an abrasive material that does not wear slippery. Stairways should be well lighted during working hours so that in case of emergency they will be safe. Elevated platforms should be provided with railings about three and a half feet high. Toe-boards about six inches high are also necessary to prevent the feet from slipping under the railing.

Clean floors tend to make the plant safe. Oily floors are slippery and dangerous for men working near high speed machines. In many plants special non-slip floors are installed near such high speed machines in order to avoid accidents. Floors should be free from splinters, protruding nails, loose boards or holes, and each foreman should report any of these items at once. Steel grating is used for flooring in many places as it is not slippery even with oil on it. It is largely used in engine rooms and for overhead platforms.

Fig. 3. By far the largest proportion of industrial accidents are due to slipping, especially on stairways

All electric wiring, switches, controllers and other equipment should be installed with all live parts enclosed so that even a careless workman cannot get hurt. Switchboards should be enclosed with wire netting guards when located out in the plant unless totally enclosed switches or breakers are used. These latter types are safe and need not be guarded. Wiring should preferably be installed in conduit and all live parts enclosed in steel boxes. This is especially important on power wiring as it is usually carrying 220 or 440 volts.

Trained men are valuable assets to any plant and it is therefore good business to take care of their safety. The managers of a great many plants recognize that the protection and safety of the men has not been given its share of their efforts as most of the stress has been laid on the efficiency of the machines. It is for this reason that safety work will pay dividends by conserving the health of the trained men, so that production will not be slowed down, due to idle machines on which men should be working but who received injuries that keep them away.

How to Reduce the Power Poll-Tax

TAX reduction is of vital interest to every business man and industrial executive.

Tax reduction is considered as necessary to the stimulation of business and the stabilization of profits.

Suppose, Mr. Manufacturer, that a government agent should come to you and say, "From now on I am going to call at your office once a year and collect a poll-tax which you must pay and which will amount to $136 for every man in your employ."

Would you enter a protest?

We'll say that you would!

You would arise and tell the world in no uncertain terms that *your* business and *all* business would go to the demnition bow-wows, unless this unproductive, unjust and unnecessary tax imposition was immediately repealed.

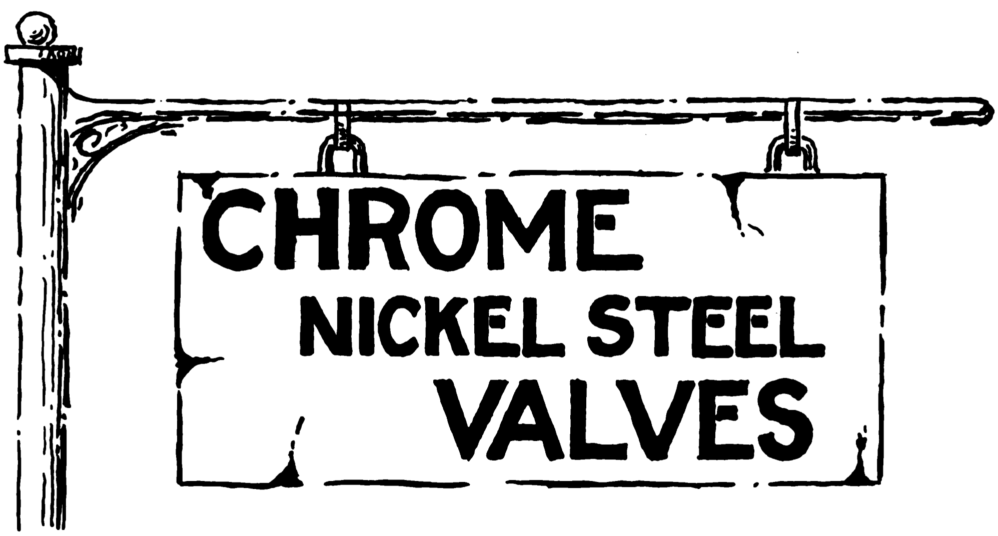
Wasteful methods and inefficient equipment in American industrial power plants exact this average poll-tax from American industry.

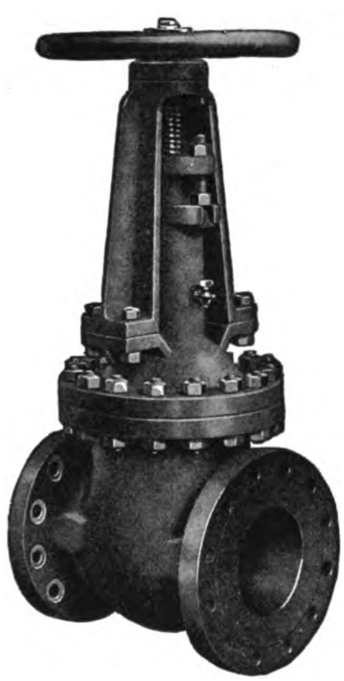
Your tax per capita may be greater than this or it may be less, but if yours is an average concern you are paying an unnecessary power poll-tax per annum per employee of $136.*

The purpose of the pages which follow in this section is to show you the ways and means whereby you can abolish this unnecessary and profit-eating poll-tax.

*We will be glad to furnish to any one requesting it, data concerning the calculation of this power waste poll-tax.

CHAPMAN





Chapman Chrome Nickel Steel Gate Valves, 400 lbs. Working Pressure, 800 Degrees Total Temperature.

High Pressure—High Temperature Valves for Modern Power Plant Economy

The gate valve of the plant is the keystone of the power plant system. Too much care cannot be given in the selection of this important unit.

Chapman CHROME NICKEL STEEL VALVES are the result of over 50 years' experience in the design and construction of valves to meet every industrial purpose. They have been especially designed to meet the needs of modern plants with their high pressures and high temperatures.

The economy, long life and assurance of safety of CHAPMAN VALVE is made possible through the use of CHROME NICKEL STEEL, produced in our own electric furnace under the supervision of our foundry engineers and metallurgists.

The physical properties, taken from actual tests at 750 degrees are

Elastic Limit	**67,400 lbs. per sq. in.**
Tensile Strength	**83,300 lbs. per sq. in.**
Elongation in 2"	**23%**
Reduction Area	**49%**

Write for complete information and catalogs.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

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VALVES

Wickes Water Tube Steam Boilers

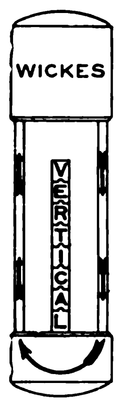
VERTICAL WATER TUBE TYPE

Steel Encased Setting
No Air Leakage

Easily Cleaned—

Ever cleaned a boiler, lamed your back, bruised your knees, and skinned your elbows doing it?

You don't do that in a WICKES. You stand erect, your most comfortable and efficient position.

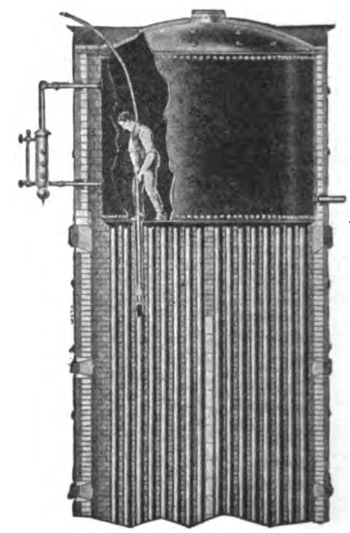


TRADE-MARK

Two men can open, wash, close, and fill the WICKES in five hours. Turbine in ten hours.

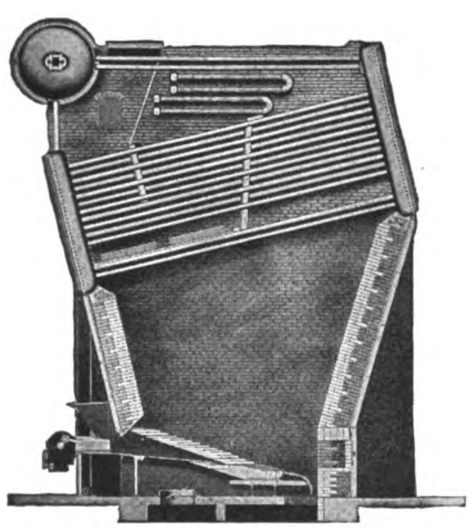
No Air Infiltration Losses—

Another very important item in boiler room cost is the loss in air infiltration in the boiler setting. The steel cased setting enclosing the WICKES boiler prevents air infiltration losses, and the highest efficiency results.



Man Stands Erect
Cleaning

HORIZONTAL CROSS DRUM WATER TUBE TYPE



The One Joint Header Boiler

A Few Points of Excellence—

1. No wrapper sheet in header.
2. No riveted joint on fire side of header or buried in brickwork.
3. The one riveted joint in header visible at all times.
4. All rivet holes in the one joint header drilled from solid plate. All rivets driven with hydraulic riveter.
5. One caulked seam in header and that visible at all times.
6. Vertical fire baffles moulded in place—hence tight.
7. No cast metal used in construction of this boiler.
8. Boiler suspended free from brickwork.

THE WICKES BOILER CO., Saginaw, Michigan

Gentlemen: Without obligation on my part I would like to read your helpful bulletins for reducing boiler room costs.

- ☐ Bulletin 2 The Steam Boiler Analyst.
- ☐ Bulletin 3 Reducing Costs in the Boiler Room.
- ☐ Bulletin 4 Magnitude and Prevention of Air Infiltration Losses.
- ☐ Bulletin 5 Saving Coal in Steam Power Plants.
- ☐ Bulletin 6 The Utilization of Waste Heat for Steam Generation.
- ☐ Bulletin 7 The Wickes Horizontal Cross Drum Water Tube Boiler.

Name ....

Business Address ....

Home Address..

Date ....

Reduce Your Boiler Room Costs

Use the Coupon

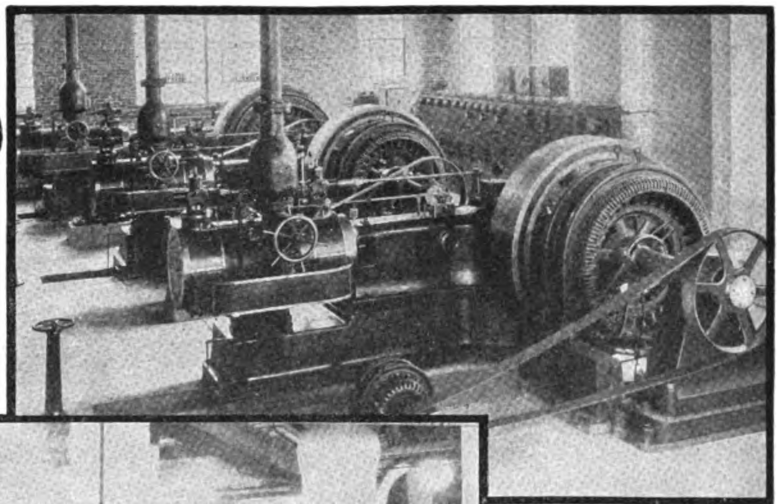
THE WICKES BOILER CO.

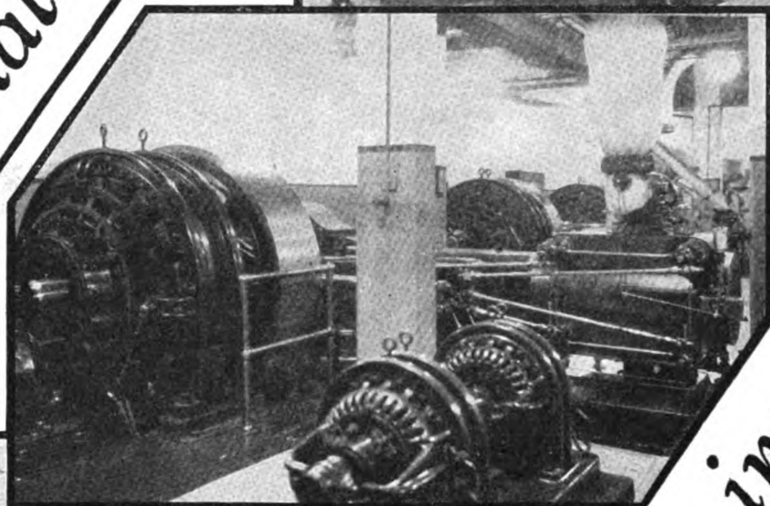
SAGINAW MICHIGAN, U. S. A.

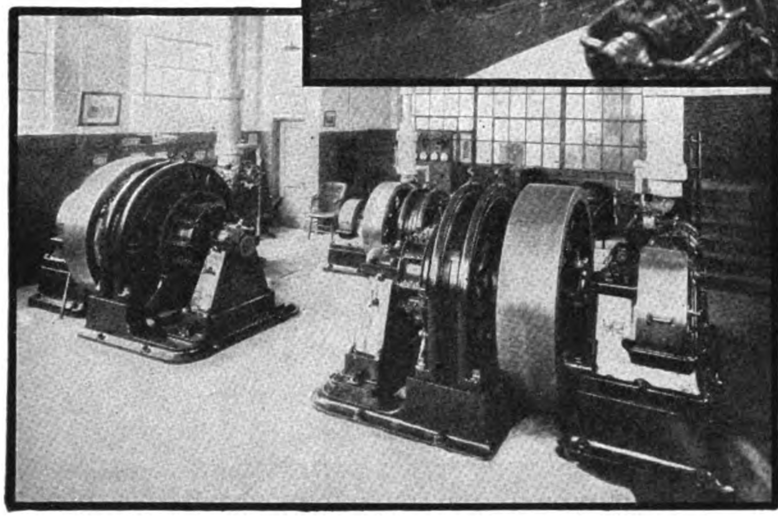
SALES OFFICES:

New York, 501 Fifth Ave. Pittsburgh, 1218 Empire Bldg.
Chicago, 76 West Monroe St. Detroit, 1116 Penobscot Bldg.
Seattle, 736 Henry Bldg.

To Save Money Commercial Economy is more important than Steam Economy







Commercial Economy, in an industrial power plant, is obtained by the selection of the *type* of engine best suited to the conditions of operation.

Of the three types of Ridgway engine-generator sets illustrated, the Unaflow (at the top) requires the least steam and, if you have use for less steam than it will deliver when developing the power required, it should be used.

