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POWER EDITION

OF THE

CANADIAN MANUFACTURER

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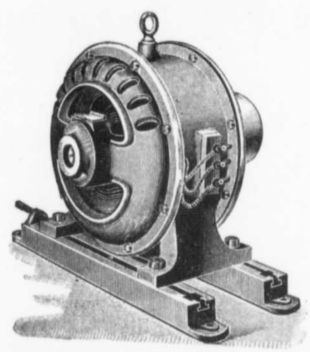

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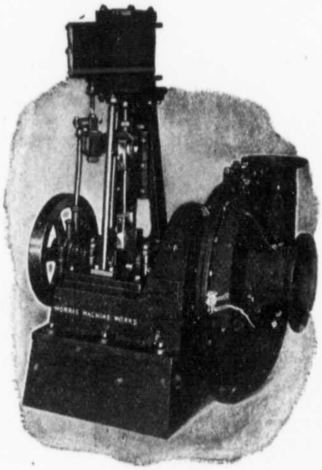


The Hochelaga Power House of the Montreal Street Railway

WRITTEN FOR THE CANADIAN MANUFACTURER BY HARRY L. SHEPHERD, MONTREAL.

The new power station is situated on Notre Dame street, two and one-half miles east of McGill street. The building is a brick, steel and concrete structure, 60 feet in height, with a ground area of 180 feet by 150 feet, and is made of fireproof material throughout, the window frames and sash being of cast iron glazed with wire glass. The floors are of reinforced concrete, supported by steel floor beams. The doors of the building are covered with sheet iron. An offset on the south side of the building forms the cable house, in which the switchboard is located. If necessary the building can be extended eastward, and to allow for this the east end has been closed in with a temporary board wall covered with sheet iron. The building foundations, the engine and auxiliary foundations, tunnels, walls, etc., are all of reinforced concrete.

GENERAL LAYOUT OF THE PLANT.

The plant is divided into two parts by a brick and steel division wall, the engine room and the switchboard gallery being to the south and the boiler room to the north.

On the main floor of the engine room there are one 1,000 K.W. Canadian Westinghouse, one 1,000 K.W. and one 2,000 K.W. Canadian General Electric 600 volt direct current generators, each driven by a McIntosh and Seymour engine, with space provided for a second 2,000 K.W. unit. The condensers, of the barometric type, are bolted to the exhaust nozzles of the engines and are supported by cast iron columns, which rest on steel framework in the engine room basement.

In the engine room basement are three steam-driven dry vacuum pumps, the feed water heaters, the oil pumps and filters and the air compressor. Below the basement floor are the condensor hot wells and a concrete tunnel into which the hot wells discharge. The tunnel discharges into a reservoir located under the cable house basement floor. From this reservoir a 48-inch steel pipe carries the discharge water from the condensors to the River St. Lawrence, a distance of about one hundred yards south of the power station.

The boiler feed pumps, the service pumps and the circulating pumps are located in the "dry well" (at the east end of the engine room), which measures about 60 feet by 40 feet and is 17 feet below the engine room basement floor. It is of ample size to accommodate all the pumps necessary for the ultimate capacity of the power house. The present capacity of the station, including the future 2,000 K.W. unit, is one-half of the ultimate capacity.

The pumps draw water from the "wet well." separated from the dry well by the foundation wall of the power station. As the variation of the water level of the river between extreme high water and extreme low water is about 35 feet, the concrete intake tunnel had to be carried down to a depth sufficient to supply the pumps with water at any stage of the river level. The water can be shut off from the "wet well" by means of gates operated by hand wheels on the engine room basement floor.

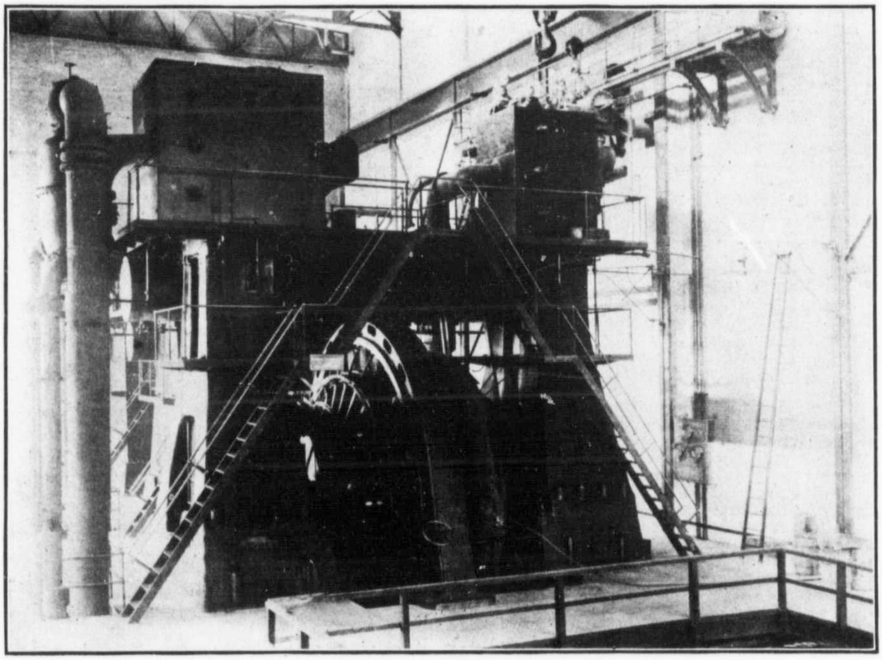


FIG. 1.—The 2000 K. W. Canadian General Electric Unit.

In the offset of the engine room, known as the "cable house," is located the switchboard gallery, which is 8 feet above the engine room floor. A portion of the bus structure, the field rheostats and the series field shunts are located on the cable house floor, below the switchboard gallery.

On the main floor of the boiler room are two rows of boilers facing each other, grouped in batteries of two. The room is designed for twelve boilers, or three batteries on either side of the fir-

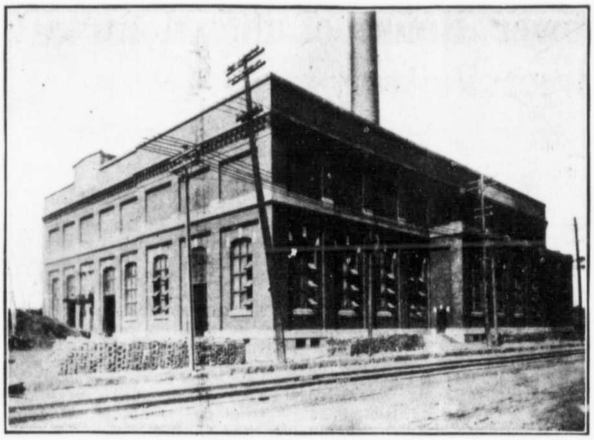


FIG. 2.—Hochelaga Power House taken from Notre Dame St.

ing floor. At present ten boilers are installed. The economizers are located directly over each row of boilers, with the main smoke flues behind each row of economizers.

The scrapers of the economizers are driven by two engines located on the economizer floor.

The concrete coal bunker, of 1,500 tons capacity, is directly over the firing floor.

The chimney is located at the east end of the boiler room.

COAL HANDLING APPARATUS.

A switch extending along the west side of the station contains a 100-ton track scale, and all the cars are weighed before and after being unloaded. The cars discharge into a hopper beneath the track. After passing through a steam-driven crusher, the coal is carried by a motor-driven bucket conveyor to the top of the boiler house structure and there automatically discharged to any part of the coal bunker, as may be desired. The conveyor has a capacity of 40 tons per hour. At the present time it is not intended to utilize the full capacity of the coal bunker for coal storage. Additional storage space is provided on the ground directly west of the power station. It is expected that arrangements can later be made so that coal may be conveyed from the coal pockets of the Dominion Coal Co. (situated on the wharf directly south of the power station) by means of an overhead or underground conveyor.

ASH HANDLING PLANT.

Small side dump cars, operating on tracks in the boiler room basement underneath the ash hoppers convey the contents of these hoppers to the west end of the building, where they discharge into a hopper directly over the coal conveyor, which hoists the ashes to the ash bunker adjacent to the coal bunker. The ashes are discharged by gravity from the bunker directly into electric cars on the coal switch.

BOILERS.

The boilers are of the Babcock and Wilcox water tube type, and are fitted with bent tube superheaters designed for 150 degrees superheat. They are constructed for 150 pounds pressure. Each of the ten boilers installed is rated at 535 h.p. and has 5,346 square feet of heating surface and a normal evaporation of 16,000 pounds of water per hour. The superheated steam is delivered to the engines from three steam drums, one over each of the batteries next to the engine room. The boilers on the opposite side of the boiler room feed into these drums. From a separate connection on the boilers the auxiliaries are supplied with saturated steam.

Each boiler is fitted with Babcock and Wilcox chain grate mechanical stokers. Two stoker engines are located in the boiler room basement, each capable of operating all the stokers. Coal is fed to the furnaces through down spouts extending from the overhead bunkers.

ENGINES.