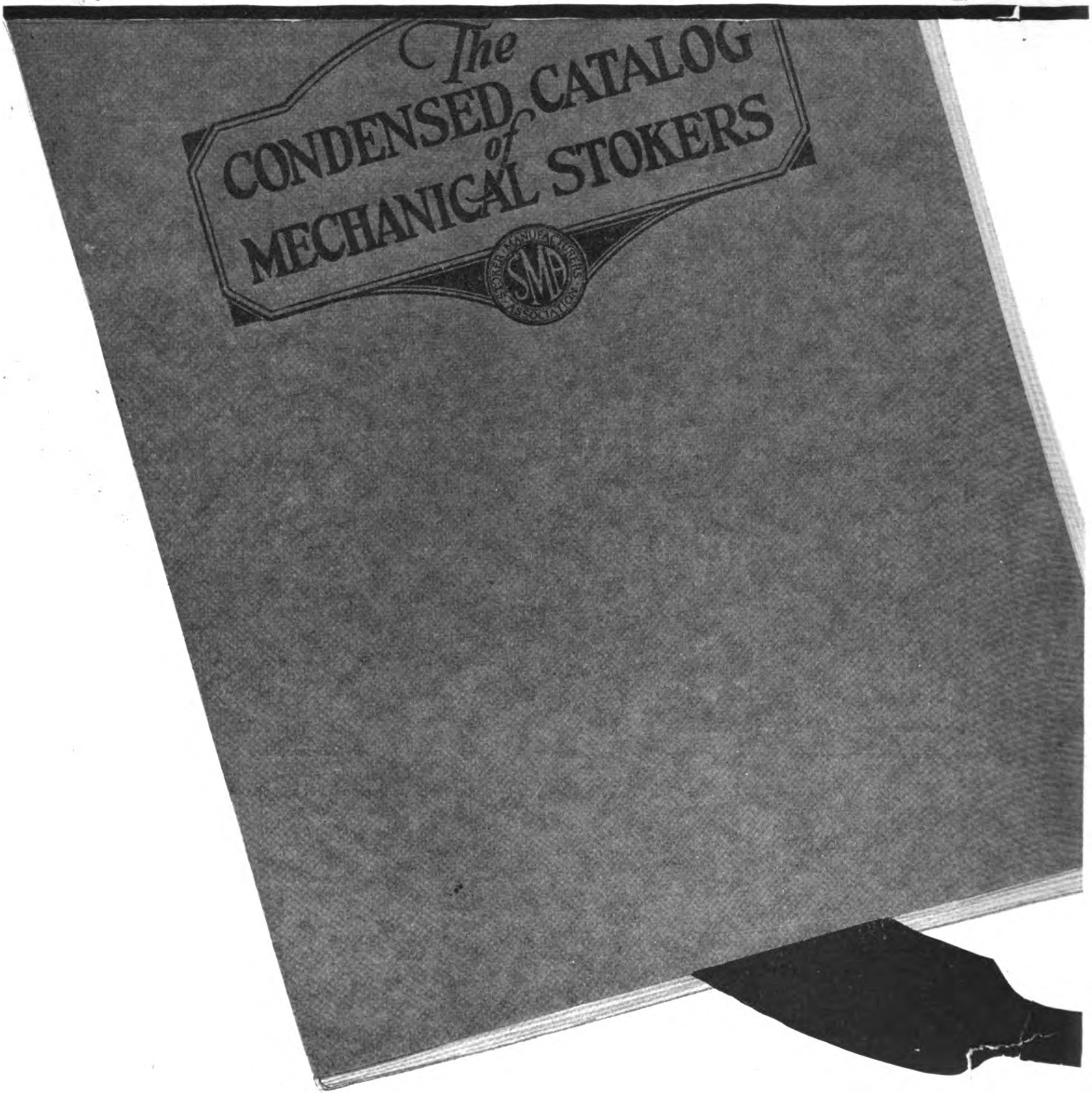
If you require more exhaust steam than it will supply and not more than a Four-valve (in the middle) will deliver, the four-valve should be used.

The Single-valve (at the bottom) requires more steam per horsepower hour than either of the others. It is applicable when the quantity of exhaust steam used in heating or process work bears a still greater ratio to that required for power than in the two preceding cases. Steam temperature also has some influence in the selection.

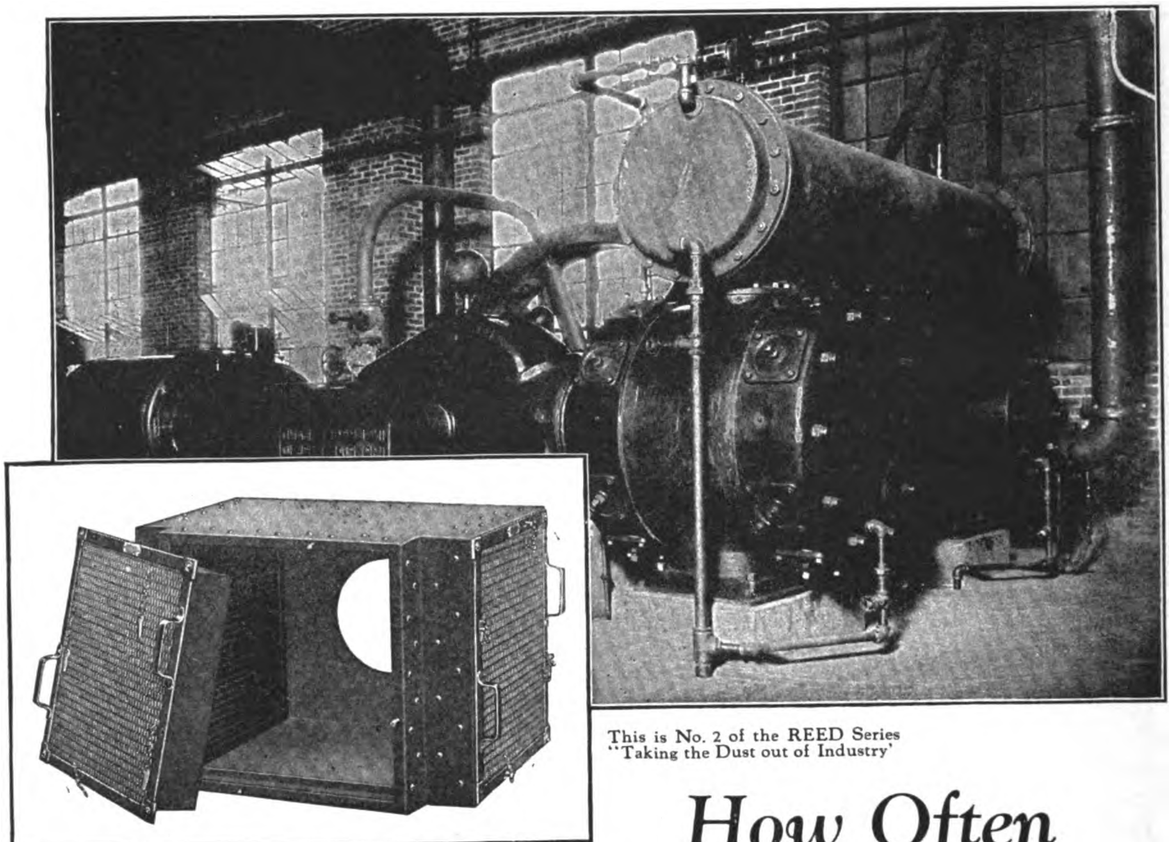
The initial investment decreases in the order given. The higher cost engine should show a good money return on its added cost. *We build all types. Our recommendation is unbiased. Ask us.*

RIDGWAY DYNAMO & ENGINE CO. RIDGWAY, PA.

The answer to every



REED AIR IS CLEAN AIR



This is No. 2 of the REED Series "Taking the Dust out of Industry"

3 unit—Reed Compressor Filter—capacity 1800 c. f. m. Ready to apply to intake of air compressor or internal combustion engine.

Reed Filters for all sizes of compressors and diesel engines. High Pressure Filters for removing entrained moisture and oil, and to clean air under pressure.

How Often do you Clean Valves?

The Standard Sanitary Mfg. Co., before equipping their compressors with Reed Air Filters had to clean the valves every six weeks. Now they clean them only two or three times a year.

On many compressors Reed Filters have reduced valve cleaning from 60% to 80% with a corresponding saving in time, labor and unnecessary shutdowns.

Most compressor troubles such as carbon deposits, overheating, high oil consumption, etc., are due to dust and dirt in the intake air. Reed Filters by removing these impurities eliminate the trouble.
Sold on the "Try Before You Buy Plan."
Write for Bulletin No. 110.

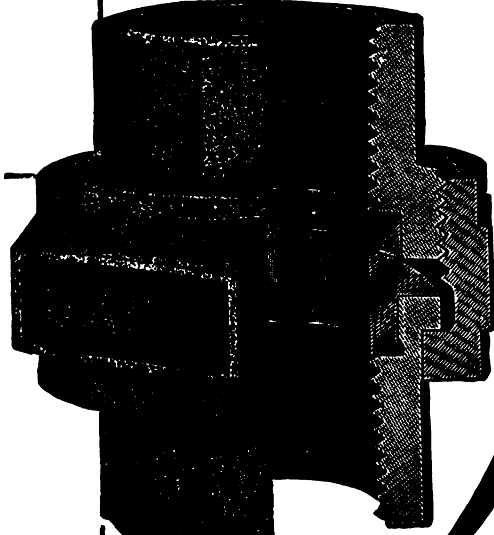
REED AIR FILTER COMPANY, Inc.
211 Central Ave., Louisville, Ky. 50 Church St., New York
Offices in principal cities

Reed Air
TRADE MARK
filters ALL METAL

REED AIR FILTER COMPANY, Inc.
Engineering Department
211 Central Avenue, Louisville, Ky.

Gentlemen: Please send me without obligation your informative folder, "Are You Interested in Clean Air?"

Application.................................C.F.M.
....
Name...
Address..



Republic Power

You Can Cut Your Power Cost
as these companies have done

$22,000 SAVED.
Sloss-Sheffield Steel and Iron Co., Birmingham, Ala.

"Our average efficiency, using the meters is about 75%, but when the meters are not used, this drops to approximately 65%. The saving, reduced to a coal basis, amounts to approximately 4 tons of coal a day for each boiler. Since seven boilers are usually run at a time the net annual saving is $22,431.44."

By Mr. M. M. Argo, Power Plant Engineer.

$13,000 SAVED.
Hanford Produce Company, Sioux City, Iowa.

"As a result of various economies effected by the Republic Flow Meters, we have cut down our consumption of coal on the average of six tons per day, although making increased demands on the power plant for power."

By Mr. F. B. Gillespie, Power Plant Engineer.

EFFICIENCY INCREASED 8%.
North Carolina Electric Power Co., Asheville, N. C.

"Considering all of the economies produced by our steam flow meters and our CO_2 Recorders, our efficiency has been increased 8%."

By Mr. H. Smith, Chief Engineer.

$108,000 SAVED.
M-K-T Railway, Parsons, Kansas.

"Republic Flow Meters have enabled us to reduce our fuel consumption in a 3000 B. H. Plant $9,000 per month since installed.

"Those in service have brought to us the fact that one cannot estimate correctly in making departmental charges. In one instance one department was charged with 61% of a total output; the flow meters showed the actual delivery was 39%, showing an overcharge of 22% had been made for years past."

By Mr. C. C. Chase, Supt. of Power.

15½% FUEL CUT.
York Gas Company, York, Pa.

"By using and observing Republic CO_2 Recorders, the average CO_2 content increased from 6 1-2% to 13 4-10%, which means a saving of about 15 1-2% in fuel."

By Mr. C. L. Beegle, Superintendent.

$20,000 SAVED.
A. O. Smith Corp., Milwaukee, Wis.

"The 19 Republic Flow Meters used in connection with our steam plant have proved very accurate and reliable. With their help we were able to increase the efficiency of our boiler so as to make unnecessary the installation of an additional boiler at a cost of $15,000.00 to $20,000.00."

By Mr. Thomas Chasty, Chief Power Plant Engineer.

$10,000 SAVED.
General Motors Corp., Detroit, Michigan.

"The Republic Flow Meters at our Buick No. 14 Plant effect a saving of $10,000 a year. This repays their original cost in less than a year."

By Mr. Charles Gladden, Member Advisory Staff.

$6,000 SAVED.
Marathon Paper Co., Rothschild, Wisconsin.

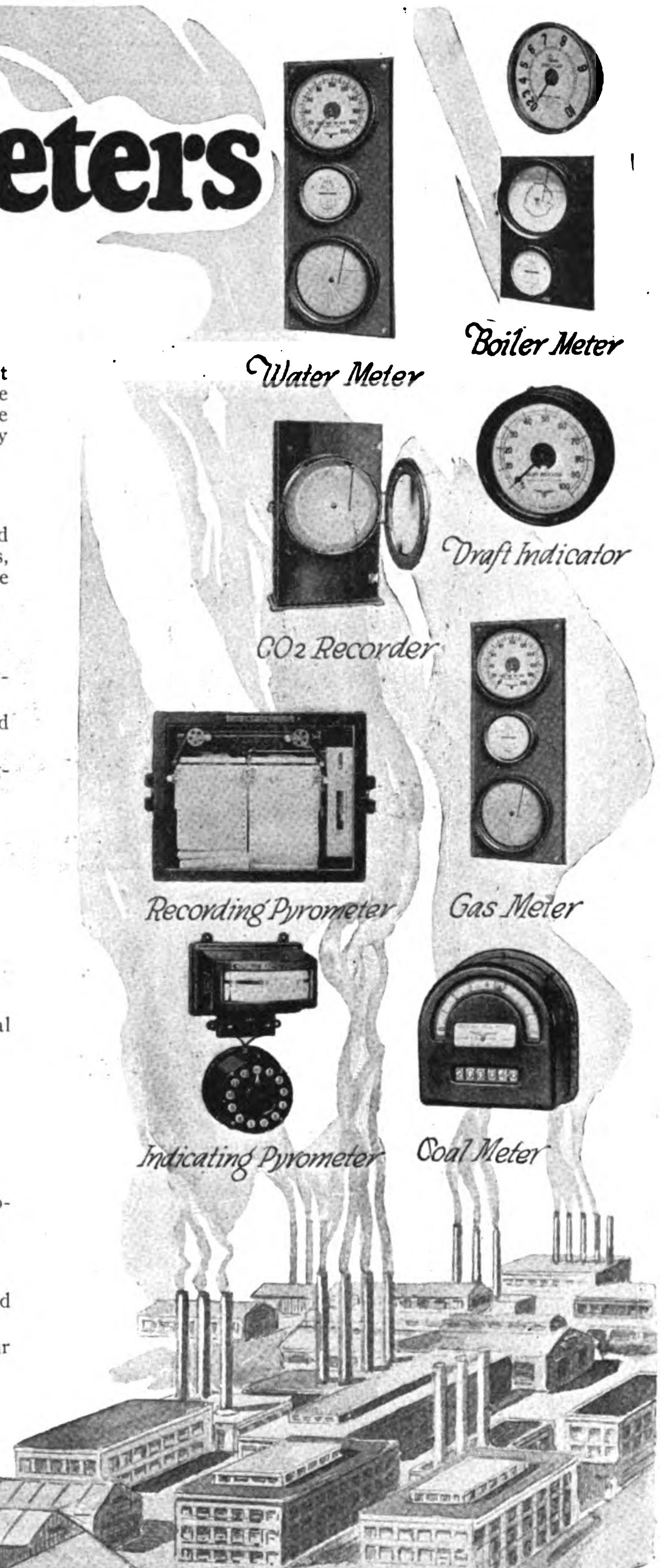
"A study made possible by our Republic meters determined that exhaust steam from our 1000 K. V. A. Engine could be used on our bleaching machines in the place of live steam. On this item alone we save in one year more than $6,000.00 which repaid the entire cost of our Republics."

By Mr. John A. Weiner, Master Mechanic.

Let a Republic Engineer work out a plan of control for your conditions.

Control Meters

A Complete Line



Republic Boiler Meter

The indicator (15" dial) located on the boiler front tells just what the boilers are doing and enables the fireman to balance loads, and shows up any faulty conditions in the boilers. The recorders and integrators, due to the electrical operation, may be located at any distant point, such as the engineer's office.

Republic Steam Distribution Meter

This meter is especially adapted for metering steam consumed by the different departments, steam sold to outside concerns, used by turbines, etc., and all the reading instruments can be located on a central panel board.

Republic Pyrometers

Indicating and Recording, together with complete line of thermocouples and protecting tubes.

An instrument that has completed long tests for accuracy and ruggedness and incorporates these exclusive features:

1. Separate chart arrangement, and all mechanism on swinging bracket and instantly accessible.
2. Six-inch chart—wider than any other duplex.
3. Highest internal resistance of any double pivoted system.

Republic Draft Gauge

1. Permanent zero setting.
2. The 12" dial is easily read at a distance.

Republic Coal Meter

An instrument for automatically registering the amount of coal consumed on chain great stokers.

Republic CO_2 Recorder

No delicate parts or adjustments.

Republic Gas Meter

Specially adapted for industrial service—by-product gas, producer gas, etc.

Republic Water Meter

Exceptionally accurate and valuable for measuring water used in various processes, also feed water to boilers.

Let a Republic Engineer work out a plan of control for your conditions.

Republic Flow Meters Co.

2256 Diversey Parkway, Chicago, Illinois

Branch Offices in 21 Principal Cities

REPUBLIC FLOW METERS

One of the 19 Venturi Meters making up the twentieth order of the Brooklyn Edison Co.

A Sign of Economy in Power Plant Operation

From the old slogan "Keep Up the Steam Pressure at Any Cost" to the present battle cry "Make Every Pound of Coal Do Its Duty" is less than 20 years.

In this period, which will go down in engineering history as remarkable for the great savings effected, there stands out one word—

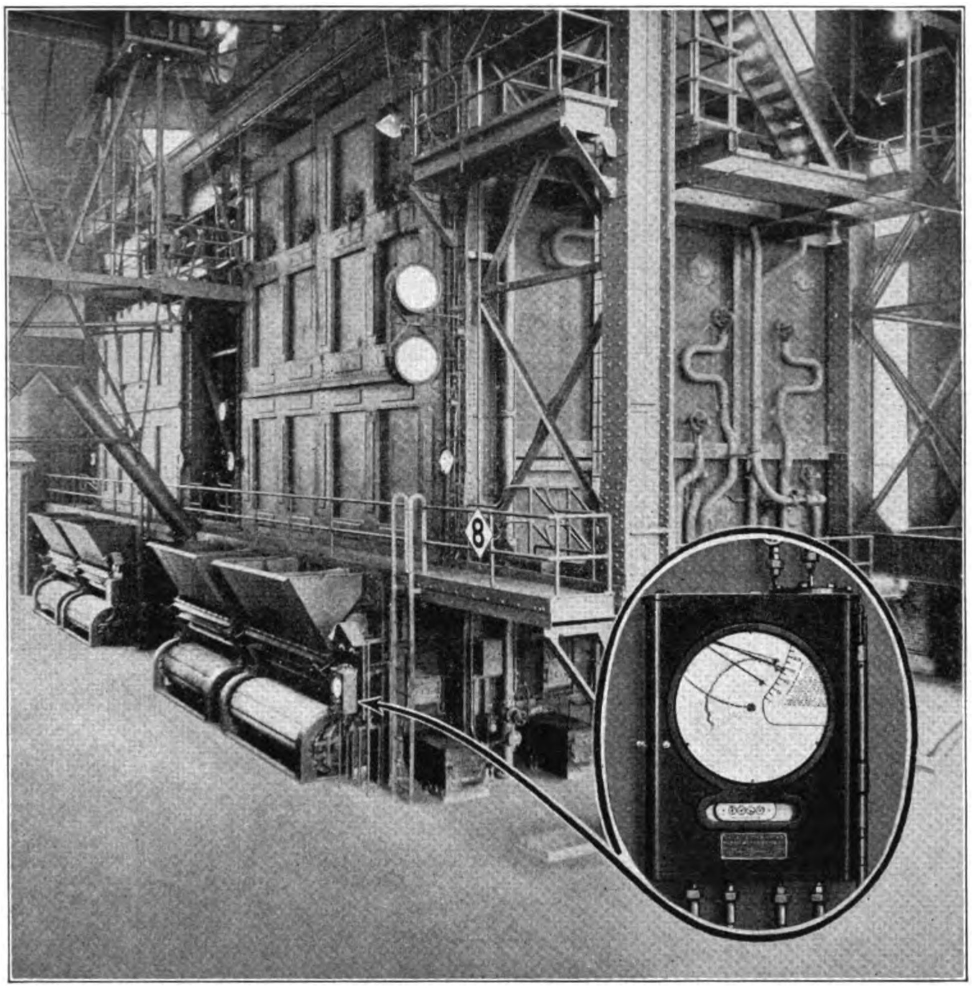
VENTURI

From the little 1000 H.P. plant to such great stations as Brooklyn Edison Co., New York Edison Co., Detroit Edison Co., Southern California Edison Co., Cleveland Electric Illuminating Co., Boston Edison Co., etc. WHEREVER EFFICIENCY IS THE WATCHWORD OF OPERATION, the sure guidance day and night, of the VENTURI METER on the main and individual boiler feed lines continues to be the accessory of first importance.

BUILDERS IRON FOUNDRY

Providence, R. I.

TURN THE LOSSES INTO POWER



Stone & Webster, Inc., Engineers

American Sugar, Baltimore use
Bailey Boiler Meters

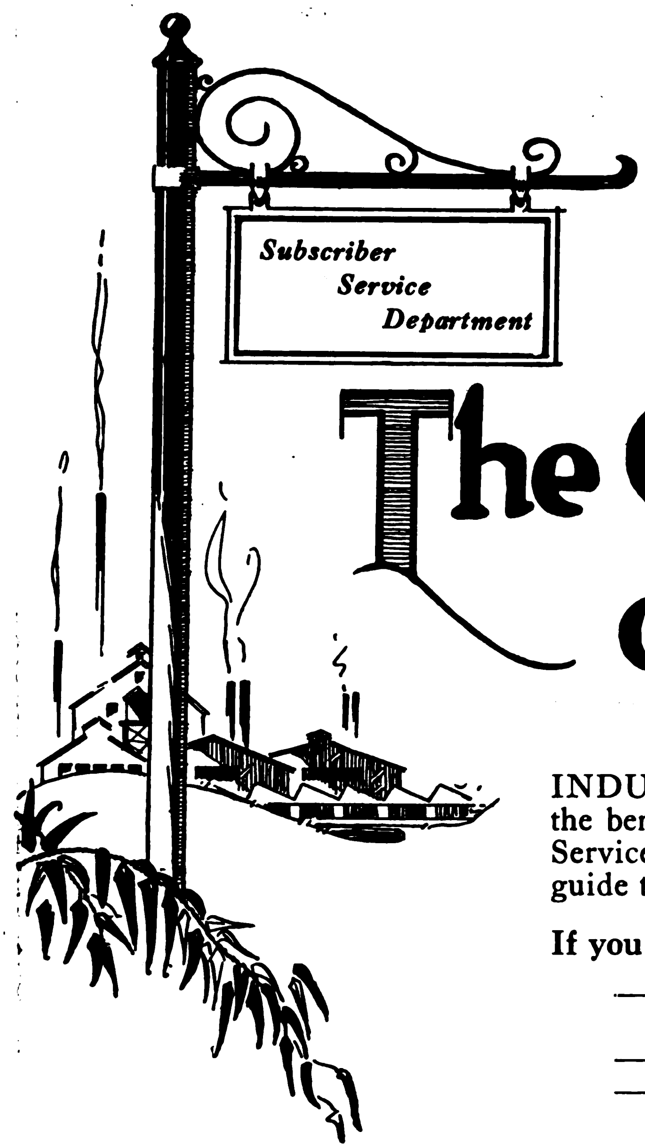
to guide the boiler operators in proper and efficient combustion so that they produce the amount of steam required for power and process work with a minimum amount of fuel.

Excessive flue gas temperatures, high excess air, incomplete combustion and large ash pit losses are not found in this modern plant. The Bailey Meters are always on the job showing the results being obtained and indicating faulty conditions as soon as they occur. With this information before him at all times the fireman is able to make such adjustments and keep his boiler in such condition as to be productive of maximum economy day in and day out.

Write for literature.

BAILEY METER CO.

2041 East 46th Street, Cleveland, Ohio



The Guide Post of Industry—

INDUSTRIAL MANAGEMENT maintains for the benefit of every managing executive, a Subscriber Service Department whose function it is to serve as a guide to the correct solution of management problems.

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The Subscriber Service Editor

INDUSTRIAL MANAGEMENT

120 West 32nd Street
New York, N. Y.

The answer—
to industry's gas problem

FOR many years a large number of industrial users of fuel gas have realized the need of a consulting service offered by an organization with a complete background of experience in all phases of gas production and application.

This is shown by the many requests for such a service which were received by this organization before the present service was inaugurated.

In fact, it was these requests that moulded the present service plan. Invariably those who desired consulting service insisted that it be wholly detached from the sale of equipment—that it should not be burdened by the limitations necessarily imposed on a "free service."

And the answer to this request is the present consulting service of the Smith Gas Engineering Co.—a service that is offered on the sound basis of a charge for services rendered.

The data accumulated during 20 years of intensive experience reaching into every phase of gas production are now at the command of users and producers of fuel gas. The typical problems, briefly outlined opposite—emphasize the scope of the service.

It is the concrete answer to industry's gas problem.

Smith Gas Engineering Co.
Dayton, Ohio

Twenty years of turning gas waste into profit

Twenty years of turning gas waste into profit is summed up in these paragraphs from the book of experience.

The application of gas to furnaces and ovens of many kinds in many industries.

The design of the most efficient and modern fuel plants for the food baking industry.

The designing and building of special furnaces for special purposes.

The designing and constructing of highly efficient metal recuperators for furnaces and ovens, applying old established principles in a new way with remarkable results.

The designing of metal recuperators for coke ovens which have greatly lessened the cost of constructions.

The developing of the most efficient method of cleaning coke oven and producer gas.

The developing of instruments for recording the heating value of gases.

The designing and constructing of clean producer gas plants in which gas is made from bituminous coal, anthracite, coke, charcoal, and lignite, distributed like city gas for use in metallurgical furnaces, ovens, kilns and engines.

The converting of hot producer gas plants to clean cold producer gas plants and extending the utility of producer gas to many refined heating operations where accurate control of processes is necessary.

The creation of methods of utilizing cheap gas of low heating value as efficiently as gas of high heating value.

The developing of apparatus for the efficient production of fuel gas from low grade lignite, wood refuse, sawdust shavings, etc.

The developing for the Delco-Light Company of a thoroughly practical and highly efficient gas producer of very small size for operating farm lighting units in those countries where liquid fuels are very expensive.

During the last three years work has been done for such well-known concerns as the following:

Aluminum Company of America
Indiana Refining Company
Kellogg Company
International Harvester Company
Standard Sanitary Manufacturing Company
Ford Motor Company
National Biscuit Company
Mutual Potteries Company
Shanghai Mint, Shanghai, China
Ganga Glass Company, Delhi, India
Vacuum Oil Company, Alexandria, Egypt

The Smith Gas Engineering Company (Manufacturing Division) manufactures the following equipment:

Smith Gas Producers for bituminous coal, lignite, coke, charcoal, semi-anthracite and anthracite. Tar extractors for coke oven and producer gas.

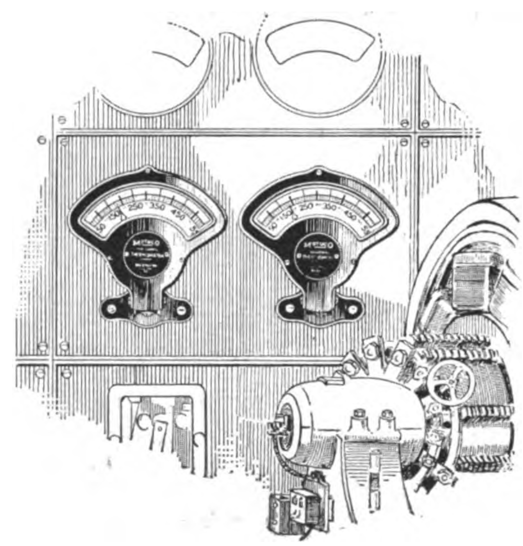
Smith Recording Gas Calorimeters.

Smith Gas Valves. Recuperators for furnaces and ovens. Special gas furnaces. Bunkers, bins and storage tanks of every kind. Scrubbers, condensers, and coolers for by-product and coke oven plants.

Trench digging machines for public service pipe lines.

Garbage disposal and rendering plants for municipalities, packing houses and the like.

II 12-M-BTG



One Good Way to Check Fuel and Power Wastes

A Motoco Thermometer will help run your power plant on an economical basis.

It is easily readable from a distance of 20 feet, and is absolutely dependable. It registers with unfailing accuracy any temperature between minus 40° and plus 750° F. And it is absolutely to be depended on for year upon year, because there is nothing to wear or get out of adjustment. There is only one moving part in the MOTOCO. It has neither gears, levers, hair springs, nor other delicate parts in the movement.

It is the *only* instrument made this way.

Friction and vibration soon wear away cams, levers, etc., and even 1/1000 of an inch of wear on such small parts will seriously effect the accuracy of the thermometer.

Yet, with all these advantages, the MOTOCO sells for the price of better grade glass-tube thermometers, and for far less than other dial instruments.

May we send you our catalog showing uses and detailing its scores of important features?

The Moto Meter Co., Inc.
Industrial Thermometer Division
8 Wilbur Ave., Long Island City, N. Y.

MOTOCO
INDUSTRIAL THERMOMETER

Made by the manufacturers of the famous Boyce Moto Meter

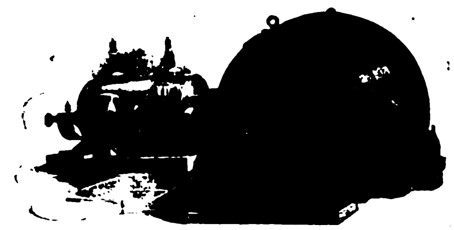
Visit Booth No. 254 at the Power Show

Quality Builders for 85 Years

NO matter what may be your settled convictions about boilers, there is much here for earnest consideration. *Erie City Boilers* cover a wide range of service. Behind them stands one of the largest and best equipped boiler factories in the world.

A word about Coal Pulverizers. A trial installation of two 3000-lb. capacity *Erie City Pulverizers* was made in a certain plant. Coal consumption was cut 30%. Labor requirements reduced one-third. Production increased from 20 to 25 per cent. A short time after that we received a repeat order for eight more pulverizers of the same capacity.

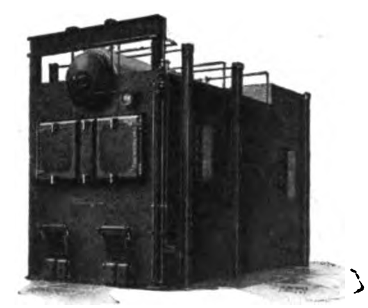

Pulverized Coal Apparatus


Lentz Engine

Write for Bulletin and "Test Reports."

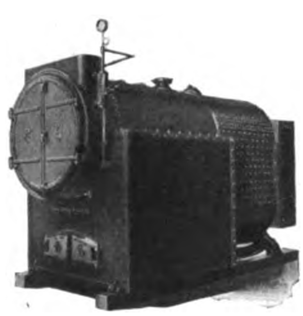
The *LENTZ ENGINE* will extract more useful work from each pound of steam (hence fuel) with less lubricating oil, interruptions of service and annoyance than any other engine on the market. REPEAT ORDERS PROVE THIS STATEMENT.


Vertical Water Tube Boiler


Horizontal Water Tube Boiler

"We are having what we consider such remarkable luck with our Erie City Water Tube Boilers that we want to write you about it." This is the way a customer began his letter to us recently. He had had two Erie City Boilers in constant use for 12 years *without renewing the tubes.*

It wasn't "luck." Such service was foreordained by design on construction—by our methods of building boilers "better than code specifications."


Economic Boiler


Horizontal Return Tubular Boiler

The "Economic" Boiler is self-contained and readily removable from place to place. It combines with this feature the excellencies of a well-set stationary boiler, being economical of fuel, and having the essential elements for safety and durability; it occupies but little space and is a rapid steamer.

ERIE CITY IRON WORKS

Erie, Penna.