Each generator is driven by a direct connected vertical cross-compound, side crank, McIntosh and Seymour engine, operating at 100 r.p.m. The cylinders are four-ported and provided with valves of the flat gridiron type and are fitted at each end with automatic combination relief valves and drip cocks. The main valves, both admission and exhaust, are driven by a fixed eccentric, and the cut-off valves are controlled by the centrifugal governor on the main shaft of the

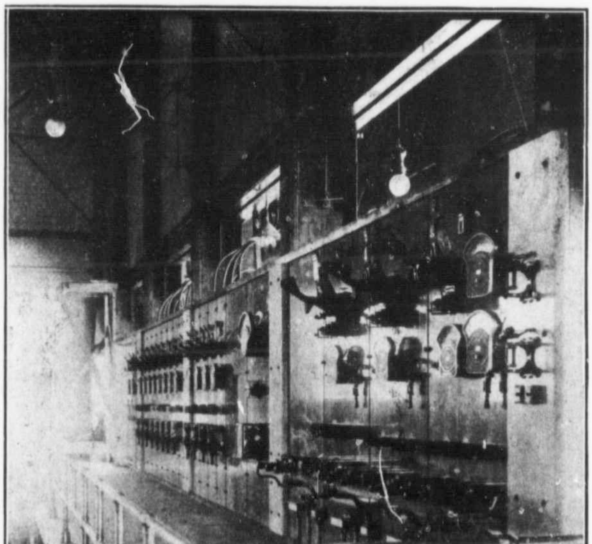


FIG. 3.—The Switchboard.

engine. Each engine is provided with an automatic safety stop, which operates a "Butterfly" valve placed above the throttle valve. An increase in speed of about seven per cent. will cause the engines to "throw out."

CONDENSERS AND CONDENSER AUXILLIARIES.

The condensing equipments are of the barometric type, with separate water and dry vacuum pumps. The guaranteed vacuum, with the engines operating at full load is 28 inches when the barometer stands at 30 inches, with the injection water at 60 degrees F. To prevent any water ..... may be entrained by the air from passing into the dry vacuum pumps, a separator is provided at the highest point of the air line and drains to the tail pipe. Each condenser is provided with an atmospheric relief valve, which opens automatically in case the vacuum is lost, allowing the engine to exhaust to the atmosphere. The exhaust pipe, in each case, is carried down and under the engine room floor to a main exhaust header, which joins the uptake near the chimney.

The three air pumps are single, steam-driven, horizontal, straight line, rotative, dry vacuum pumps. The three circulating pumps are two stage turbine pumps, direct connected to single cylinder vertical engines. No foot valves are used in the suction pipes.

The method of priming a circulating pump is as follows:—The air pump is started and sufficient time given to allow the vacuum created to pull the water up through the pump; the circulating pump is then started. Steam ejectors, now being installed, will allow the circulating pumps to be started without the use of the air pump. The condensers operate successfully without the use of the air pumps, a vacuum of 27 inches being maintained with full load on the engines. The condensers were manufactured by the John McDougall Caledonian Iron Works.

BOILER WATER SUPPLY.

The circulating pumps, besides supplying the injection water to the condensers, also supply water to two Cochrane open feed water heaters, the supply of water to the heaters being automatically regulated by floats. The exhaust pipes from all the main auxiliaries are brought together into one exhaust steam main, which discharges into the feed water heaters. The steam space in the heaters is in free connection with the outside atmosphere by being joined to the main exhaust uptake, thus preventing any back pressure on the auxiliary engines. From the heaters, which are located at the east end of the engine room basement, the water falls by gravity to the boiler feed pumps located in the "dry well" directly below the heaters. The boiler feed pumps, of which there are two, one being a spare, are Fairbank-Morse outside packed duplex plunger pumps, fitted with automatic pressure regulating governors. These governors are controlled by the pressure in the main discharge pipe, to which they are connected by a small pipe. As the water tender closes the feed valves to the different boilers the pumps slow down or are stopped automatically. The opening of the same valves starts the pumps up again. Connections are arranged so that the water may be forced either through the economizers or direct into the boilers. Two service pumps, one a spare, also fitted with automatic pressure regulating governors, supply water to a service tank located on the economizer floor. This service tank is also connected to the city water mains. Both supplies are governed by floats. The boilers are supplied from the service tank by the use of injectors, when the boiler feed pump is not running. For taking care of the high pressure drains separate Holly systems have been installed, one in connection with the superheated steam mains and the other in connection with the auxiliary steam mains. In each case all the drains are carried to a receiving tank, and from this tank, which is at boiler pressure, the water is forced to a closed tank 34 feet above the boilers, from which it drains direct to the boilers, passing first of all to a common loop, from which all the boilers can feed.

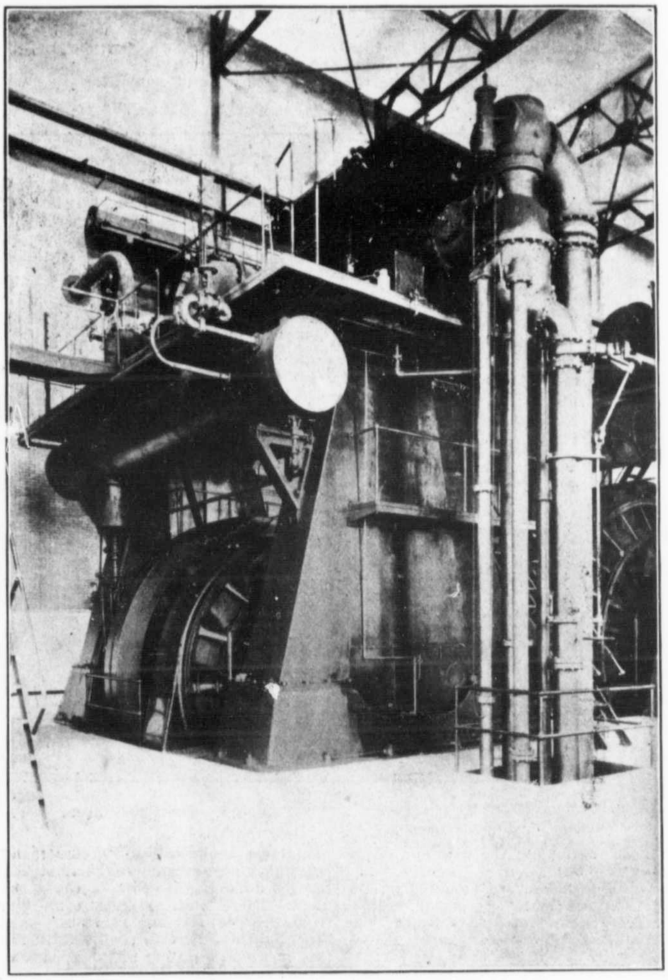


FIG. 4.—The 1000 K. W. Canadian General Electric Unit.

OILING SYSTEM.

To provide an adequate amount of oil for the engines a complete oil system has been arranged. In the engine room basement, next to the boiler room wall, are located the oil tanks, oil filters and motor operated oil pumps. Three tanks, two for engine oil and one for cylinder oil, are fastened on the engine room wall above the engines, into which the oil is pumped from the basement. The cylinder oil flows by gravity to a small tank on the platform of the large engine, from which it is drawn and distributed by hand to the cylinder oil pumps on each engine. The engine oil flows by gravity to small tanks on the engine platforms, and from these tanks flows, by gravity, to the oiling system of the engines, and from thence to the oil filters and tanks in the basement, and starts anew on its circuit.

ELECTRICAL EQUIPMENT.

The generators are all capable of a continuous overload of twenty-five per cent. and a one hour overload of fifty per cent.

The switchboard gallery is 8 feet above the engine room floor. It is 7½ feet wide,has a neat tile floor bordered on the outer side by blue Vermont marble, and is guarded with a brass railing. The switchboard panels are 9 feet high and of 2½ inches blue Vermont marble. The face of the switchboard is almost flush with the inside of the main south wall. The steel columns of the south wall of the engine room are, on the switchboard gallery, boxed in with white marble. The four generator panels, one being spare, are located in a bay between two of these columns at the west end of the gallery. The positive, negative and equalizer switches are mounted on the generator panels, all the machine cables being brought to the switchboard. The width of the generator panels, 4 feet, allowed sufficient space on the back of each panel for an accessible and substantial layout. In the bay east of the generator bay is a 4-foot totalizing load panel, a spare 4-foot future motor-booster panel, and beyond that the feeder panels, which are each 2 feet wide. On the totalizing load panel is mounted a 15,000 ampere range ammeter, a Sangamo integrating wattmeter of 15,000 amperes, and 100,000,000 K.W. H. capacity, operating from the shunt of the ammeter, and a Westinghouse D. C. recording (curve drawing) voltmeter. Duplicates of the instruments on the totalizing load panel will be mounted in the office.

The negative busbar is located in the cable house gallery near the top of the switchboard, and is supported on a substantial steel framework bolted to the steel columns of the generator bay. It is carried across the cable house and down the cable house wall to the ground busbar under the cable house gallery floor. The positive and equalizer busbars are supported on a steel framework on the cable house floor (on a level with the engine room floor), and provision has been made so that a booster busbar can, if necessary, be installed at a future date.