Steam Boilers, Lentz Engines, Coal Pulverizing Apparatus, Tanks, Steel Plate Construction

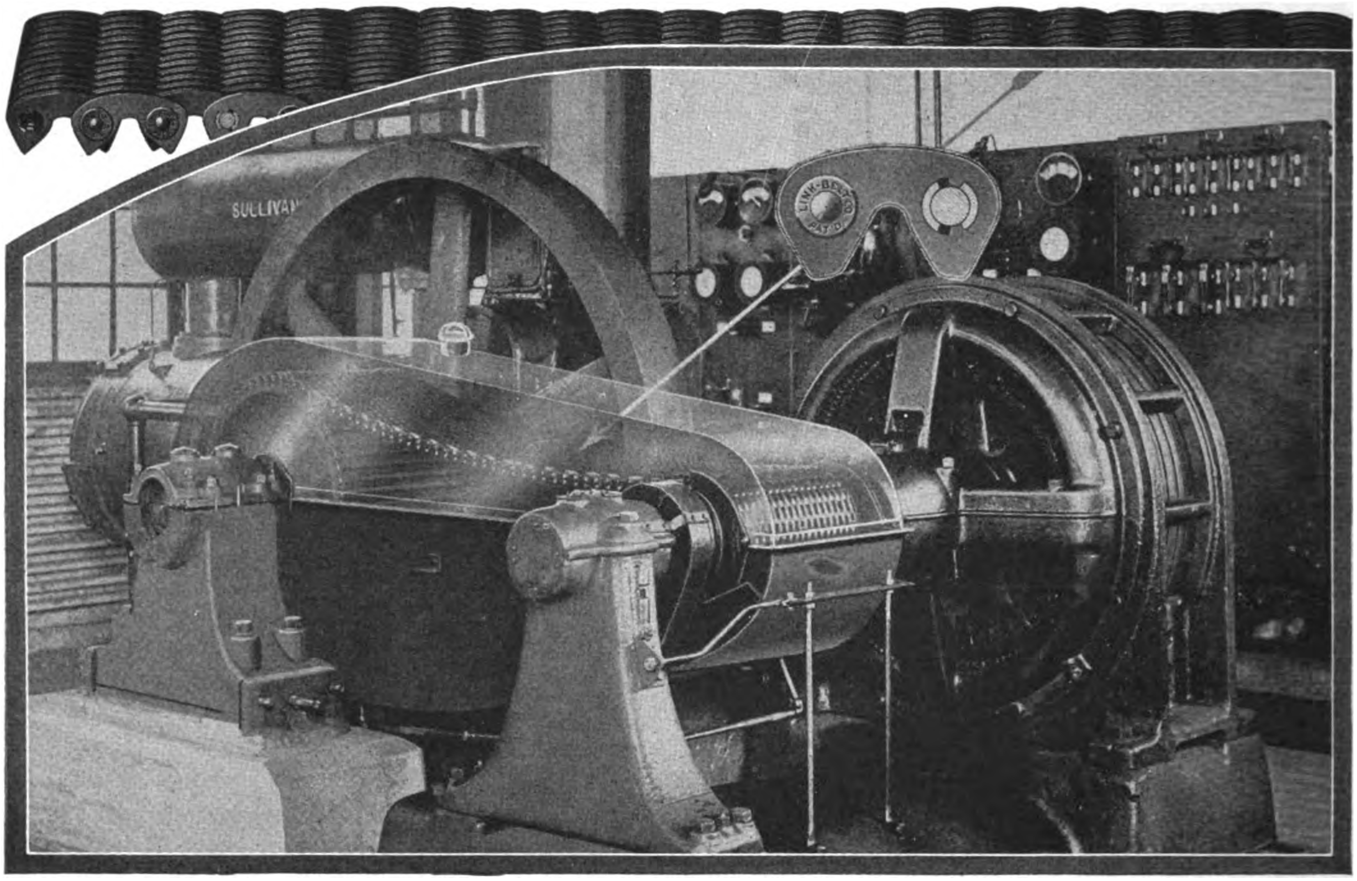
Power Transmission Section

INSTINCT teaches us to fear the unknown and dread the unseen. Civilization dulls this instinct, sometimes to our detriment.

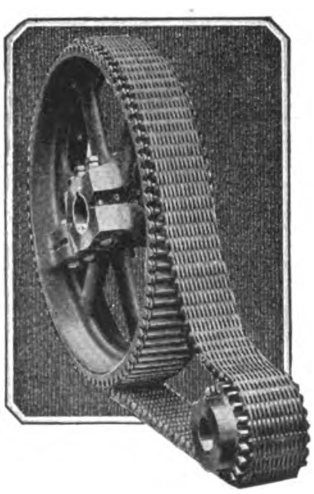
Perhaps this is why thousands upon thousands of dollars are complacently permitted to escape in the guise of power transmission losses in the average industrial plant.

Bearing friction, shaft misalignment, slipping belts, radiation, leakage, electrical losses and hundreds of other unseen and unnoticed profit eaters are busily engaged tearing down the progress that you build up.

Why not put a stop to their insidious activities during the coming year? The following section tells you how.



Flexible As A Belt—Positive As A



LINK-BELT Silent Chain is the efficient drive for line-shafts and machinery of every character—in every line of industry. It is the ideal means of transmitting power from motor or prime mover to machine or lineshaft.

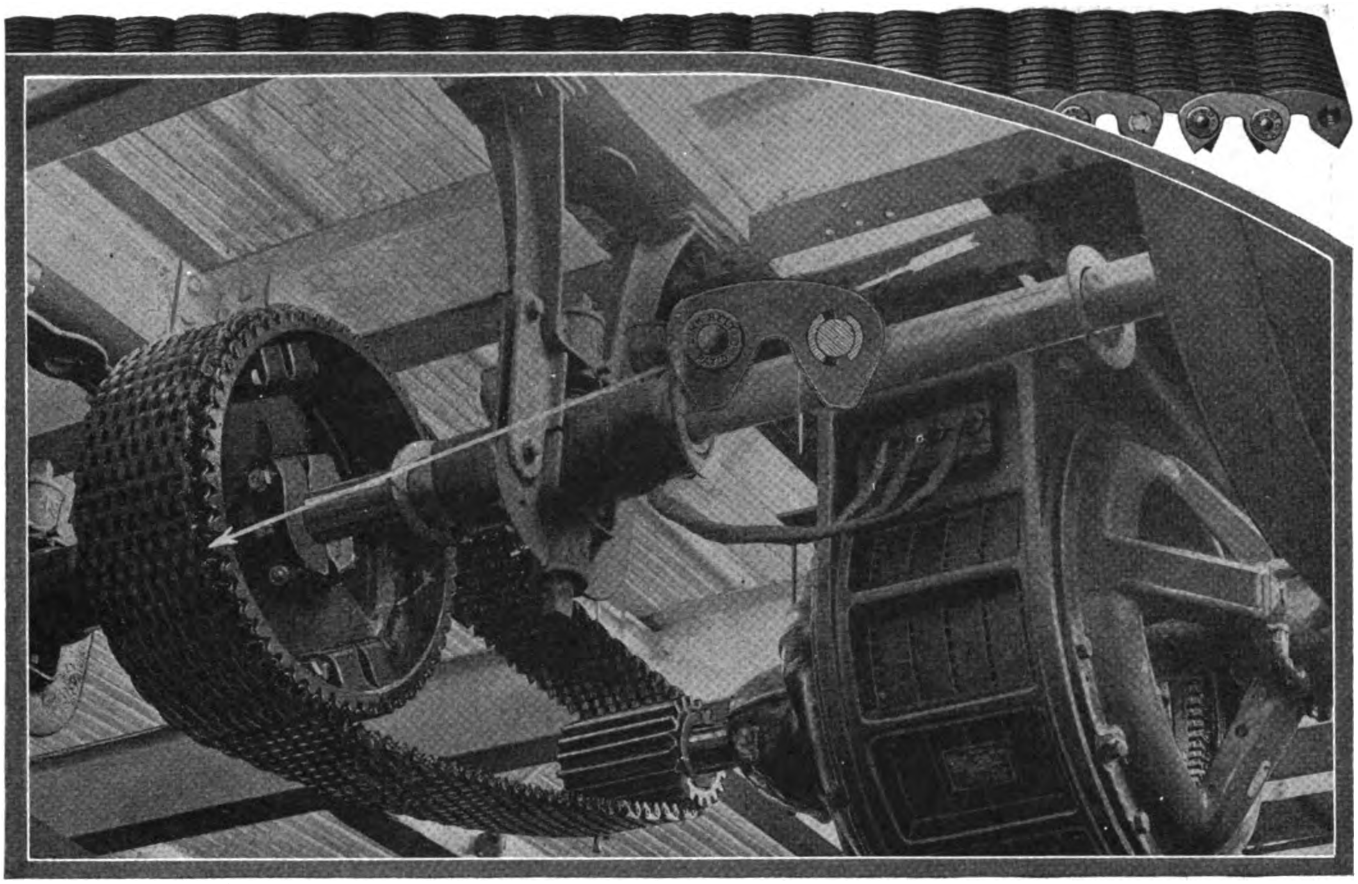
It is 98.2% efficient (on actual test). Made in various sizes to transmit power from ¼ to 1,000 H. P. and over. Thousands of successful installations testify to its unrivaled success.

Link-Belt Silent Chain is practically a flexible gear. It cannot slip. Tension is on the pulling side of the chain only; hence journal friction is much less than with belt drives. No power is lost because of bearing friction; 98.2% of the energy of the motor is transmitted to your shaft or machine to perform useful work. This means increased production.

The drive is not affected by atmospheric conditions, operating well in hot, cold or damp places; it permits economy

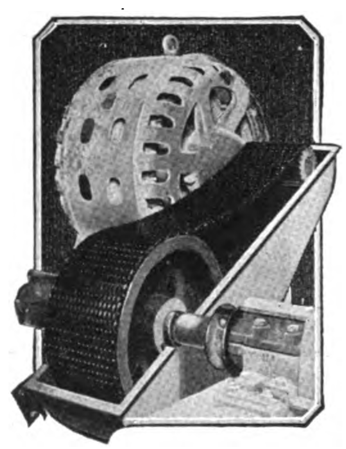
1959

LINK-BELT



Gear—More Efficient Than Either

of space because you are able to arrange for centers to suit the convenient location of your driving unit. It combines in one drive the best points of leather belts and cut gears, minus their disadvantages.



Link-Belt Silent Chain is the efficient means of transmitting power, and we welcome the opportunity of proving it to you in your own plant, under your individual conditions. We sell each drive complete and guarantee its successful operation.

Learn more about this effective, quiet drive. Send for our 144-page Link-Belt Silent Chain Price List Data Book No. 125.

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

PHILADELPHIA, 2045 Hunting Park Ave. CHICAGO, 300 W. Pershing Road

INDIANAPOLIS, P. O. Box 85. Offices in Principal Cities

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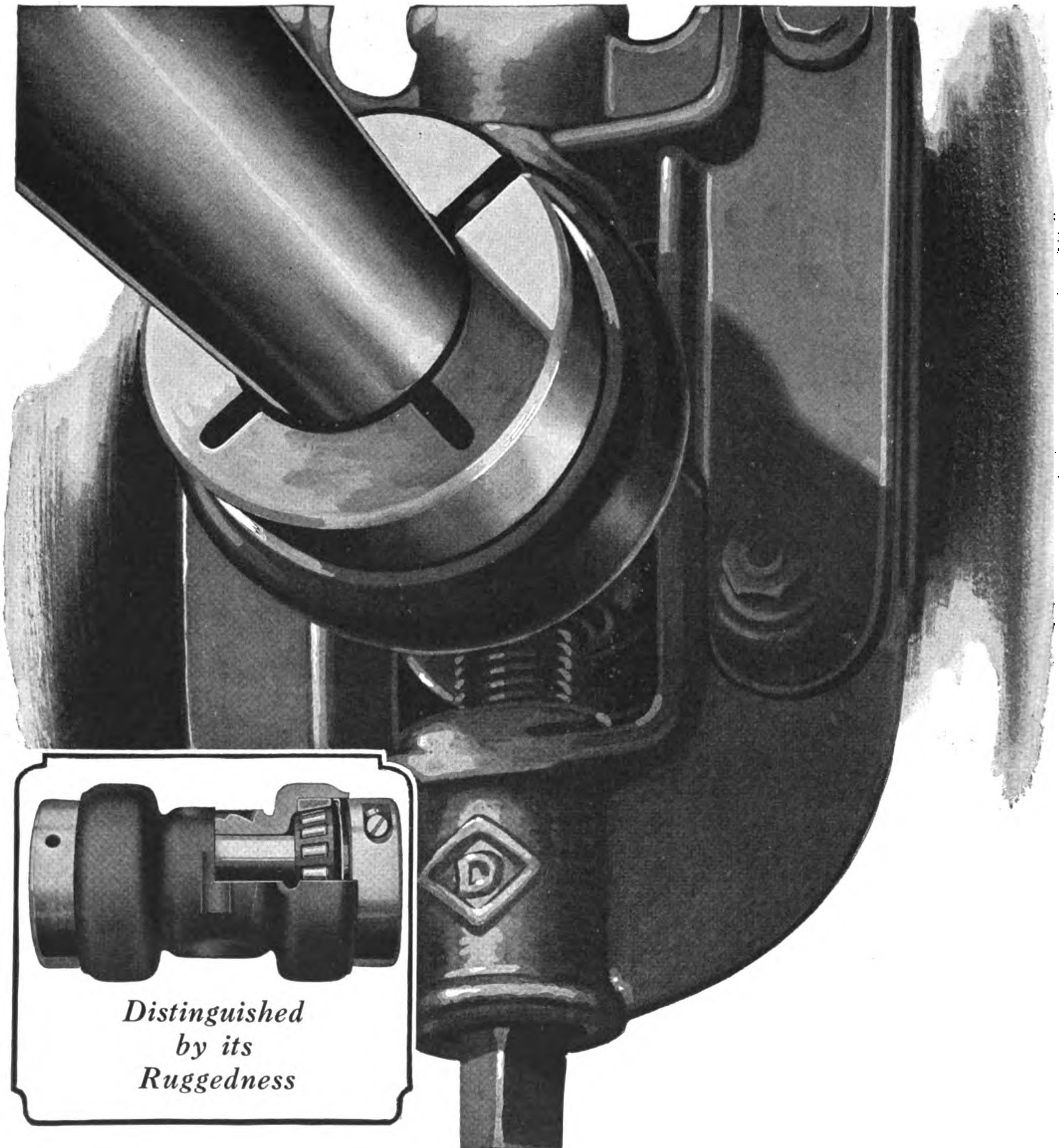
SILENT CHAIN


Distinguished
by its
Ruggedness

To realize continued power savings you need

A Rugged Roadbed for Power!

Your lineshaft bearings constitute your power roadbed.

Their ruggedness and ability to withstand the pounding and jarring of hard service will determine whether the initial savings following the installation of new equipment will continue for years without trouble or depreciation.

The Dodge-Timken Roller Hanger Bearing is first of all a rugged bearing. Its introduction to industry followed years of investigation and careful development in the Dodge shops.

The adoption of the Timken roller bearing was justified by the performance of over one hundred and ten million of these bearings in the automotive and industrial field.

The Dodge-Timken Roller Hanger Bearing will mean power saved in your plant, but it will mean more than that. Year after year of economical, dependable and trouble free operation that can only be the result of the ruggedness and durability of the product.

The name Dodge has stood for power savings for over forty years—Timken stands for twenty-five years of successful performance in the roller bearing field. This is your guarantee of continued power economy.

DODGE MANUFACTURING CORP.

General Office: Mishawaka, Ind.

Works: Mishawaka, Ind., and Oneida, N. Y.

Branches:

New York	Pittsburgh	Newark	Seattle
Chicago	St. Louis	Atlanta	Portland
Boston	Houston	Minneapolis	San Francisco
Philadelphia			

The

DODGE TIMKEN

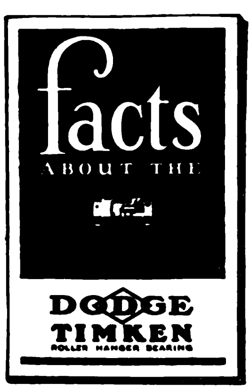
BALL AND SOCKET PILLOW BLOCK

A logical result of the successful performance of the Dodge-Timken Roller Hanger Bearing.

This pillow block incorporates the ruggedness essential to successful, trouble free operation under severe conditions.

Mail the coupon for special bulletin.

Get the



Dodge Manufacturing Corporation,

Mishawaka, Indiana.

Gentlemen:

Please send "Facts about the Dodge-Timken Roller Hanger Bearing."

Firm..

Address..

Individual..

Position..

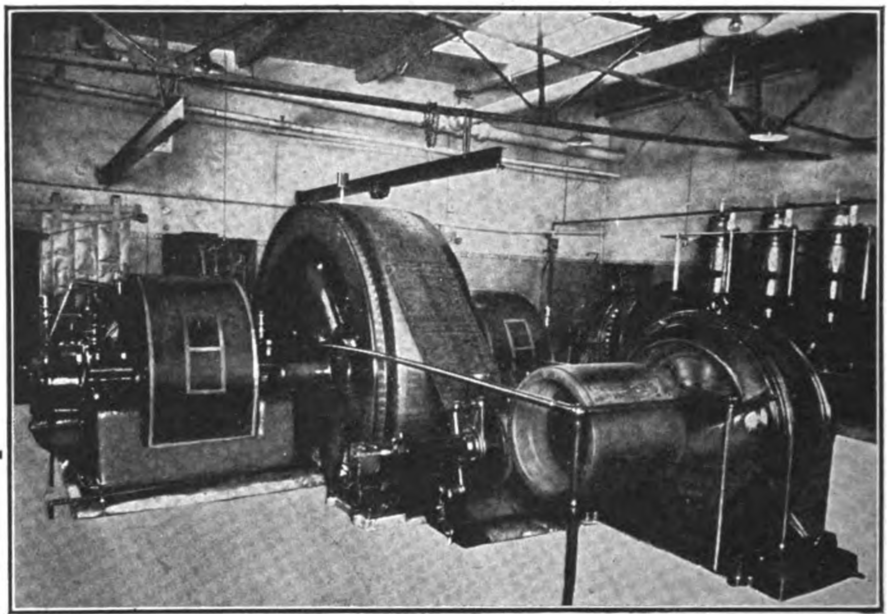
When writing advertisers please mention Industry Illustrated

AT BOOTH Nos. 281 & 282-POWER SHOW-DEC. 1-6

25% More Power from the Same Gas Engine

Saved— *31 feet of floor space*

Saved— *62 feet of belting*



300 H.P. Gas Engine driven Alternator
Engine pulley 114" diameter, 31" face.

Alternator pulley 27" diameter, 27" face.
Pulley centers 10 feet.

Five Points:

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

This increase in the capacity of a 300 H.P. gas engine driven alternator is one of three highly important benefits derived by a western power company from the installation of a Lenix Drive. That company needed space for an additional unit. The Lenix reduced the floor space of 41 feet of the original layout to 10 feet. The space reduction of 31 feet enabled them to place the new unit in the same engine room. The cost of the addition to the building was saved. The new belt is approximately 62 feet shorter than the original belt and this saving in belting was more than sufficient to pay for the Lenix.

In the words of the general manager of the power company,

"We were able to shorten our belt centers approximately 31 feet; this has meant a great saving to us in room and permitted room for an additional unit. The drive has also been very helpful by eliminating belt slippage and belt trouble generally and increasing the capacity of the unit about 25%. It has also increased the life of our belt and we are highly pleased with the operation of this drive from that standpoint as well as the saving of space."

The Lenix will be exhibited at the Power Show, New York, December 1-6, at Booth 281-2 on the Mezzanine Floor. There will be a visual demonstration by the stroboscopic method of the elimination of belt slippage and increase in capacity of the Lenix short center belt drive over the ordinary open belt drive. Everyone interested in the transmission of power from one unit to another should see this demonstration and all who visit the Power Show are cordially invited.

Send for Booklet Saving Slippage and Space.

F. L. SMIDTH & CO.

50 Church St. ***ENGINEERS*** **New York, N. Y.**

THE LENIX DRIVE

(Registered)

When writing advertisers please mention Industry Illustrated

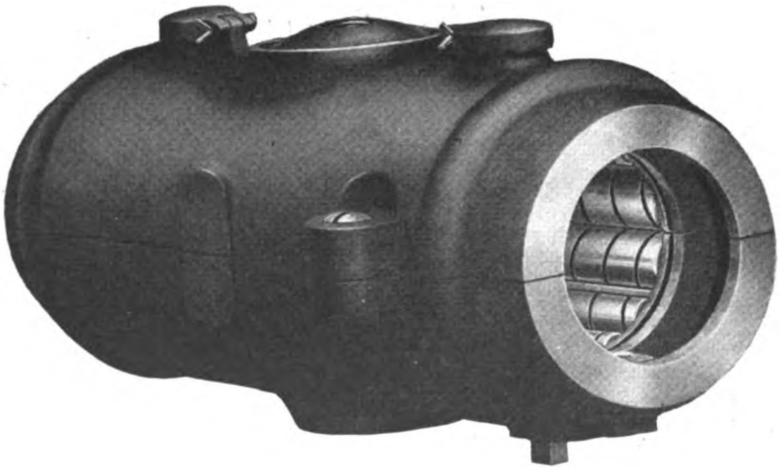
Delivering Power

ECONOMICAL delivery of power through your line shafting is as necessary to profitable plant operation as proper methods in the generating and applying of the power.

The principal requirement is the installation of line shaft bearings that eliminate dragging friction and which possess the strength and positive lubrication features required by such service. Many successful plants have solved the problem by using Hyatt line shaft roller bearings.

These bearings eliminate from 50% to 80% of the dragging friction of plain bearings—thereby saving 15% to 25% of the total power transmitted. This saving means either reduction in power costs or a surplus of power for the operation of additional machinery.

Other advantages are 80% reduction of lubrication costs, dependable operation and long life—some have operated 33 years.



The bearing assembled

HYATT ROLLER BEARINGS

With Minimum Loss

It is an easy matter to make the change. Hyatt bearings are split and can be installed without removing belts, pulleys or other shaft equipment. No delays or holdup of production.

Two tools—a wrench and screw driver—and a few minutes time of an ordinary millwright are all that are required for the job.

And the cost—very low when considered as an investment. The resulting economies will pay the cost of the bearings in one to two years. After that these savings can be counted as clear profit.

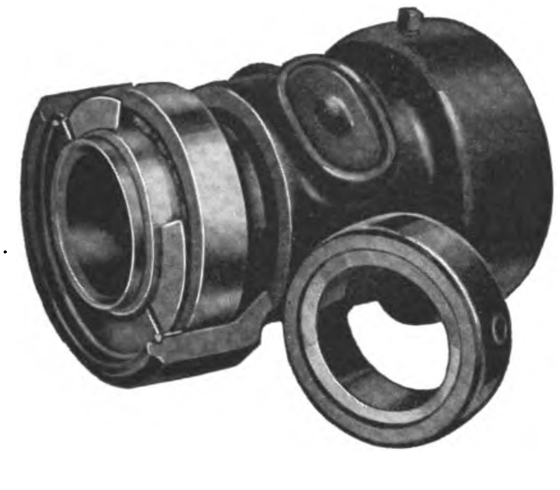
[For new plants and old, Hyatt line shaft bearings are paying investments. *Write for Bulletin 130.* It contains information of interest and value.]

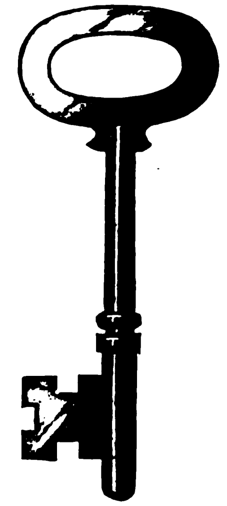
'Phone the Nearest Mill Supply Dealer

HYATT ROLLER BEARING COMPANY
NEWARK, NEW JERSEY
PACIFIC COAST ADDRESS: SAN FRANCISCO, CAL.

Split and easily installed

FOR LINE SHAFTING





The Key to Unused Power—
Fafnir Unit-Aligning Hanger Boxes

WHY YOU NEED A BALL BEARING HANGER BOX

Do you actually use all the power that you pay for? Without increasing their power plant or power bills by one dollar many plants could make available for production as high as 45% of the total power now paid for and not used. Most of this power is locked up in line shaft friction. The ball bearing hanger box is, therefore, the key that will release this unused power for production purposes.

UNIT ALIGNMENT

The **Fafnir Hanger Box** aligns as a unit in the frame. Since there is **no** alignment within the bearings, there is no necessity of sacrificing the advantages of the deep groove raceways. We have incorporated this unit-alignment feature in our entire industrial line because we believe it follows the best principles of ball bearing design.

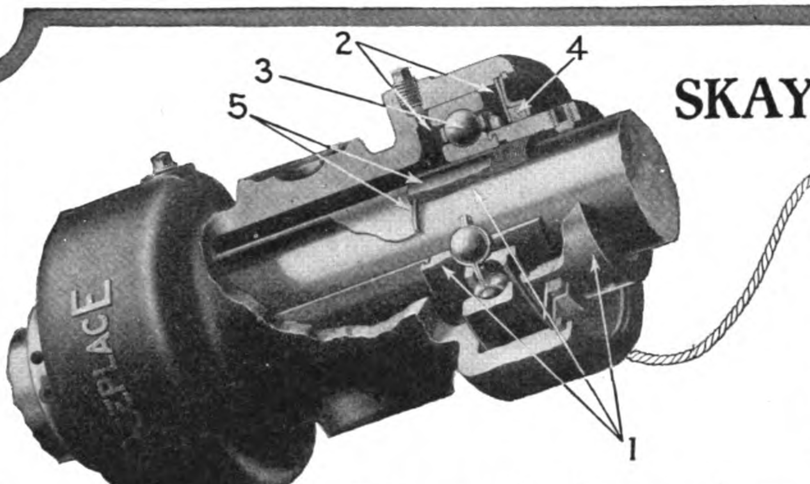
A FAFNIR HANGER BOX

For these reasons the **Fafnir Ball Bearing Hanger Box** is the key for you to take in unlocking your unused power.

The Fafnir Bearing Company

DETROIT **NEW BRITAIN, CONN.** **CHICAGO**

FAFNIR
BALL BEARINGS



SKAYEF REEPLACE BOX

Designed to meet conditions where it may be impractical to remove present hanger frames

Fits regular hanger frames of corresponding size

1. **It is securely clamped to shaft by means of taper adapter sleeves and lock nuts—No play between shaft and sleeves.**
2. **It takes care of shaft contraction and expansion.**
3. **It requires no bearing adjustment.**
4. **It keeps dirt out and lubricant in.**
5. **It possesses the maximum in flexibility and adaptability though it is not self-aligning.**

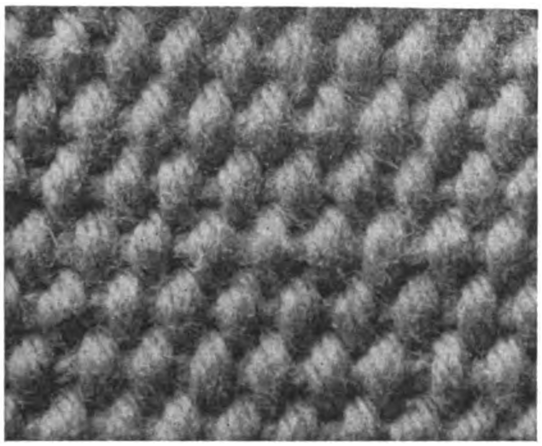
THE Skayef Self-Aligning Ball Bearing Hanger illustrated below has been used in numerous industries in practically every country throughout the world and has achieved undisputed supremacy by over fourteen years of satisfactory service. It is the only ball bearing hanger which possesses within the bearing itself, the true self-aligning feature.

1266

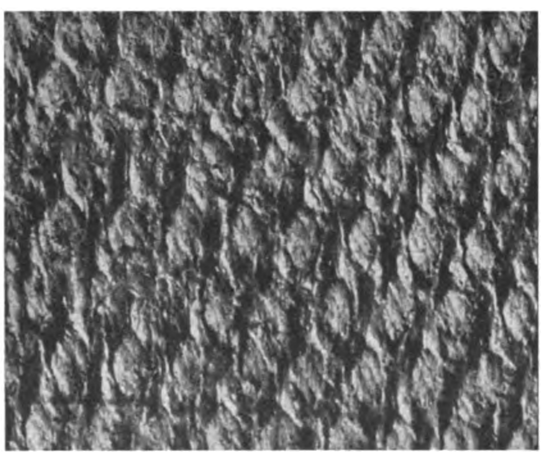
THE SKAYEF BALL BEARING COMPANY . . . . 165 Broadway, New York City

BRIEF TALKS ON RUBBER BELTING

BULL DOG—The Belting for hard and heavy drives



Fabric used in making Bull Dog belt enlarged three diameters. Shown before friction is applied.



Fabric used in making Bull Dog belt enlarged three diameters. Shown after friction is applied.

OUR Bull Dog belting for heavy transmission work is made in two weights of fabric and in two types of friction, and in any required number of plies. The number of plies in a belt depends not so much on proportion to its width, as is sometimes supposed, as on the use to which the belt is to be put. The number of plies should be figured on that basis. (See our belting manual.)

Bull Dog extra heavy belting is made of 36-ounce duck with special weight friction for work of the heaviest and steadiest loads. On a continuous drive it is superior by every test to any other friction belting manufactured. It is a giant for work and need be used only on the very hardest places.

Bull Dog regular belting is made of 32-ounce duck with a special high-grade friction. For all ordinary use of friction where a heavy load is to be carried with a steady pull, it has never had an equal.

Bull Dog belting applies even power and causes no trouble from stretching. It is not seriously affected by heat up to 200° Fahrenheit, and is impervious to alternations of heat and cold.

Every buyer and user of belting will appreciate our new Belting Manual, a highly readable book on belting construction and practice. Send for your copy.

BOSTON WOVEN HOSE AND RUBBER CO.

WORKS	WAREHOUSES	POSTAL ADDRESS
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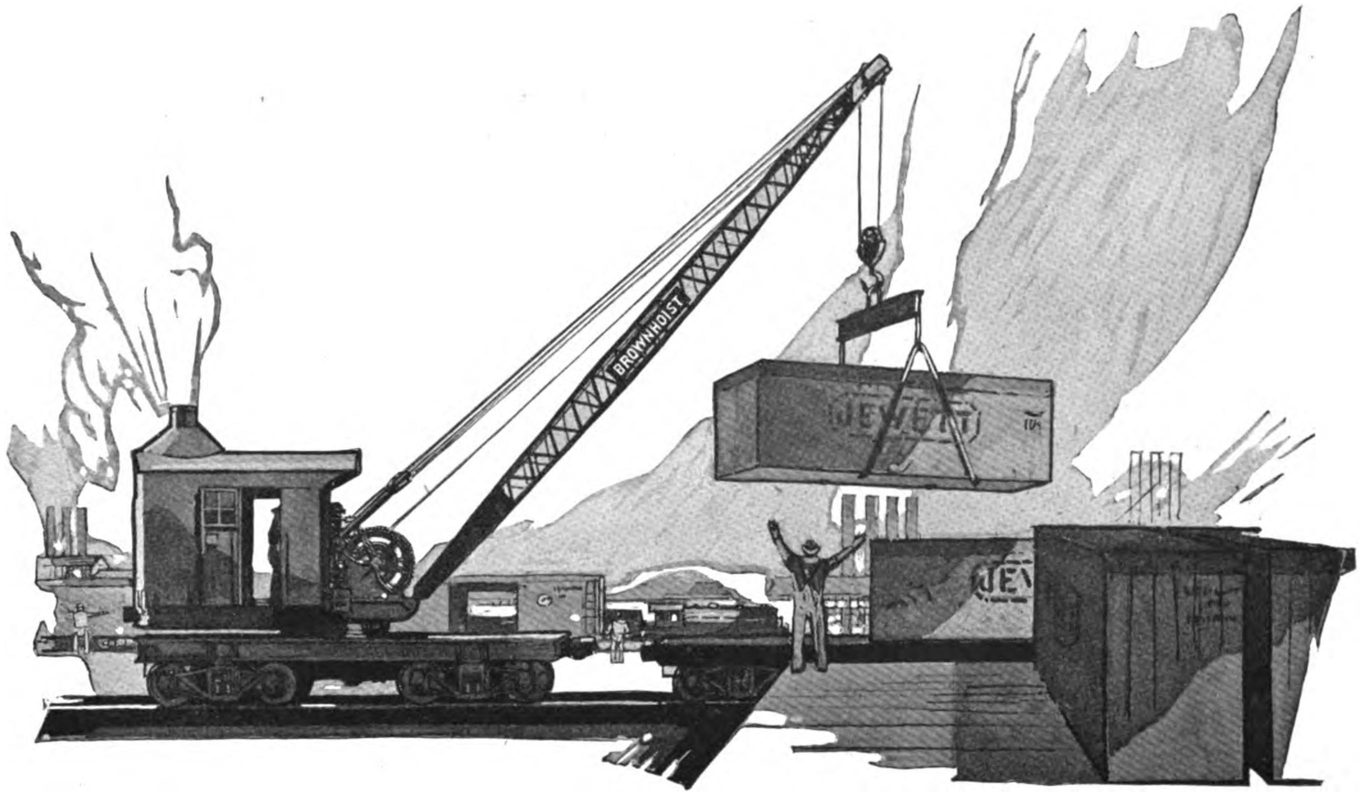
Coal Handling Section

DID you ever stop to think that the biggest part of the labor problem in connection with the power plant has to do with materials handling—and chiefly with one material—coal?