The feeder switches are all single pole double throw, the bottom jaw—the booster connection—not being used. On each feeder and generator panel is mounted a choke coil and a corresponding lightning arrester connection. This insures double protection to the generators. There is also a direct connection from the positive busbar to a "water box" lightning arrester, which still further insures the safety of the apparatus. With the exception of the Westinghouse recording (curve drawing) voltmeters and the Sangamo integrating wattmeters, the instruments are all of Weston manufacture. I. T. E. circuit breakers and Walker switches are used throughout. The generator circuit breakers and generator ammeter shunts and the totalizing load ammeter shunt are all connected in on the negative side. The shunts to the series fields of the generators are located on the cable house floor, taps being carried to them from the positive and equalizer straps under the cable house floor. The field rheostats are located under the switchboard gallery, and are operated "direct" from the rheostat stands on the switchboard gallery floor. Besides the brass rheostat stands there are also brass voltmeter plug stands and brass annunciator stands, all mounted in line on the switchboard gallery floor in front of their respective panels.

CONDUIT SYSTEM.

The lead covered machine cables are carried, in separate ducts, through the foundations, then down over wooden racks to concrete trenches, which cross over the discharge tunnel, located under the engine room basement floor. From these trenches the cables pass into bituminized fiber ducts of 2½ inches internal diameter. The fiber ducts lead to a common cable compartment directly below the switchboard gallery. From this compartment the cables are carried up on racks to meet the copper straps, connected to the switch studs, under the switchboard gallery. The connections to the machine terminal lugs and the lugs on the copper straps are made by cutting the lead back about 15 inches and taping from 6 inches back on the lead sheath along the varnished cloth insulation on the cables and over the mouth of the lug. Several layers of friction and rubber tape are used, each layer being varnished. The lead covered field cables will stand a test of 10,000 volts A. C. for five minutes, from core to sheath. The exposed parts of the field cables outside the trenches and ducts are run in "circular loom," as an extra protection to the lead covering.

The bituminized fiber ducts are laid in cement grout; all bends are of 3 to 4

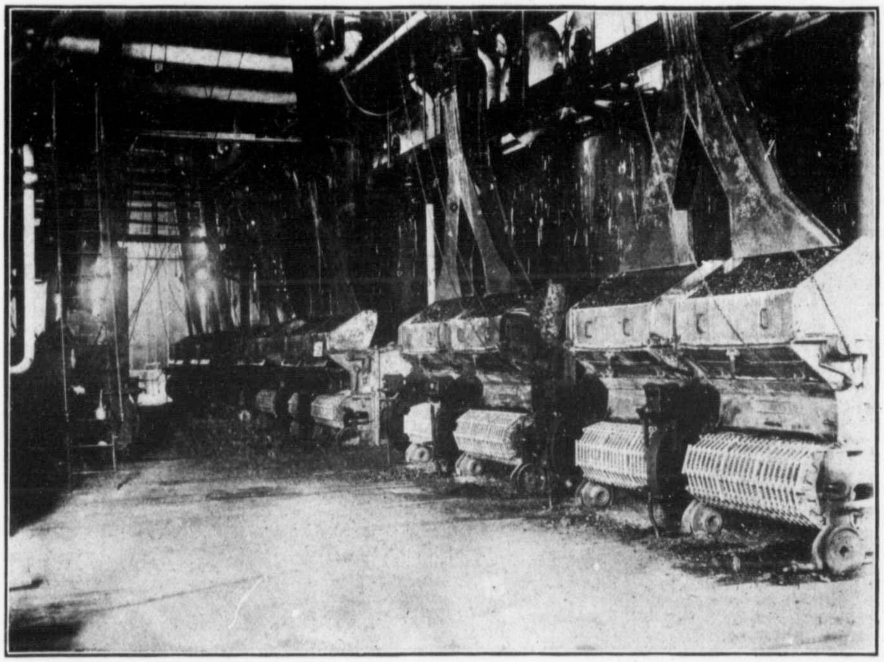


FIG. 5.—The Boiler Room.

feet radius, and are made up from 4-inch lengths. The use of the fiber ducts and the concrete trenches was necessary on account of the very limited space available. The trenches are covered with iron plates flush with the engine room basement floor.

The 1,000,000 c. m. copper feeders are carried up and across the cable house roof, then out through separate ducts in the cable house wall to cradles on two steel poles outside. From the cradles 500,000 c. m. copper feeders branch to the overhead feeder system.

The plans for the building were drawn by Messrs. Marchand and Haskell of Montreal; the construction and mechanical engineering features were carried through by the Canadian White Company, under the supervision of Mr. N. H. Rybitzki; the switchboard was designed by Mr. A. S. Byrd, Supt. of Power Plants of the Montreal Street Railway, and built by the Street Railway Company's staff. All matters pertaining to the engines, condensers and the complete electrical equipment were handled throughout by Mr. Ralph D. Mershon, Consulting Engineer for the Montreal Street Railway, the installation of the same being carried on under the supervision of the writer, who represented Mr. Mershon on the work.

The Correct Way to Apply Detachable Link Belt

By Staunton B. Peck, Vice-President of the Link-Belt Company in the Iron Age

When considering the relative merits of different methods of running chain-drives, the drive should be considered as a whole, and the action noted at the four points indicated in Fig. 1—(a) the entering point on the driver, (b) the releasing point on the driver, (c) the entering point on the driver sprocket, (d) the releasing point on the driver sprocket. In this discussion the action at a point is said to be good when all the articulation or bending takes place in the joint of the chain, Fig. 2. The action is said to be bad when, in bending, the link rubs on the sprocket, producing wear on the sprocket and outside or external wear on the hook, Fig. 3.

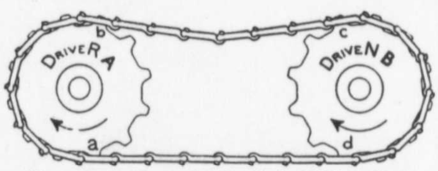


Fig. 1.—A Properly Applied Driving Chain.

Another fact is also to be remembered—there is never more than one tooth in action at any one time. No matter how carefully the chain and sprocket may be made, as soon as the load comes on, there is a change caused by stretch and wear. It can be predetermined which tooth shall be in action by making the pitch of the wheel either larger or smaller than the pitch of the chain. Thus, on the driver, Fig. 4, the wheel pitch being smaller than the chain pitch, the entering tooth does all the work. In Fig. 5 the conditions are reversed; the wheel pitch is the larger and the releasing tooth does the work. On the driven sprocket the same thing holds, except that here conditions are reversed. When the wheel pitch is smaller than the chain pitch the releasing tooth does the work, Fig. 6. When the wheel pitch is larger than the chain pitch the entering tooth does all the work, Fig. 7. For the best work the pitch of the driver should be larger than the pitch of the chain, see Fig. 5, and the pitch of the driven sprocket should be smaller than that of the chain, as in Fig. 6. The releasing teeth b and d are then the working teeth, and the chain can set at a and c quietly and take the load gradually as the wheel revolves.

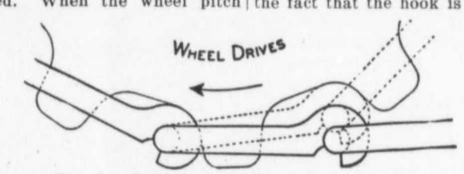


Fig. 2.—Good Action—Bar Working in Hook.

Fig. 3.—Bad Action—Hook Working on Bar.

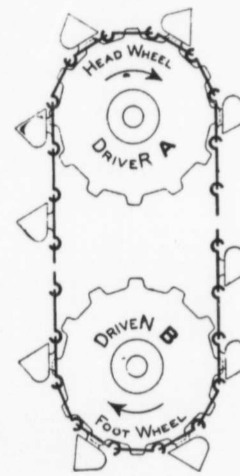


Fig. 12.—An Elevator Chain, with the Links Running Bar First.

Next to be considered is the drive as a whole to determine whether the chain links shall be run bar first or hook first.

In Fig. 8 the pitch of the driver is larger and that of the driven sprocket smaller than the pitch of the chain, hence b and d are the teeth in action. The chain runs with the bar of each link leading; the action at a is good, at b bad, at c good and at d bad. In Fig. 9 the sprockets are the same as in in Fig. 8, but the chain links run hook first. Here the action at a is bad, but the fact that the hook is not in contact with a tooth face at this point makes the consequent wear of little extent. The action at b is good. The action at c is bad, but this is on the slack side of the chain and this bad action causes no wear. The action at d is good. It is thus seen that there are two very bad points, b and d, where the links run bar first, and only one serious trouble, a, when running hook first.

As usually furnished the sprockets are ground to fit the new chain; when the latter stretches both the driver and the driven sprocket are smaller in pitch than the chain and teeth a and d are now in action. In Fig. 10 is shown a pair of wheels with the chain links running bar first. The action at a is good, at b it is bad, but as there is no tension on the chain at this point this is not objectionable. At c the

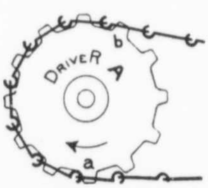


Fig. 4.—Wheel Pitch Smaller than Chain Pitch.