Mountains of coal, and ashes (which are a by-product of coal) are moved into and through and out of our plants every day.

Therefore, when you have solved the problem of the economical handling of coal and of ashes you have gone far toward the solution of power plant labor costs.

Hand and foot labor is out of date for this purpose. Mechanical equipment to fit every condition is available and will do ten men's work at less than one man's pay. The following section describes and illustrates such equipment.



Steady Work for their Brownhoist— Steady Savings for Paige-Jewett

"It certainly is astonishing to see how rapidly the export department is able to load up a carload of four automobiles with this Brownhoist. They load a carload, nailing the boxes to the flat car complete, in about half an hour."

So runs a letter from the Paige-Jewett Motor Car Co.—Detroit. And the saving doesn't stop with the car loading. The letter continues—

"The crane is used about equally to load boxed automobiles for export and to handle coal with a clamshell.

"It is also used as a switch engine, pulling as many as 12 or 14 cars at a time."

Leading companies the world over are using Brownhoists to speed production and shipping. At the same time they are making substantial savings in their handling expense.

Brownhoist engineers are specialists on material handling. Why not let them work with you on your handling problems? There will be no obligation on your part.

The Brown Hoisting Machinery Co., *Cleveland, Ohio*

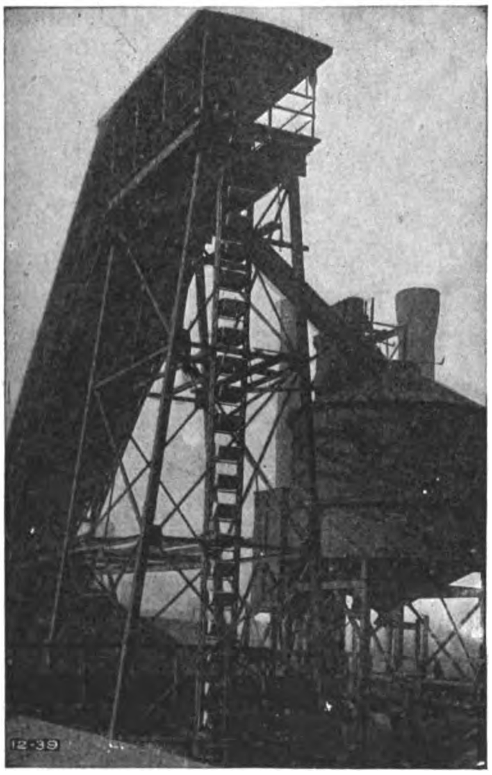
Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans, London, Eng.

Heavy Dock Machinery, Locomotive Cranes, Bunkers, Conveyors, Bridge Cranes, Buckets, Etc.

BROWNHOIST

MATERIAL HANDLING MACHINERY

Common-Sense Figuring Will Attain Results



Here is an installation of Plant "B," Detroit City Gas Co., that has proven profitable to its owners and admirably suits their particular requirements.

Coal is elevated by a Hunt Pivoted Bucket Conveyor and discharged through a chute into tank shown at the right, from which it is loaded into Hunt Industrial Cars and taken to storage bins.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

Keen analysis and plain "horse-sense" will accomplish better results in procuring low-cost production than many of the so-called "efficiency" methods.

Every single item that enters into the manufacture of a commodity must find a place in the production cost of each unit. But, unfortunately these items are not always properly apportioned; more often they are lumped in one mass; consequently errors are permitted to creep in which nullify the usefulness of the figures of production costs in formulating selling prices.

Take for example, the cost of power. How many industrial executives can tell to a certainty the actual cost of transporting their coal from car or barge, to storage and boiler room hoppers; or the disposal of ashes from the pits?

Manual labor for handling coal and ashes, as well as unsuitable mechanical apparatus are dual "profit eaters." The former method is becoming rare, but still exists in some plants; the latter method, because of its unsuitability is costly when untimely breakdowns cause expensive interruptions, heavy repair bills, inordinate upkeep and other irritating troubles.

Very frequently the cost of vital functions of this character are hidden away among a mass of figures under the general head, "power cost." Find out exactly where you stand on "power costs."

Hunt Cost-Cutting Equipment was designed, over half a century ago, to lower the cost of handling coal and ashes. It was conceived upon correct engineering principles and with a far-sightedness that, with but few modifications, makes it applicable to every requirement of coal, ash and other bulk material handling problems of present day practice.

Hunt Engineers will be pleased to look over your handling system and make recommendations to lessen the labor, increase the capacity, and plan an economical and thoroughly efficient layout. Write them *today.*

C. W. HUNT COMPANY, Inc.

West New Brighton, New York City

NEW YORK OFFICE—Whitehall Building

PHILLIPS, LANG & CO., Inc., 431 South Dearborn St., Chicago, Ill.

ENGINEERING EQUIPMENT CO., Ltd., 358 Beaver Hall Square, Montreal

ERNEST F. LEARNED, 141 Milk Street, Boston 9, Mass.

1—A Barber-Greene Conveyor, with cleated belt, handles lump coal at the J. S. Davis Coal Co., Toledo, Ohio, storing it well back from the tracks. It unloads a car of mine run in an hour.

2—Before the Miamisburg Light, Heat & Power Co. bought this Barber-Greene, there was demurrage on one or two cars out of every three received. There has been no demurrage since.

3—A Barber-Greene Conveyor stores coal at the Miamisburg Paper Co., two conveyors being used to reclaim to a bucket elevator. A car is unloaded in one hour.

4—The Barber-Greene which unloads a 50-ton car of Shamrock 4-inch lump in 59 minutes. It has eliminated storage bins near the tracks, and has increased the storage capacity of a limited area.

5—Showing Barber-Greene equipment in use at a large plant. Cars are unloaded to the conveyor, which stores at the rate of a car an hour. A Barber-Greene Loader reclaims the coal.

Stopping demurrage with Barber-Greenes

Unloading a 50-ton car of 4-inch lump in 59 minutes, a Barber-Greene Conveyor has solved more than one problem for Grove & Weber, Inc., of Miamisburg, Ohio.

It has done away with all demurrage, and eliminated a large "floating gang" of workmen. The storage bins which were formerly required near the tracks, have been discarded. The Barber-Greene conveys the coal well back, greatly increasing the storage capacity of a limited ground area.

For every three carloads of coal delivered to the Miamisburg Light, Heat & Power Company, there was demurrage on one, and often two cars. Unloading and storing a car in an hour, a single Barber-Greene has eliminated this demurrage. Storing and reclaiming are now done by the boiler room force of two men.

At the J. S. Davis Coal Company of Dayton, Ohio, Barber-Greenes are preventing demurrage which had amounted to $600 to $800 each year. Photograph No. 1 shows how one of these conveyors, with cleated belt, handles lump coal, storing it back away from the track.

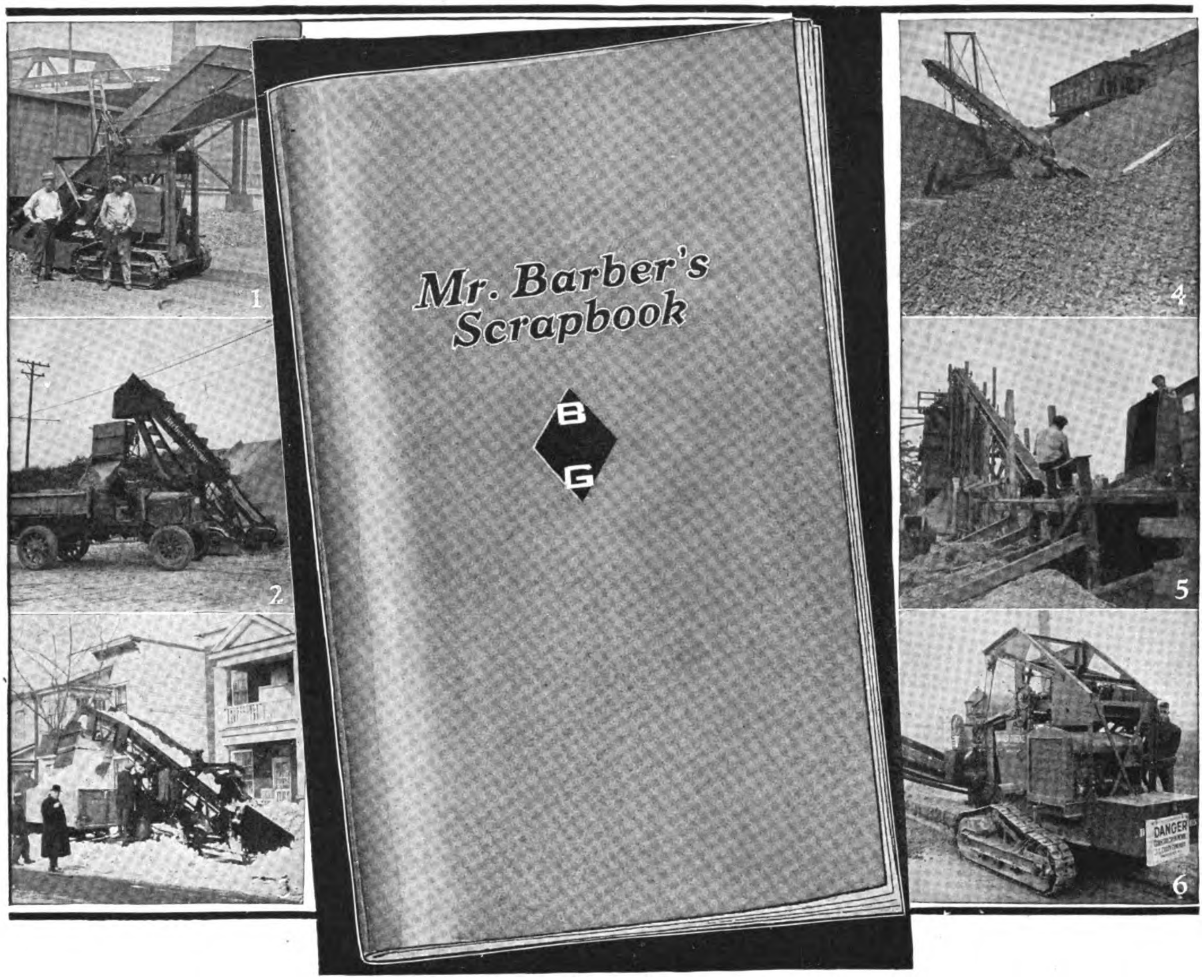
This type of conveyor, 24 inches x 45 or 60 feet, can store more than a drag conveyor, which is not built in such lengths. It multiplies the storage capacity of ground areas. With one man, it unloads a car of mine run in one hour. Send for our E Catalog, and data showing how Barber-Greenes will increase the speed and efficiency of your operations.

Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

Representatives in thirty-three cities

BARBER GREENE

Portable Belt Conveyors **Self Feeding Bucket Loaders**



For one cent you can inspect thirty-five material-handling jobs

You have often wanted to examine the material-handling layouts that have proved conspicuously successful in plants similar to your own. Yet the cost of a satisfactory tour of inspection is prohibitive, both in time and money.

For one cent you can have this information, in brief and lucid form, ready for instant reference, by sending a postcard for "Mr. Barber's Scrap Book."

As designer of Barber-Greene equipment, Mr. Barber has maintained a rigid check on the way in which Barber-Greenes are meeting material-handling requirements of every sort.

He has acquired such a mass of valuable data which bears directly upon your own operations, that we have collected some of it and bound it in a compact forty-page booklet.

The photographs show graphically how a great many companies are defeating the heavy overhead costs of unskilled labor, and at the same time often increasing production speed as much as 300%.

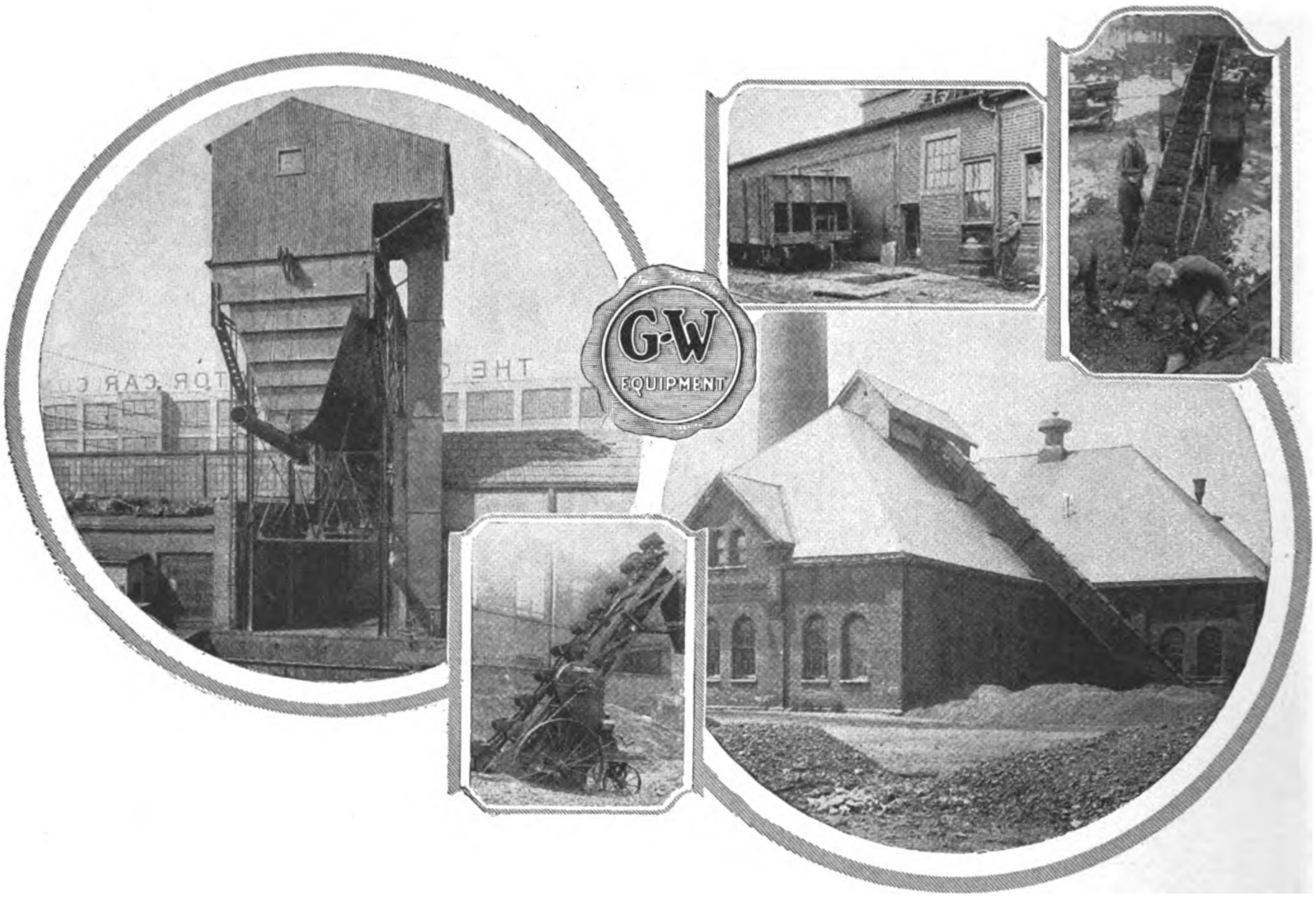
With immigration restriction choking the supply of unskilled labor at its source, the high cost of moving materials by hand threatens to mount even higher. This presents you with a serious problem, which cannot be ignored without loss. It is just here that "Mr. Barber's Scrap Book" should prove valuable. It will point the way to greater economy, efficiency and speed, no matter what the nature of your work. Send for it.

BARBER-GREENE COMPANY—*Representatives in 50 cities*—500 W. Park Ave., Aurora, Illinois

BARBER B G GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Coal Loaders . . . Automatic Ditch Diggers . . Coal Feeders

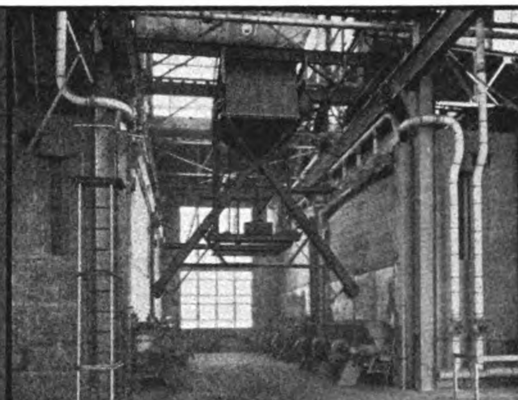

G-W
EQUIPMENT


MUTUAL POTTERIES CO
TRENTON, N.J.
TOLEDO REX SPRAY CO.
TOLEDO, OHIO
RATH PACKING CO.
WATERLOO, IOWA
These Concerns have Reduced Their Handling Gangs to one Man
Let Us Tell You How?
These are a few of the many Godfrey installations that have resulted in substantial savings—labor gangs reduced to one man—demurrage costs eliminated—coal handled from car to storage piles and to boiler rooms at a cost of from 3 to 7 cents per ton.
You will find representative concerns like these in every industry who had a troublesome problem, with coal handling costs away beyond what they should be. When the Godfrey Conveyor system was explained they hardly thought that such a system—simplicity itself—was possible.
If it is costing you more than 7 to 8 cents per ton to handle your coal, it is time you investigated the Godfrey Conveyor System.
Just drop us a line and one of our Sales Engineers will gladly go over the facts with you, or show you an installation in your locality. At least write for full particulars.
Ask for Bulletin A-42
Godfrey Conveyor Company
Elkhart, Indiana
GODFREY CONVEYOR
One Man's Wages—the Only Labor Cost

THE SCOOP CONVEYOR
Cuts Power Costs
Hundreds of Millions are spent annually for handling the coal and ashes necessary to the production of power. Many of these millions could be saved if the best handling equipment were used for each requirement.
Our organized field staff has made a thorough study of all equipment in this field and it is always ready to co-operate with you in making an investigation.
A personal interview carries no obligation and we may be able to help you with our product or by our suggestions.
Write, phone or wire
Portable Machinery Co., Inc.
Passaic, N. J.
ATLANTIC COAST
The next page illustrates actual Money Savings
askanyuser
PORTABLE MACHINERY CO.
PASSAIC, N.J. U.S.A.

Belt Conveyor Distributing Coal to Overhead Bunkers

Ash Skip Hoist
and Storage Bin



Larry Feeding Boilers

Ash Skip Hoist
Outside Boiler Room

DON'T REMODEL YOUR WHOLE PLANT

SUPPOSE your plant has grown and grown. Suppose buildings and equipment have been put where it was easiest and aren't right where you want them now. Suppose it looks as if you're really up against it.

You don't have to remodel the whole thing simply because you want your company to pocket the savings that come from dependable coal and ash handling equipment. There is another way out of it.

Let Bartlett & Snow come in and suggest how their coal and ash handling equipment can go right into the space you've got. How it can dodge buildings and columns and boilers even though they are where they shouldn't be.

You can count on Bartlett & Snow engineers to show you money-saving methods of handling coal and ashes even when you're up against tough conditions. Hundreds of money-making installations form the background of their suggestions. Thirty-nine years of doing things well is built into Bartlett & Snow equipment.

There's no obligation behind this offer. All we want to do is suggest the money that can be earned in your plant by simple coal and ash handling equipment.

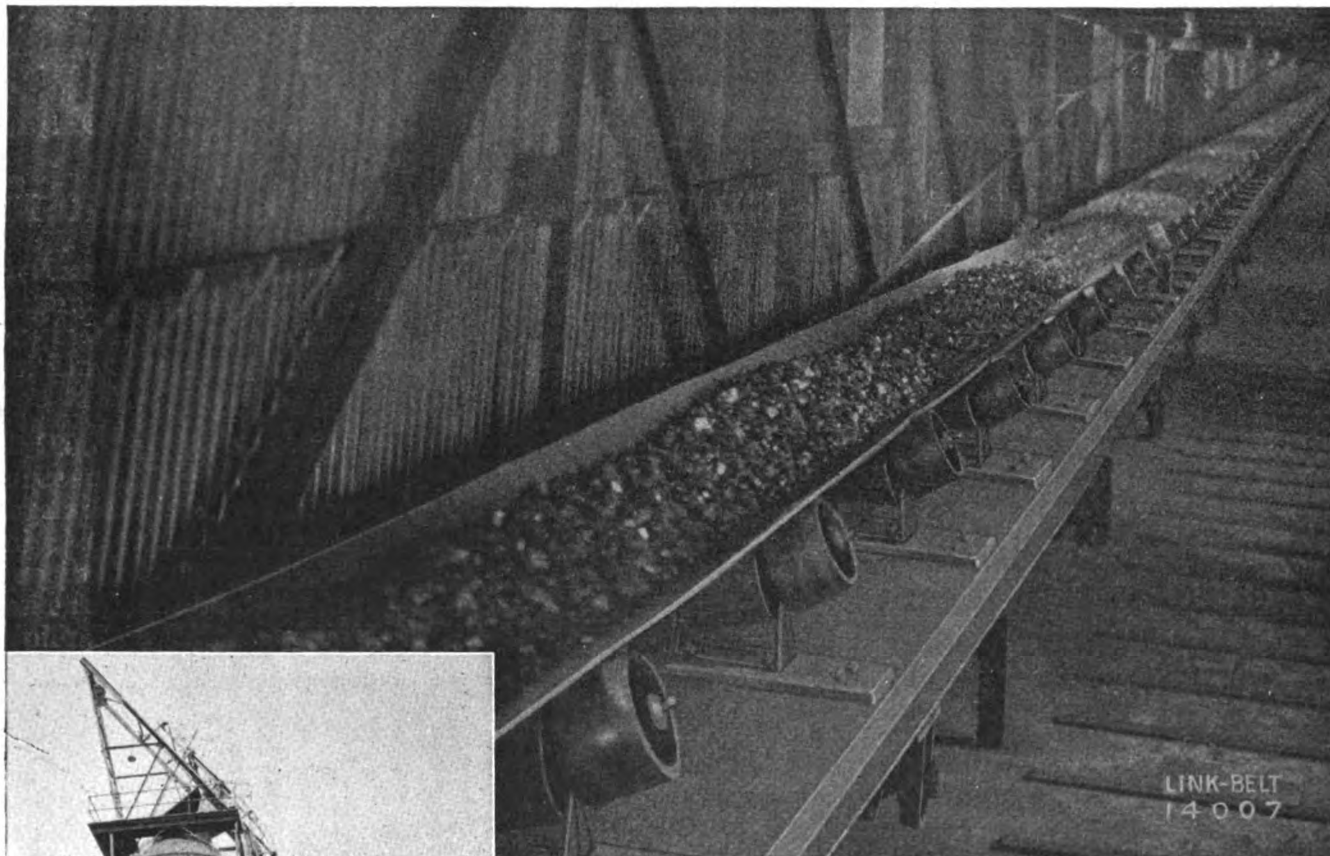
Write for literature, if you desire it; but better, let us send an engineer to go over the ground and study your conditions so we can offer definite suggestions.

THE C. O. BARTLETT & SNOW CO.

Main Office and Works: CLEVELAND, OHIO

Builders of complete and partial coal and ash handling systems consisting of

CONVEYORS · SKIP HOISTS · LARRIES · CRUSHERS



Belt Conveyor delivering coal to bunkers at the Indiana Electric Corporation, Wabash River Power Plant, Terre Haute, Ind.

Link-Belt Skip Hoist, 103 foot travel, 25 tons per hour, at Iroquois Gas & Electric Co., Buffalo, New York.

Modern Handling

LINK-BELT manufactures complete, in its own plants, every type of modern coal and ashes handling equipment that has stood the test of efficient, practical operation, and that has received the approval of the engineering profession. From this advantageous position, the designs by Link-Belt engineers are made without prejudice as to type of equipment, and with the sole thought of supplying our customers with what our accumulated experience indicates will best and most economically meet their requirements.

Combined with suitability of design, is sturdiness in construction, which for fifty years has characterized all Link-Belt products. Since our first skip hoist installations were made, over twenty years

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

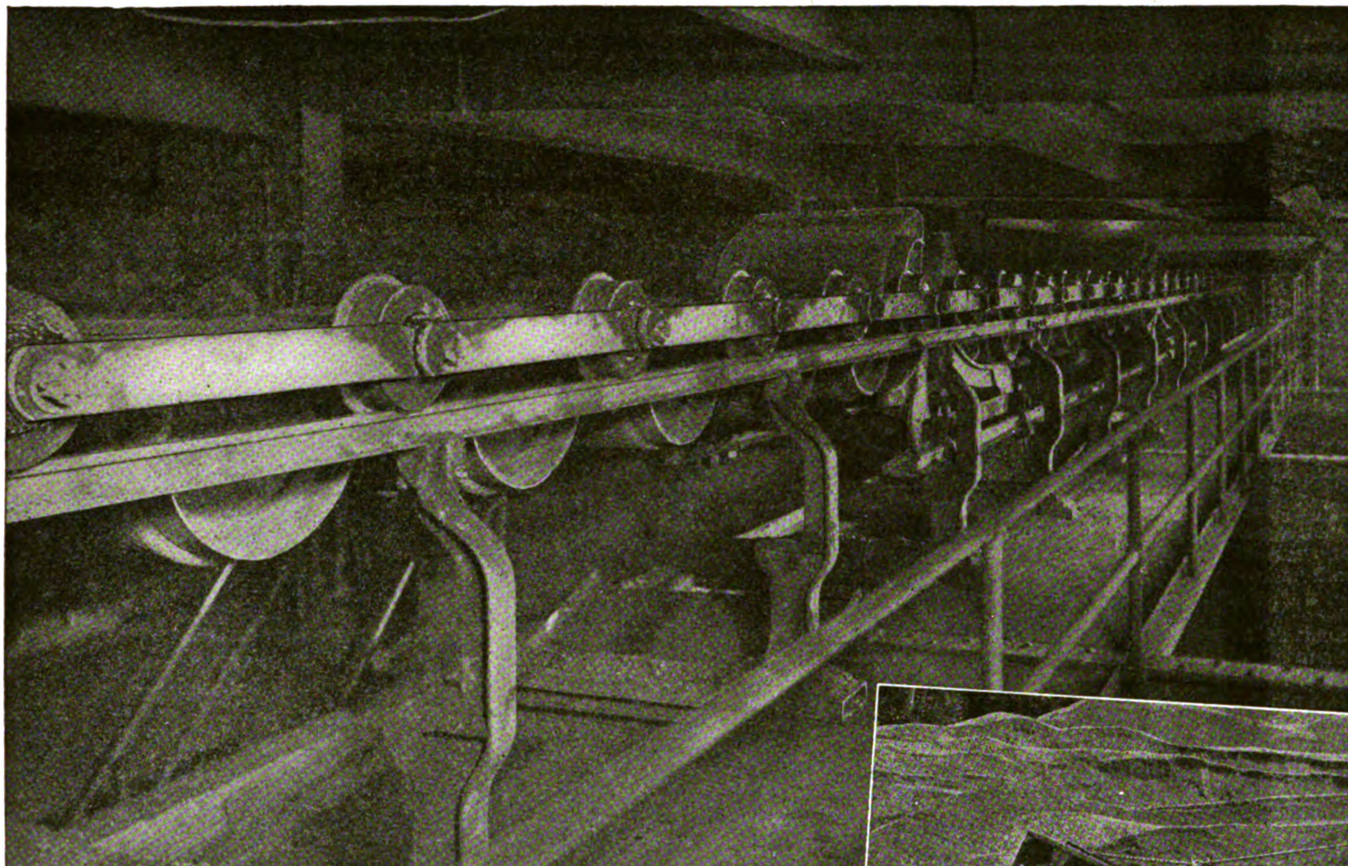
PHILADELHIA, 2045 Hunting Park Ave. CHICAGO, 300 W. Pershing Road INDIANAPOLIS, P. O. Box 346

Offices in Principal Centers

1960

LINK-BELT

Coal and Ashes Handling Equipment



Peck Carrier at Calumet Station of Commonwealth Edison Co., Chicago. Capacity 200 tons per hour.

# of Coal and Ashes

ago, we have continually improved this type of equipment. Our Peck Carrier has been used for twenty-five years, and is standard equipment for most sizes of boiler house. Our Belt Conveyors, chain-and-bucket elevators and conveyors, Screw Conveyors, and other standard types, have been used for forty to fifty years, for handling materials of all kinds. Our cranes have shown unusually large saving in handling coal to and from storage, for 25 years.

We have furnished coal and ashes handling equipment for the largest power houses of the country, as well as for the smallest. Each installation is designed and built to fit the individual requirements. Therefore, if planning to store coal, or change your present method of getting coal into the boiler house, let us work with you and your engineers.

Upper—Link-Belt Power Hoe storing and reclaiming coal at the Electric Storage Battery Co., Philadelphia, Pa. (Mfrs. Exide Batteries).
Lower—Link-Belt Locomotive Crane loading and unloading coal in storage.

H. W. CALDWELL & SON CO.
CHICAGO, 1700 S Western Ave.
NEW YORK, 2676 Woolworth Building
DALLAS, TEXAS, 810 Main St.

LINK-BELT MEESE & GOTTFRIED CO.
SAN FRANCISCO, 19th and Harrison Sts. LOS ANGELES, 400 E. Third St.
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SEATTLE, 820 First Ave. S.