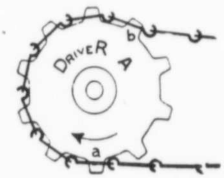


Fig. 5.—Wheel Pitch Larger than Chain Pitch.

action is good, at d it is bad. In this case, therefore, it would seem that the wear would be confined to the driven wheel. This is so in actual practice.

The same wheels with the links running hook first are shown in Fig. 11. The action at a is bad, at b it is good, at c it is bad, but not objectionable, because, as before, there is no tension at this point, and the action at d is good. Thus all the wear would seem to be on the driver as a result of the

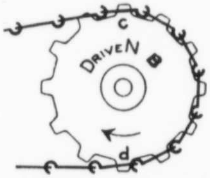


Fig. 6.—Wheel Pitch Smaller than Chain Pitch.

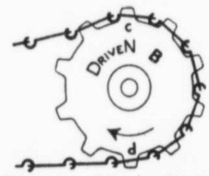


Fig. 7.—Wheel Pitch Larger than Chain Pitch.

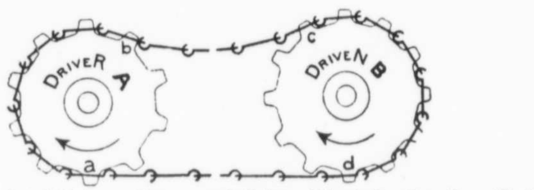


Fig. 8.—Pitch of Driver Larger and Driven Wheel Smaller than Chain Pitch, with the Links Running Bar First.

action at a. This is found to be the case, and theory and practice agree that with the chain links running bar first the driven wheel wears, and with the chain links running hook first the driver wears.

It is found that because the wear at d, running bar first, is caused by the link slipping up the tooth, it tends to undercut and form a hook and thus break the chain. On the other hand, the wear at a, when running hook first, is caused by the link slipping down the

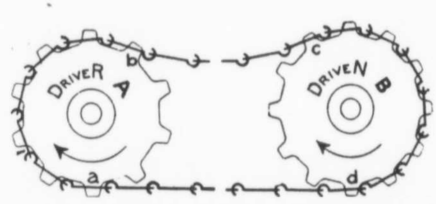


Fig. 9.—Pitch of Driver Larger and Driven Wheel Smaller than Chain Pitch, with the Links Running Hook First.

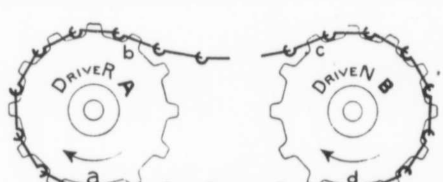


Fig. 10.—Pitch of Both Wheels Smaller than Chain Pitch, with the Links Running Bar First.

tooth, and the wheel will wear out completely without endangering the chain. It has also been proved that the driver, when running the chain links hook first, lasts several times as long as the driven wheel when running the links bar first. As the driven wheel is in nearly every case much larger than the driver, and the consequent wear on each tooth is less, it would seem that if the chain were run so as to wear the driven wheel the wear on the two wheels would be equalized. This would be poor practice, for the reason that the driver, being smaller, is more cheaply replaced and the repair account will therefore be less running the links hook first.

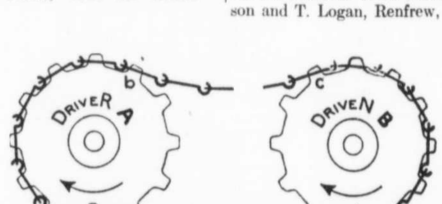


Fig. 11.—Pitch of Both Wheels Smaller Than Chain Pitch, with Links Running Hook First.

In elevators, Fig. 12, the head wheels act as a driver, the foot wheel simply as an idler, because it is doing no work. Therefore the chain links should be run bar first, so as to favor the driver. On conveyors one wheel is always an idler, comparatively speaking, and the same reasoning holds as for elevators; the chain links should run bar first in all cases.

The foregoing applies equally well to all closed end pin chains; the closed end corresponds to the hook and the pin end to the bar of the Ewart chain. In general, therefore, on drives run hook first, on elevators and conveyors, run bar first.

Plans are being considered for making about 2 miles of extensions to the transmission lines of the municipal electric light plant at Battleford, Sask.

The Halton Oil & Gas Co., Limited, Milton, Ont., have been incorporated with a capital of $40,000, to manufacture oil, gas, etc. The provisional directors include A. E. Guidal, G. H. Luxton and S. E. Brandon, Milton, Ont.

The Renfrew Knitting Co., Limited, Renfrew, Ont., have been incorporated with a capital of $50,000, to manufacture knitted and woven goods, etc. The provisional directors include J. G. Barnet, G. B. Ferguson and T. Logan, Renfrew, Ont

Danger in Lubricating Oils

To the Editor of The Canadian Manufacturer :

Dear Sir,—In your issue of July 17, there appears a letter headed, "Danger in Lubricating Oils," signed by Mr. O. E. Dunlop, Secretary of the International Acheson Graphite Co., in which he exploits the use of artificial graphite, "defloculated," for lubricating purposes.

While there is a great lack of agreement between the title of the article and its substance, it is not that feature which is to be criticised, but, rather, it is to Mr. Dunlop's statements as to the peculiar manner in which defloculated graphite fulfills the function as a lubricant, that exception is taken.

Before going on, it will be well to state that graphite exists in two forms; crystalline and amorphous. There may be some doubt as to the existence of natural amorphous graphite, as it may be that what is so-called is merely aggregations of minute particles of crystalline graphite assembled and compressed with earthy matter into the form in which it is found, but there is no question on this score concerning the artificial graphite which is undoubtedly amorphous in its form.

Returning to a consideration of the article in question, objection is first made to the apparent desire of the writer to use the word "unctuous" in an exclusive sort of way, as if no other graphite possessed this remarkable quality.

The facts are that all graphites have this quality, the crystalline more so than the amorphous forms, for the reason that when a crystal of graphite is broken, the cleavage surface is smooth, while in the case of amorphous graphite, and because it is amorphous, the line of the fracture is necessarily irregular and rough. It is only when the irregularities are worn away that such a surface becomes smooth and unctuous.

This quality (unctuousness) is usually determined by rubbing between the thumb and finger. This method does not give entirely satisfactory results for reasons as follows :

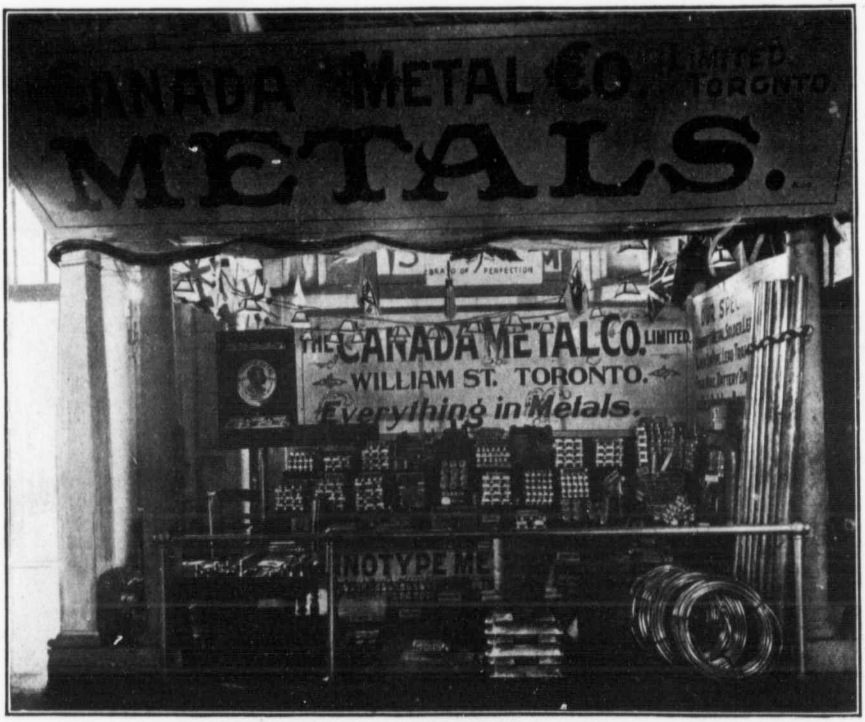
Crystalline graphite, either flake, needle-like or irregular, is dense and compact, and not easily reduced by crushing between the fingers, so that the individual particles maintain their size and continue to be easily felt, while on the other hand the amorphous kinds of graphite, both natural and artificial, continue to be reduced in size until the particles no longer are evident to the touch and the "unctuous" sensation comes into evidence.

Display of Electrical Equipment by J. F. B. Vandeleur Toronto.

Second, "a true lubricant" is described as "a body that will subdivide so that all movement will be within itself and not between it and the adjacent metal" ; also, "Acheson graphite meets this requirement and is of a nature that permits of slipping within its own mass without any expenditure of energy that will produce high temperature."

The close connection of the definition of a perfect lubricant, and the mention of graphite as possessing the qualities of a perfect lubricant is deceptive. This definition of a true lubricant is a very excellent one, and describes perfectly a liquid or semi-liquid substance where the material adheres to both friction surfaces and the globules between are in constant movement one on the other, but no stretch of our imagination can enable us to conceive such a condition when considering graphite, which is a solid substance and which requires considerable force to render the particles asunder.