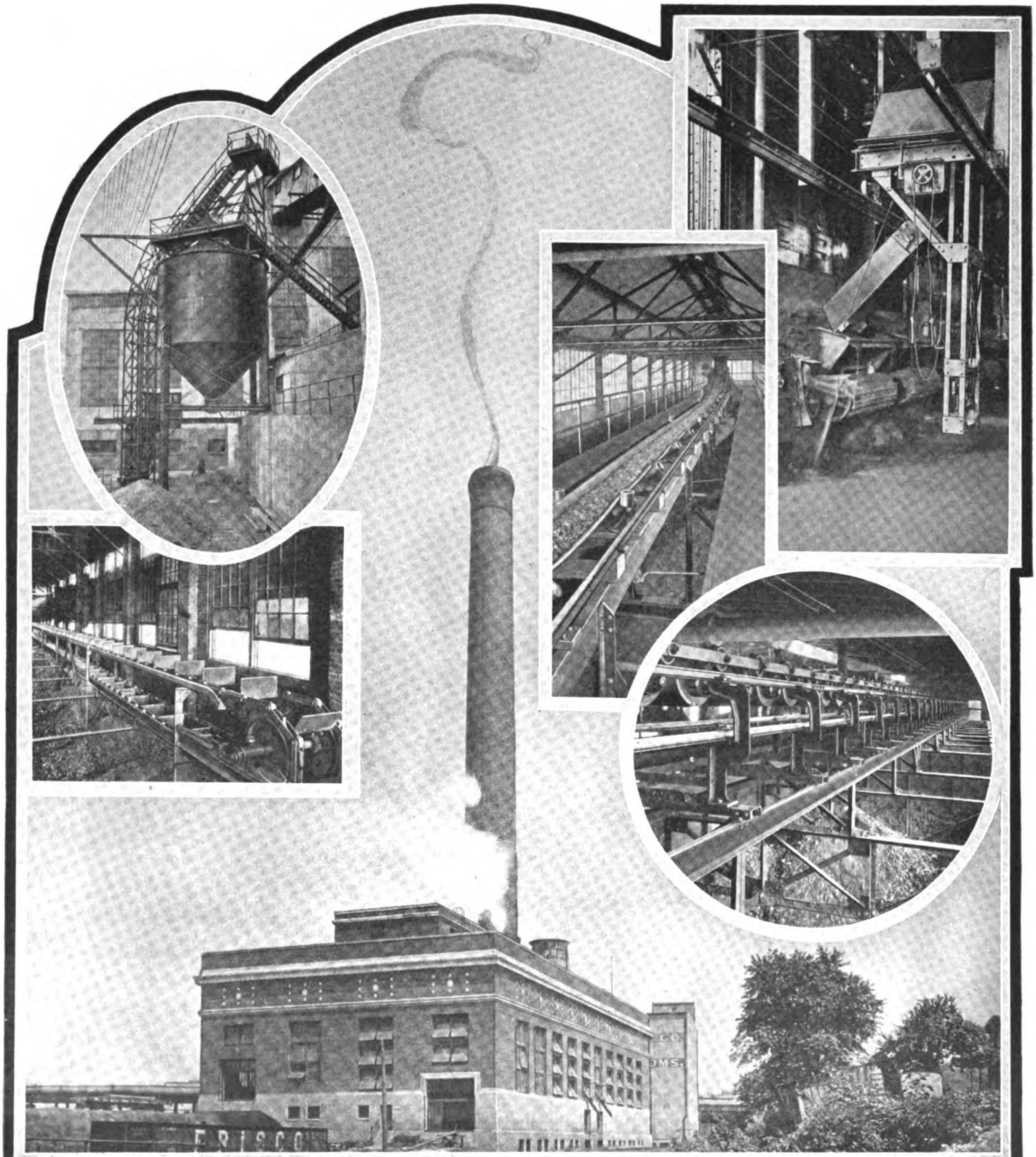
LINK-BELT LIMITED
TORONTO, Wellington and Peter Sts.
MONTREAL, 10 Gauvin Lane

1960

LINK-BELT

Coal and Ashes Handling Equipment

Equipment to Serve



Unloads Pig or Scrap Iron much cheaper than the steam-cranes.

The P & H can be moved readily.

Can do work that could not be accomplished at all with cranes on tracks.

10 INDUSTRIAL HANDLING September, 1924

Tractor Crane Repays Cost in Year

By P. W. Reck

Master Mechanic, The Bettendorf Company, Bettendorf, Iowa

THIS company has derived a great deal of satisfaction from the installation, some time ago, of a "crawler" type of tractor crane, a machine which propels itself over any kind of footing, regardless of obstacles, like an army "tank."

We have been using this piece of equipment on the difficult job of excavating ground for a tunnel 7 by 7 ft. and about 900 ft long, to be used for power transmission lines. In this work alone we estimate that the crane paid one-half of its cost in the first six months of use.

As we also have and use three 15-ton steam cranes of the locomotive type, we are able to make some interesting performance comparisons. We find that we can unload pig or scrap iron much cheaper with the tractor crane than with the steam machines. The tractor outfit can readily be moved to either side of a car, completely unloading it in short order, whereas the steam cranes have to get first on one end of the car and then on the other because their booms are not full car length.

The fact that the tractor crane can be used anywhere in or about the plant, track or no track, is also a great advantage, as work can thus be done that could not be accomplished at all with track cranes.

The Bettendorf Company's crawler-type tractor crane, which repaid half its cost in six months on excavating work alone. It is seen here handling pig iron with a lifting magnet.

The P & H is driven by gasoline or electric motor. It is ready for work at a moment's notice—and when not needed—whether for 30 minutes or 3 hours it can be as readily shut down. No fuel is wasted.

The operator has instant control of crane travel, hoisting and swing through a full circle. He can locate his P & H at either side or end of cars or material stock piles. Like P & H Electric Traveling Cranes and Hoists, P & H Corduroy Cranes provide dependable, economical service with low maintenance costs.

Let us mail our Bulletin 40-X to you.

Excavating Machinery Division

PAWLING & HARNISCHFEGER CO.

Established 1884

3850 National Ave., Milwaukee, Wis.

New York	Chicago	Philadelphia
Atlanta	Portland	Pittsburgh
Detroit	Memphis	Los Angeles
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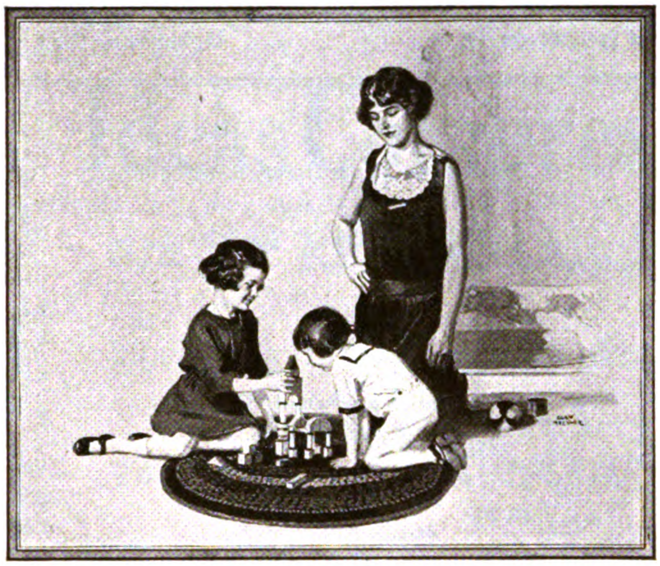
Warehouses and Service Stations: New York, Memphis, San Francisco

P&H CORDUROY CRANES



Tuberculosis might strike your home today

THERE is no precaution too great for you to take to protect your home and family from tuberculosis. Your children are constantly exposed to tuberculosis germs. The one effective protection against tuberculosis is the organized, co-operative campaign to stamp out the disease. It can be stamped out. Only half as many people die from tuberculosis today as died ten years ago. The organized battle against tuberculosis, carried on by the Tuberculosis Associations, has helped to save the other half.

Tuberculosis Associations are financed by the annual sale of Christmas Seals. One tangible, sure way to protect yourself and your family against tuberculosis is to buy Christmas Seals.

Buy Christmas Seals. Buy as many as you can. Seal every letter, Christmas card, and Christmas parcel with Christmas Seals.

STAMP OUT TUBERCULOSIS WITH CHRISTMAS SEALS

The National, State, and Local Tuberculosis Associations of the United States

CORRECT THE LIGHT—
PROTECT THE SIGHT

The Nearest Approach to Natural Daylight Yet Devised

The 9 A. M. Lens

Your workers are certainly entitled to the best light available. Apart from the standpoint of saving eyesight, good light reflects itself in less fatigue and steady production.

The 9 A.M. Lens Units provide a soft, white, clear and restful light, the easiest light to work with. We call it the 9 A.M. Lens because the light is similar to natural daylight at its best—at 9 A.M.

We are so confident that you have never seen its equal that we are willing to make this offer.

Try it out in Your Plant at our Expense

Fill in the coupon below and mail it to us. We will be glad to send you a 9 A.M. Lens Unit. Try it out at our expense and pay for it only after you are satisfied that it is everything we claim. Write today.

W. T. Edwards Corp.

100 Broad Street, New York

Branch Office: Pittsburgh, 204 Sixth Avenue

There are no Strings to this Offer

Use This Coupon

W. T. Edwards Corp.,
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Please send us one of your units for trial. It is understood that we are to try it out at no expense to us.

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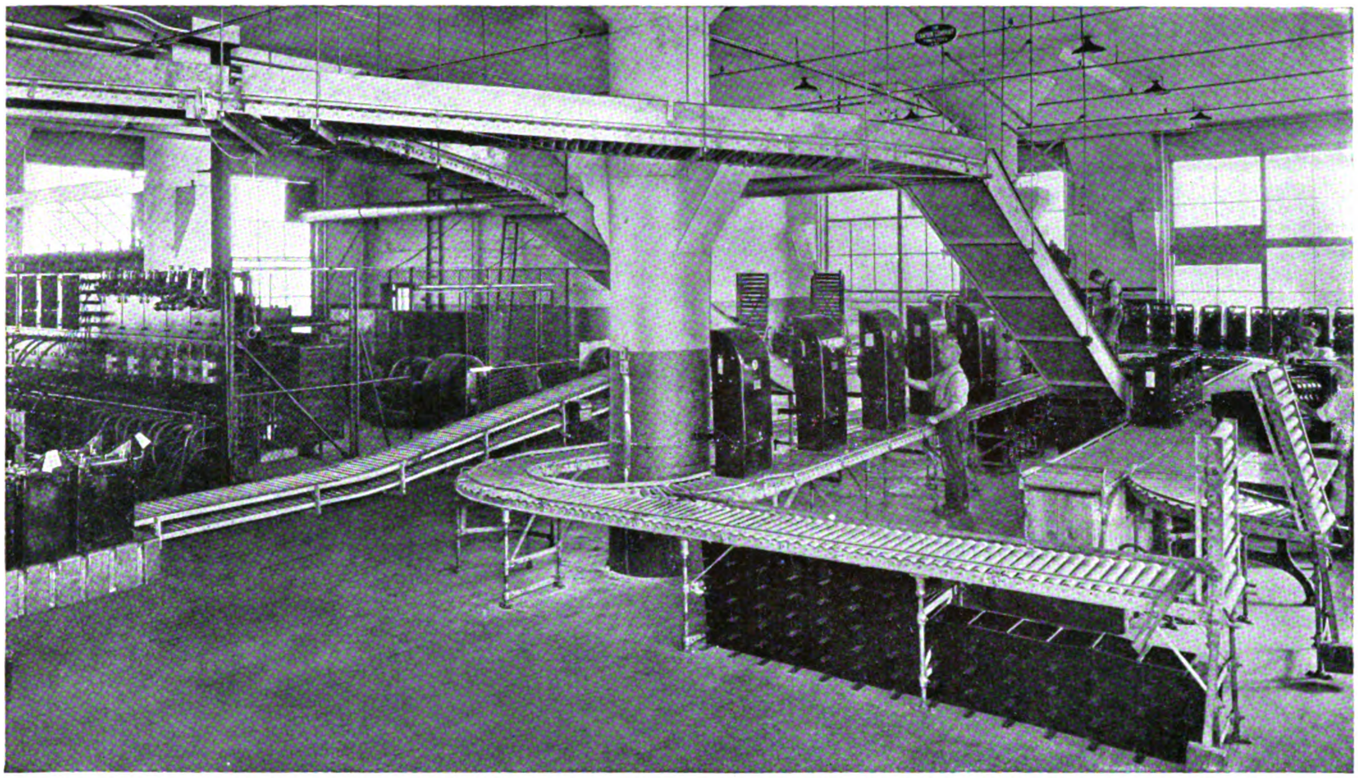

Lamson Conveyors help General Electric to solve difficult production problem

LIKE so many manufacturers, the General Electric Company, in their Bloomfield, N. J., plant, had a "problem that was different." Their compensator business had expanded. The assembly department had grown step by step. The time had come to apply a unified production plan.

Survey points way to profitable changes

A preliminary survey showed so many parts of different kind and size, so many separate operations, that the savings of the continuous flow assembly method seemed impossible.

But Lamson engineers, working in closest cooperation with General Electric plant engineers, delved deeper into the problem. The product was re-routed — like processes concentrated — waste space eliminated. The movement of parts was broken into separate "rivers," which flowed from stock to the various sub-assembly operations, then united in a main stream for final assembly, inspection, and packing.

The savings made by this system were remarkable.

1. **Labor cost was reduced.**
2. **Production was better controlled.**
3. **More output was obtained from the same floor space and equipment.**
4. **Material in process was cut down.**
5. **Accidents were reduced.**

Your production problems, too, can be solved by material handling.

PERHAPS you, too, have a "problem that is different." The door may seem closed to the great savings of the modern continuous flow method. But part of Lamson Service is helping to solve just such problems — designing material handling systems to meet unusual situations.

We should like an opportunity to serve you. A Lamson engineer will be glad to discuss your problem. Or, if you prefer, we will mail you booklets showing what we have done for others and how. No obligation, of course.

THE LAMSON COMPANY
SYRACUSE, NEW YORK
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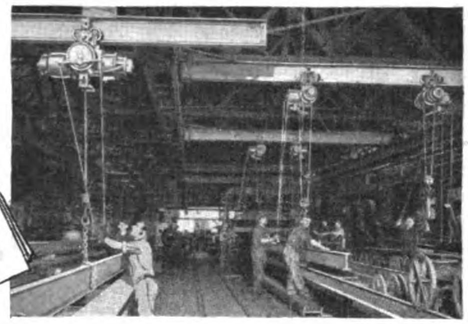
Hoist data for every hoisting service

Complete

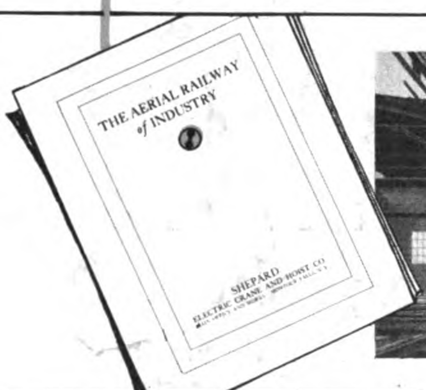
Comprehensive information from America's largest manufacturer of electric hoists. It is so arranged as to be easily understood and followed through.

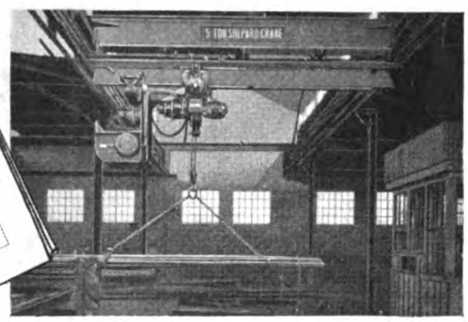
Capable of handling anything from ashes to automobiles and built in capacities of 500 pounds to 10 tons, Shepard Electric Hoists provide, for every type of business, a lifting and load moving service that quickly pays for itself in the money it saves. Learn about the different types of Shepard Hoists—secure the reference books below which give actual savings and complete data.



Shepard Electric LiftAbouts

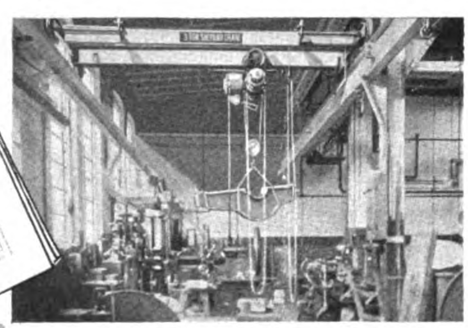
Executives in practically every line of business and industry report substantial savings with the Shepard LiftAbout. Truly, it is "an electric hoist for everybody." Built in ½ and 1 ton capacities. Easily and quickly installed. Easy to operate—by merely working the control cords, the operator moves the load up or down.





Cage Operated Electric Hoists

Tonnage loads are easily and quickly switched about with the Shepard "Aerial Railway." It provides "through without change" express service for any points covered by the overhead track. It is a combination of one or more Shepard Cage Operated Electric Hoists operating on Shepard Transfer Crane, monorail track and switches.



Floor Operated Electric Hoists
Capacities above 1 ton

Detailed information — dimensions, specifications, prices, installation views, descriptions — comprehensive data systematically arranged to be easily understood, is included in this new Shepard Hoist Catalog. It is a valuable hoist reference for your files.

Shepard Electric Crane & Hoist Co.
420 Schuyler Ave., Montour Falls, N. Y.

Without obligating us, send the catalogs as checked at the right.

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Address..................................

☐ LiftAbout "Book of Illustrated Economies"

☐ "Aerial Railway of Industry" Bulletin

☐ Floor Operated Electric Hoist Catalog

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