What Mr. Dunlop would have this definition apply to is evidently a mixture of oil and graphite such as he describes; substance, the fallacy of which is of course apparent. The separating substance, in addition to keeping the surfaces apart, must not in any way detract from the smooth frictional surfaces, and on the other hand, must make them smooth when they are rough. Graphite fulfills these requirements provided it becomes permanently attached to the surfaces. A reasonable doubt might be entertained as to whether the defloculated graphite can readily become attached to the frictional surface since it passes through the pores of filter paper, which would indicate that the particles of graphite are surrounded by an



Display of Metals by the Canada Metal Co., Limited, Toronto.

but such a mixture acting in the way he mentions can have no particular advantage over a non-graphited oil as a lubricating material, because the particles of graphite, being in perfect suspension cannot break through the surrounding film of oil or easily become attached to the metal surfaces. They simply move about in the oil film without at all decreasing the viscosity of the oil itself, the only way in which any reduction of friction could be brought about. In fact, a mixture of finely divided graphite and oil has a higher viscosity than that of oil alone, and so reduction of friction is not to be sought along this line.

Mr. Dunlop points out the real function of graphite as a lubricant when he says that its presence serves to keep the metallic surfaces apart. But so would the presence of any solid material such as sand, carborundum or any abrasive unbreakable oil film. But if these particles could become attached to the frictional surface, efficient, but not lasting aid to lubrication, would certainly result.

As was said, these amorphous graphites, both artificial and natural, are extremely friable and easily worn away.

"Place a very little amorphous graphite on the palm of the hand and rub with the finger and notice that it cannot be rubbed off." The above has been cited as an evidence of the adhesiveness of amorphous graphite, but go a little farther, wash and dry the finger between repeated rubbings, and it will soon be noticed that the finger slides over the palm with difficulty, though the graphite still appears to be there. Now what has happened? Simply that the graphite, being so friable, has all been worn off the high points, while enough remains in the depressions to give the idea that it is all there. The very fact that the rubbing finger continues to get blackened between washings, shows how easily the amorphous graphite wears away.

Now place some crystalline graphite, preferably flake, in the hand and repeat the experiment, and note how much less rapidly it blackens the rubbing finger.

It has been always understood that wear means friction. Because of this belief, steel wearing parts are tempered. Knife-edge bearings of fine balance are made of hardest agate.

In all friction surfaces there are irregularities both above and below the normal surface. It is the irregularities above the normal that cause the trouble, and it is important that whatever surfacing material is used should be able to build up the surfaces to the level of the high points, rather than to simply fill up the very minute pores of the metal. It is not conceivable that any particle of graphite small enough to go through a filter paper could become impaled on one of these projecting peaks, but such a result is entirely possible where the broad flake is used. Even on smooth surfaces the flake form of graphite adheres with wonderful persistance and its resistance to wear due to its smooth crystalline surface and compaction is remarkable.

JOSEPH DIXON CRUCIBLE CO.

Jersey City, N. J., Sept. 2, 1908.

THE POWER EDITION

OF THE

CANADIAN MANUFACTURER

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THE POWER EDITION.

This issue of The Canadian Manufacturer is the second number of the schedule announced in our issues of August 7 and 21.

The first, The Office Edition, was devoted exclusively to office work and needs. This issue, The Power Edition, is devoted entirely to power problems and appliances.

We were delighted and gratified by the reception given The Office Edition; by the general expression of approval it aroused. We hope for and believe we have reason to expect a reception for this edition which will be fully as cordial and encouraging.

For many years we have been paying a great deal of attention to the power problem in Canada, especially in its relation to manufacturers. This study led us to realize that the generation and transmission of power was of such importance to our readers, the manufacturers of Canada, that it warranted our devoting one issue each month to this field and its problems.

In the past we have been content to reach the owners, managers and superintendents of manufacturing concerns. Hereafter, while we hope to continue to make it of value to the thousands of firms who are already subscribers, we will endeavor to reach with this issue the stationary engineers, the operating electricians: in short, the practical power men of Canada.

If any reader will suggest any way by which we can make the paper of still greater value to the practical men we would sincerely appreciate the suggestion and do everything in our power to carry out its good features

A WORD TO ADVERTISERS.

This is not a new paper.

True it has a new appearance, a new significance, a new purpose. Yet behind it is nearly thirty years of effort to serve the great power users of Canada, the manufacturers.

It starts with a subscription list including thousands of the most important concerns—a list which a new paper, no matter how aggresive, could not duplicate in three years.

It starts with the advertisements of nearly all the leading Canadian manufacturers of power equipment, yet nine out of ten of these advertisers have been using The Canadian Manufacturer for from twenty-five months to twenty-five years.

It is easy to promise to do big things with a new paper—to promise to GET a big subscription list—but it is not always so easy to accomplish this. We, therefore, want to emphasize that we are in a position to do a little more than to merely promise. We can GUARANTEE a couple of thousand of the best possible class of readers and can PROMISE to make as big an effort as possible to get additional subscriptions from practical men.

"A bird in the hand is worth two in the bush." We guarantee the "bird in the hand," and hold out to you the opportunity of also reaching as large a number of "birds in the bush" as any new paper could reasonably expect to reach.

THE CANADIAN NATIONAL EXHIBITION.

Canada in general and Toronto in particular has good reason to be proud of the Canadian National Exhibition, especially as it has been conducted in recent years, under the able management of Dr. Orr.

Year after year it has grown in popularity, in its educative value to all classes of visitors and in its commercial value to the manufacturers and merchants who exhibit their wares there. Each year it seems to reach the apex of possible attainment, but each successive year witnesses new records for attendance, interest and in revenue.

All this has not happened without a cause. The bold course taken by the authorities five years ago in erecting such magnificent and permanent structures as the Manufacturers' Building, the Process Building, etc., gave exhibitors the opportunity and the impetus to greatly improve the appearance of their booths and the attractiveness of their displays, thus adding to the interest and so increasing the attendance.

The cumulative force of more attractive exhibits and steadily increasing attendance has not spent itself. It is absolutely necessary that provision be at once made for better accommodation for two classes of exhibitors.

The manufacturers of machinery and power equipment have for several years been pleading for a modern building for the display of their wares. The effect of the delay in granting this request has been felt this year in the withdrawal of many prominent exhibitors. The carriage manufacturers have taken a radical course to express their need of a suitable building. Practically every one of them refused to exhibit this year.

A NEW MACHINERY HALL WANTED.

To many people in any community nothing is more fascinating than the whir and action of machinery in motion. Not only does such a display attract the practical man intent on increasing his technical knowledge of developments in machinery design and construction, but it has a magnetic influence over the average man or woman.

"Machinery Hall" has ever been one of the most popular buildings at the C.N.E. Nearly every day it has been the scene of crowds of interested, fascinated visitors from early morning till late at night. The publicity secured by exhibitors there has unquestionably been of great value to exhibitors.

Each year, however, many exhibitors have hesitated about incurring the great trouble and expense incurred in placing their heavy machinery or power equipment in a building utterly unsuitable for the handling or display of such goods. This year, partly as a result of this and partly as a result of the money stringency, several of the most prominent exhibitors have withdrawn their exhibits, with the result that in the building supposed to be exclusively devoted to machinery, several booths had to be filled up with potato peelers, smoothing irons, roller skates, agricultural implements, etc.

Machinery men are unanimous in their demand for a new building and we would commend their demand to the attention of Dr. Orr and his assistants.

THE CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

In this issue we present our readers with a full official report of the annual convention of the Canadian Association of Stationary Engineers, recently held at Windsor, Ont.

The report will be of especial interest to engineers, but it is also desirable that manufacturers should read it, so that they may fully understand the aims and objects of this organization.

In some quarters the opinion that this body is similar to a trades union has been manifested. This, however, is quite incorrect. The C. A. S. E. has carefully and consistently sought to make itself an educative body and to avoid causing any lack of harmony between its individual members and their employers.

The attitude of the body in this matter is well defined in the preamble to the constitution of the Executive Council, which reads as follows:

"This Association shall at no time be used for the furtherance of strikes or in any way interfere between its members and their employers in regard to wages. It shall recognize the identity of interests between employer and employes and shall not countenance any project or enterprise that will interfere with perfect harmony between them. Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the promotion of educational, professional and mechanical knowledge."

Manufacturers of all classes and in every part of Canada will be sure to give their cordial support to an organization like the C. A. S. E., the great purpose of which is to increase the usefulness and efficiency of the individual member.

Canadian Association of Stationary Engineers Meet at Windsor

Official Report of the Nineteenth Annual Convention.

Supplied to The Canadian Manufacturer by W. A. Crockett, Secretary of the C.A.S.E.

The nineteenth Annual Convention of the Canadian Association of Stationary Engineers was held at Windsor, Ont., on August 11, 12 and 13, 1908. The convention opened on Tuesday, the 11th, in the City Hall, which had been converted into a typical convention hall, with bunting and flags in evidence in every direction and with tables at the rear of the hall for the display of supplies, catalogues, booklets, etc. by exhibitors. When the convention assembled the hall presented an attractive as well as animated appearance.

Mayor Wigle was on hand and extended a cordial welcome to the visiting delegates. W. C. Maybury, who was mayor of Detroit so long that people forgot to keep track of the number of terms, held the championship for extending official welcomes, but the honor now belongs to your humble servant, Ernest S. Wigle, Windsor's chief executive, who is recognized past grand master of the Noble Order of the Glad Hand and Beaming Countenance. He expressed the hope that when the engineers returned to their homes they would carry with them the highest opinion of the border town.

He extended to them the freedom of the City of Windsor.

Ald. Foster, like his namesake, is quite an orator, and his words of welcome were couched in brilliant phrases, pointing out the beauties of the position of Windsor. The address of welcome was replied to by treasurer A. M. Wickens.

E. Grandbois, executive president, was in the chair.

The roll being called, with two exceptions, all the delegates were present.

The executive officers were:

Past president, Joseph Ironsides, Hamilton.
President—E. Grandbois, Chatham.
Vice-President—Chas. Kelly, Chatham.
Treasurer—A. M. Wickens, Toronto.
Conductor—W. McGhie, Toronto.
Doorkeeper—J. J. Heeg, Guelph.
Secretary—W. A. Crockett, Mount Hamilton, P.O.

After the termination of the reception ceremonies the Association went into regular session and the business of the convention began.

Bros. W. A. Sweet, W. Norris and W. McGhie, the Committee on Credentials, reported that so far twenty delegates had filed credentials.

W. A. Crockett, Executive Secretary, then read the minutes of the last Grand Meeting, which were duly approved and adopted.

Moved by Bro. W. Norris, seconded by Bro. W. A. Sweet, that minutes be confirmed. Carried.

Committees Appointed.

The following were appointed to the Striking Committee by President Grandbois.

Striking Committee—Bros. W. Norris, John Bain, A. W. Borbridge, J. Ironside, J. Ogle.

This Committee proposed the following names for the Standing Committee.

Committee on Good of the Order—Bros. Fowler, London; McGhie, Toronto; Tait, Toronto; A. W. Borbridge, St. Thomas; J Ironside, Hamilton; J. Ogle, Brantford; F. Robert, Ottawa.

Committee on Ways and Means—Bros. H. R. Clark, Hamilton; W. H. Bradt, Windsor; W. I. Dolan, Berlin; E. Phelps, Petrolia; F. Revell, St. Thomas.

Mileage and Per Diem Committee—Bros. C. Moseley, A. W. Heath and S. Keats.

Moved by Bro. W. Norris, seconded by Bro. Dawson, that the report of Striking Committee be received. Carried.

Moved by Bro. Moseley, seconded by Bro. W. E. Archer, that auditors be appointed for 1907-08 by the president, and that their services be ended at this convention. Carried.

Bros. Phelps, Dolan, Robert and Norris pointed out how necessary it was to be guided by the constitution in every detail.

Bros. Fowler and Tait were appointed auditors.

Moved by Bro. Dawson, seconded by Bro. Fowler, that Bro. Phelps, delegate from Petrolia, be admitted. Carried.

The Executive Secretary was deputed to introduce Bro. Phelps to the convention, and he was heartily received.

Group Photo of Members and Visitors at the Annual Convention of the Canadian Association of Stationary Engineers held at Windsor, Ont., in August.

Secretary Crockett's Annual Report.

Secretary W. A. Crockett read his annual report as follows:

Gentlemen and brothers,—I have again the honor and privilege of submitting a report on the proceedings of the Executive Council of the C.A.S.E. for another year, this being the nineteenth year of our existence. Two new lodges have been added to our ranks, Midland and Ottawa, and in this connection I desire to mention the names of J. Baldwin, Midland, Bro. Donaldson, Toronto, and F. J. Merrell, Ottawa.

I desire to thank the officers of subordinate lodges for their courtesy and promptness. I also thank Berlin for their reception this spring. I visited during the year Berlin, Windsor, Chatham, London and Toronto. Had time permitted I should have been delighted to visit mor.. [illegible]

I trust that nothing has arisen to mar the harmony and good feeling that exists among our members.

There have been many enquiries concerning our association, especially from the Northwest Territories.

Our finances are in good shape, and we are steadily forging ahead, as the following statement will show:

Receipts to July 31st, 1908:
August, 1907:

Cash on hand	$373 24
Dues, etc	300 28
Interest to date	2 77
	$675 59
Disbursements:	
Expenses of Guelph Convention	$213 40
Secretary's honorarium	25 00
Ed. Grandbois' expenses	7 30
Committee meeting, Oct., '07, Toronto	14 50
Guelph souvenir	17 50
Stationery, etc	46 85
Printing and Advertising	30 00
Lapel buttons	36 75
Postage, express charges, etc	19 56
Total	$409 86

Receipts	675 59
Expenditure	409 86
Cash on hand	$265 73

Membership is as Follows:

Toronto, Lodge No. 1	104
Hamilton, Lodge No. 2	60
Brantford, Lodge No. 4	7
Ottawa, Lodge No. 7a	36
Guelph, Lodge No. 7	31
Berlin, Lodge No. 9	14
Waterloo, Lodge No. 17	9
Chatham, Lodge No. 21	21
Owen Sound, Lodge No. 25	21
Galt, Lodge No. 27	24
Kingston, Lodge No. 27a	27
Windsor, Lodge No. 28	22
Petrolia, Lodge No. 29	21
London, Lodge No. 30	51
Stratford, Lodge No. 31	29
St. Thomas, Lodge No. 32	35
Midland, Lodge No. 33	18
Total	520

The names and addresses of the Lodge Secretaries are as follows:

W. B. Archer, 213 Pape Ave., Toronto.
C. A. Leckie, 58 Ashley St., Hamilton.
J. Ogle, 73 Richmond St., Brantford.
F. J. Merrell, 38 Fourth Ave., Hintonb'rg.
J. J. Heeg, Box 825, Guelph.
C. Emmeritz, 186 Victoria St., Berlin.
Chas. W. Dobbin, Waterloo.
J. Congdon, Box 113, Chatham.
Wm. Johnston, National Table Co., Owen Sound.
E. W. Geiger, Preston.
P. J. Milne, 164 Bagot St., Kingston.
J. J. Jacob, 99 Crawford Ave., Windsor.
E. Preston, Petrolia.
W. Norris, 47 Bipam Ave., London.
A. Scrimgeour, 362 Brunswick St., Stratford.
S. D. Spire, Box 523 St. Thomas.
John A. Baldwin, Clinton.

I strongly recommend the Committee on Good of the Order to consider the advisability of extending work along the line of last year's report. The License Law has been amended, and will come into force on January 1st, 1908. The Government of Ontario have promised to appoint examiners in the near future to act under the new law. A circular letter was issued to all the subordinate lodges.

(Signed) W. A. Crockett.

Windsor, Aug. 11, 1908.

The Circular Letter.

Dear Sirs and Brothers.—At no time in our history have we needed more help and assistance than at present. Our future depends to a great extent on what we do now. The world seems to say, "Do something, and do it now." That something we should all assist in doing. To the secretaries of subordinate lodges I desire to point out the fact that your individual council is needed. We have the framework of the finest technical association for engineers in existence and it remains for every individual engineer to help us to pursue a persistent, wise and steady course, and thus to be assured of final success and prosperity.

Again and again it has been pointed out that the C.A.S.E. is formed for the purpose of mutual instruction and advancement in the profession, and for social intercourse.

We are steadily advancing, and so we should, because our principles are so founded as to insure success; and so to this end we again bring to your notice our preamble.

We have associations in Toronto, Hamilton, Brantford, Galt, Guelph, Berlin, Ottawa, Waterloo, Chatham, Owen Sound, Kingston, Windsor, Petrolia, London, Stratford, St. Thomas and Midland. Every city, town and village where seven or more engineers are employed should organize and join us. We are not a labor organization. We invite to our open meetings every engineer who is not a member, and we would like the manufacturers to accept the invitation to attend our meetings and take part in the discussions with us. We want every engineer to join us, not so much for pecuniary help, although that is needed in equipping our lodges with indicators, models, etc., as for individual co-operation in advancing our profession.

It is the organized effort that counts, and counts big. The engineer who can help us best is the one who attends his meetings regularly. He becomes a trained and accurate worker and assists others to be the same. Your example is followed by others; your attendance encourages others, thus adding strength to your own. Working on these lines will eventually expand and strengthen your arena of influence, extending your mental horizon. Again you will need us and we will need you.

If while being organized we work together in harmony we can triumph over a vast number pulling in different directions.

If you believe in co-operation, co-operate with us. Knowledge is power but remember we cannot know it all, as it takes everybody to know everything, and very little of anything is yet known. Our association is made up of subordinate lodges, and these lodges of individuals. As the members are true to the lodge, the lodge is influential in the association.

Toronto Lodge No. 1, recommends as follows:

Executive Council Constitution.

Amend article XII, section 1, to read as follows: The annual convention be held bi-annually.

Subordinate Constitution:

Amend article XI, section 2, by inserting after the word "fees," the words, "Not to exceed the sum of $1." That article XIII, section 1, be rescinded.

It is probable that a resolution will be brought forward to the effect that no delegate will be permitted to act on the Executive Council unless actually operating or in charge of a plant.

(Signed) W. A. Crockett.

Moved by Bro. Moseley, and seconded by Bro. Dawson, That the secretary's report be received and handed to the Committee on Good of the Order, and that the secretary be one of that committee. Carried.

Treasurer's Report.

The treasurer, A. M. Wickens, stated that the year's finances were in good shape, and that although books were only posted up to July 31st, that $208 had been received since August 1st, making a cash balance of $473.73. Moved by Bro. Moseley and seconded by Bro. Archer, that the treasurer's report be received. Carried.

The meeting adjourned at 3.10 p.m. to meet again at 7 p.m.

Tuesday Evening Session.

The evening session opened shortly after seven o'clock.

Moved by Bro. Kelly, seconded by Bro. Archer, that in future all amendments and by-laws shall be sent to the Executive Secretary on or before the first day of June preceeding the meeting of Convention. Amendments to be printed or typewritten and a copy of same to be mailed to each of the subordinate associations not later than July 1st of each year, and any amendment received after the date above mentioned shall not be entertained.

After much discussion for and against the amendment, it was carried.

Moved by Bro. Archer, seconded by Bro. Bain, that Constitution, Article XII, Section 1, be amended to read: The Annual Convention shall be held on the last Tuesday in July each year and shall last for three days unless it be found necessary to lengthen or shorten the session by one day. This can only be done by motion. Carried.

This was freely discussed by Bros. Revell, Moseley, Kelly, Wickens, Tait, Bain, Norris, Dawson, Borbridge and Heath.

Moved by Bro. Moseley, seconded by Bro. Tait that convention be held bi-annually.

After much discussion the motion was lost.

Moved by Bro. Archer, seconded by Bro. Dolan, that Article XI, Section 2, page 15, of Constitution, be amended to read after the words on payment of not more than $1.00 shall be, etc.,—. Carried.

Moved by Bro. Archer, seconded by Bro. Taylor, that Article XIII., Section 1, page 16, be rescinded. Carried. As this refers to Sick Benefit Fund it was deemed advisable to do away with this feature.]

The meeting adjourned until 9 a.m. Wednesday morning, in order to attend the banquet tendered the association by Windsor Council.

The Annual Banquet.

This function proved most generous and brought everybody present into the most cordial spirits. Many Detroit engineers, members of the N.A.S.E., added by their presence, to the enjoyment of the evening.

Vice-President Kelly acted as toastmaster.

The toast to "Our King" was honored by singing the National Anthem, in which the Detroit visitors enthusiastically joined.

"Canada" was proposed by inimitable Jack Armour, and was responded to by Bros. A. M. Wickens, Toronto; W. A. Crockett, Hamilton, and J. T. Wing, Detroit. Mr. Wing referred to the good feeling that existed along the border and trusted the time would arrive when no customs barrier was needed.

"Our Legislative Assembly"—Responded to by Hon. R. F. Sutherland, speaker of the Canadian House of Commons. In his wonted style Mr. Sutherland set forth the advisability of education and technical training in conjunction with the practical side of things. He spoke of the great benefit which would accrue from the Tercentenary celebration at Quebec, and said that he thought the C.A.S.E. were moving along right lines and should be better appreciated. Said the speaker: "I am a stationary engineer myself. I am stationary in my chair, yet it takes some good engineering at times to keep things running smoothly in the House."

"Our Mayor and Corporation"—Responded to by Mayor Wigle, Ald Foster and Ald. Stewart. All expressed themselves as being in accord with the aims and objects of the Association of Engineers.

Fred. Low, Mayor of Passiac, N. J., also spoke, and being editor of "Power," was in sympathy and liked to keep in close touch with the C.A.S.E.

"Our Executive Officers"—Responded to by Bros. Moseley, Sweet and Norris, who outlined the aims and objects of the Association.

"Our Subordinate and Sister Societies"—

Wednesday Morning Session.

Shortly after 9.30 a.m. on Wednesday morning the convention opened, all members being present when the roll call was read.

Delegate Taylor wished information re badges for subordinate lodges. He was referred to Secretary Crockett, who told him that an official button was issued, also that officers

to the Northwest Territories. Carried. Moved by Bro. Moseley, seconded by Bro. Phelps, that the Secretary have full power to settle any little troubles and differences re the business of the Executive. Carried.

Moved by Bro. Moseley, seconded by Bro. Kelly, that credential cards be supplied to subordinate lodges with instructions that signature of the President and Secretary of

Exhibit of Asbestos and Magnesia Products by the Canadian H. W. Johns-Manville Co., Toronto.

Responded to by H. E. Stone, Past President of the N.A.S.E., who expressed his love for and good will toward the C.A.S.E. He spoke at length on the good to be derived from connection with societies of this kind. Too much stress cannot be placed upon this feature of this organization. Bro. Dawson also spoke in the same strain. Bro. Borbridge also responded.

of subordinate lodges always wore these emblems while in session.

Bro. Taylor expressed the opinion that on account of the many bright and good ideas possessed by Bro. Norris he be placed on the Good of the Order Committee. Allowed.

Moved by Bro. Dolan, seconded by Bro. Dawson, that we endorse the attitude taken by our Secretary, in some matters relating

subordinates be affixed thereto. Carried. Moved by Bro. Wickens, seconded by Bro. Archer, that our ladies be permitted to form an auxiliary lodge to assist in convention work. Carried.

Bros. Fowler, Clark and Dawson spoke of the good work done by the ladies of Windsor in entertaining the visiting ladies to auto rides around Detroit and Windsor and the kind manner in which they were treated.

Moved by Bro. Bradt, seconded by Bro. Dolan, that the idea of card for Convention be referred to the Good of the Order Committee. Carried.

Moved by Bro. Taylor, seconded by Bro. W. C. Tait, that the incoming Executive Secretary be instructed to make out and send to all subordinate associations, to be distributed to all members of the order, a statement of the proceedings and financial report of the Annual Convention.

Moved by Bro. Archer, seconded by Bro. Bradt, that the above be referred to the Good of the Order Committee. Carried.

Moved by Bro. Wickens, seconded by Bro. Moseley, that the Good of the Order Committee be requested to take up the matter of advisability of writing the government re examiners and the issuing of certificates. Carried.

Bro. Bradt asked for information re souvenirs.

Moved by Bro. Dawson, seconded by Bro. Dolan, that the matter of souvenirs be referred to special committee. Carried. Committee—Bros. Archer, Taylor and Williams.

Adjournment until 9.30 a.m. Thursday morning at 1.30 p.m.

The Visit to Detroit.

An invitation to visit Detroit had been sent by the members of the National Association of Stationary Engineers of the United States, Detroit, Nos. 1 and 7. At 1.45 p.m. the delegates of the C.A.S.E. left Windsor on the ferryboat and upon arriving at Detroit were met by a special committee who presented to the Canadians a very pretty and unique watch fob inscribed on the one side with letters N.A.S.E., on the other side their aims and objects, which are similar to the C.A.S.E. Autos were provided and a ride to the electrical plants of the city of Detroit and the water works, thence along Jefferson avenue and the fine residential parts to Belle Isle. A ride around and through this beautiful resort was taken, and places of interest visited, and amongst these the Aquarium with its many specimens of the finny tribe.

After this round of sight seeing the party were taken and refreshed. Those in charge: President No. 1, J. Bonesath, N.A.S.E.; secretary Alex. Werner; Bros. Alex. McDonald, James Parrott, T. E. Lloyd, D. A. Reid, R. Burrows, R. Fox, E. J. Berrick. President No. 7, C. Ellis; Secretary W. H. Stoddard, Bros. R. Shapland, P. Kersten, Alf Brady, J. Babbington, C. Davy, J. E. McKay, F. Edwards.

The ladies from Canada were taken care of by the Detroit Ladies' Auxiliary of the N.A.S.E. After luncheon speeches were made by Bros. Ellis, Werner and Davy, setting forth in glowing terms their appreciation of a fellow craft and proving by their actions their true brotherly love for one another.

W. A. Crockett, the Executive Secretary, was called to his feet to reply. He said it was more than a pleasure to be present at an event of this kind where citizens of the two greatest nations upon earth could meet together in amity and brotherly love and why not? Do we not have the same colors in our flags, the same tune in our national anthem, the same language, the same customs, the same race, the same laws, because American laws are formulated from British laws, and, in fact, are we not one and the same Anglo-Saxon race springing from the same parentage?

After thanking them for their kind hospitality they were given a sample of a Canadian cheer.

Bro. A. M. Wickens also spoke in like terms, after which a street car ride was given the delegates and their friends to the foot of Woodward Avenue, where they went on board the steamer engaged by the J. T. Wing Co. for their trip on the river.

The Trip up the Detroit River.

This trip proved an extremely enjoyable affair, despite the heavy rain which fell during the evening. If it had not been for the rain the steamer would have been hardly able to accommodate the crowd, as invitations had been sent to 3,500 persons. The trip proved a charming one, while the entertainment provided was at once captivating and generous. A fine orchestra provided music for the dancers. After most sumptuous luncheon was served, the passengers were entertained by Jack Armour, the "glad hand artist" representing Power.

All present enjoyed themselves so thoroughly that at the end of the journey three cheers and a tiger were most enthusiastically given Mr. J. T. Wing.

Thursday Morning Session.

At 9.30 Thursday morninp the delegates assembled at the Convention Hall, all being present.

The report of the Mileage Committee was received on the motion of Bro. Dawson and Bro. Borbridge. Adopted.

Ways and Means Committee.

The report of the Ways and Means Committee recommended the following changes: First, that article XII, section 1, of the Constitution, be amended to read: This Association may provide for honorary members to be elected from citizens who have been or are engineers desiring, etc.

(2) That the hours of meeting of the Convention should be fixed, and we also recommend that the hours shall be:

First day, 11 to 12 a.m., 2 to 5 p.m.

Succeeding days, 9 to 12 a.m., 2 to 5 p.m.

(3) Article XI should specify what goes with a charter.

(4) That something be done towards securing a rebate on railroad fares to Convention.

All of which is respectfully submitted,

R. H. Clark, Chairman.

Moved by Bro. Dawson, seconded by Bro. Moseley, that the report be received. Carried

The report of the Good of the Order Committee was taken up clause by clause on motion of Bros. Moseley and Dawson.

(1) Re membership cards: We would recommend that the Executive be authorized to issue a membership card, said card only to be issued by the local secretary to members in good and regular standing.

Moved by Bro. Moseley, seconded by Bro. Dawson, that this clause be adopted. Carried.

(2) That the Executive Secretary be empowered to purchase a typewriting machine to be used for the benefit of the executive work.

Moved by Bro. Sweet, seconded by Bro. McGhie, that this clause be adopted. Carried.

(3) That a system of general examinations be adopted in each subordinate lodge whereby all members may be examined on all classes of certificates and that all assistance be given to help members in qualifying and that the Executive Council have the matter in their hands to draft out rules to govern same.

Moved by Bro. McGhie, seconded by Bro. Moseley, that this clause be adopted. Carried.

(5) Clause referring to pass word: Moved by Bro. Moseley, seconded by Bro. Dolan, that this clause be referred back. Carried.

(6) We would suggest re communicating with the Ontario Government that this motion of Bro. Wickens, that as the Executive Secretary has been in touch with the Department no good would at present come from further communication at this particular time.

Moved by Bro. Moseley, seconded by Bro. Archer, that this be amended. Carried.

Moved by Bro. Moseley, seconded by Bro. Borbridge, that this Convention in session assembled do hereby memoralize the Minister of Agriculture as follows:

The fact that the license law now enacted and to come into force on Jan. 1, 1909, is at present working a great injustice to a large number of engineers, many of whom are out of work, these men when applying for situations are often asked by the employer have you a certificate or license? Our engineers are forced to say no, and also that they cannot get a certificate until the government makes the necessary appointments. This is not satisfactory either to the manufacturer or the engineer. Consequently we pray that the machinery be provided to relieve this undesirable condition at a very early date. Carried.

Moved by Bro. Archer, seconded by Bro Dolan, that the report be adopted as amended. Carried.

Auditor's Report.

Mr. President, your Auditors beg to report having gone over the books of the secretary and treasurer and find same to be correct in every particular.

W. C. Tait, Chairman.
George D. Fowler.

Moved by Bro. Dawson, seconded by Bro. Sweet, that the Auditors' report be adopted. Carried.

Moved by Bro. Archer, seconded by Bro. Dolan, that the following be endorsed and forwarded to Windsor, No. 28.

Thanks to Windsor Lodge.

Local Entertainment Committee, Windsor, No. 28: We, the undersigned visitors, wish to thank your committee and Mr. George Bradt particularly, for the courtesies extended to us during our visit to the different points of interest on the automobile ride Tuesday, August 11th. Signed: Mrs. A. M. Wickens, Mrs. C. Moseley, Mrs. Ed. Grandbois, Mrs. Johnson, Hattie Tait, Mrs. Coutts-Bain, Mrs. E. B. Phelps, Mrs. George W. Dawson, Mrs. W. A. Sweet; Messrs. Tait and Smith. Carried.

The Officers Elected.

For President—Chas. Kelly, Chatham.
For Vice-President—W. McGhie, Toronto.
For Secretary—W. A. Crockett, Mt. Hamilton.
For Treasurer—A. M. Wickens, Toronto.
For Conductor—J. J. Heeg, Guelph.
For Doorkeeper—W. Norris, London.

NEXT PLACE OF MEETING.

Moved by Bro. H. R. Clark, seconded by Bro. Robert, that London be the next place of meeting. Carried.

Moved by Bro. Moseley, seconded by Bro. Tait, that a vote of thanks be tendered the scrutineers. Carried.

This was responded to by Bro. Archer, who said it was a pleasure to perform the duties as assigned.

The meeting adjourned at 11.50 a.m. to meet again at 1.30 p.m.

AFTERNOON SESSION.

Moved by Bro. Moseley, seconded by Bro. Borbridge, that the thanks of this Convention be sent to the mayor and aldermen for their kindness. Carried.

Moved by Bro. Bradt, seconded by Bro. Dawson, that the secretary tender thanks to all who entertained us during our brief sojourn here, and intimate that these several tokens are indelibly impressed upon our hearts. Carried.

Moved by Bro. McGhie, seconded by Bro. Norris, thanks to No. 28 for this exceptional pleasure never to be forgotten. Carried.

Moved by Bro. Ogle, seconded by Bro. Sweet, that the janitor of the hall be given $5. Carried.

Moved by Bro. Dawson, seconded by Bro. Archer, that the secretary be donated $25. Carried.

Bro. Kelly intimated that he would give out the password.

Moved by Bro. McGhie, seconded by Bro. Crockett, that the supply men be given the privilege of the hall. Carried.

Bro. W. J. Cullen was presented with maple leaves for N.A.S.E., No. 1, Detroit, by the Engineering Journal of Canada.

INSTALLATION OF OFFICERS.

Bro. Ironsides in the chair; Bro. Sweet conductor.

Short speeches were made by the incoming officers which reflected great credit upon the C.A.S.E. for its wise choice.

In the absence of Mayor Wigle, Dr. Sampson presented the retiring president with a beautiful jewel.

Moved by Bro. Wickens, seconded by Bro. Borbridge, that a vote of thanks be tendered to Dr. Sampson. Carried.

Replying, Dr. Sampson said: The man that watches his boilers should be responsible. There is no such thing as accidental explosions, they are caused by neglect. Men have no business to tamper with things they know nothing about. It is commendable to compel men holding such responsible positions to prove their ability. Every manufacturer should assist you in your good work. May God speed you.

After singing "Auld Lang Syne" and "God Save the King" the Nineteenth Convention of the C.A.S.E. adjourned to meet in London in 1909.

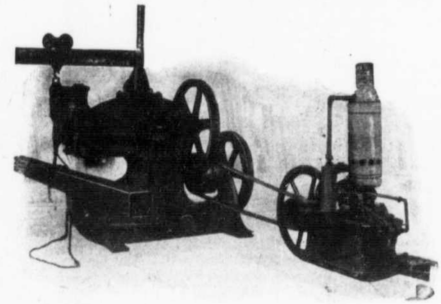
After the session closed at 4 p.m., a car was ready to take the delegates for a ride to Kingsville. Luncheon was served at Kingsville before returning.

At night a band concert was given by the City Council of Windsor in honor of the visitors. Everybody spent a most enjoyable time.

An Unique Use for a Gasoline Engine.

There seems to be no limit to the number of uses to which a small unit gasoline engine can be put.

As a rule they have "made good" most largely in places where a small amount of power is needed and where one engine of moderate capacity will answer all needs.



Gasoline Engine Operating Heavy Shear.

Goold, Shapley & Muir, Brantford, Ont., one of the largest builders of this type of engine in Canada, have, however, found a use for a small size engine which is so unique as to be worthy of special comment.

This firm make, in addition to many other goods, a large line of windmills and need a powerful shear for cutting the structural steel for the tower. This machine stands alone in a large building quite separate from all other machine tools. After studying various methods of driving this shear, they decided that in no way could they do it more economically than by placing a small gasoline engine near it and connecting it by a short belt. The arrangement, which is shown in the accompanying photo, has proven entirely satisfactory.

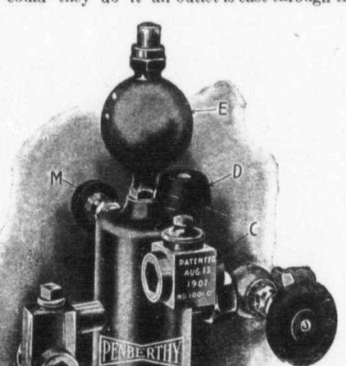
PUBLICATIONS.

CATALOGUE NO. 11.—The attention of stationary engineers is called to the offer of the Michigan Lubricator Co., Detroit, Mich., to send illustrated catalogue of their engine room specialties free of charge to any man in charge of an engine. Mention the firm you are with when you write for this catalogue.

The New Penberthy Lubricator.

A new steam lubricator, which has several new features of interest to engineers has been placed on the Canadian market by the Penberthy Injector Co., Windsor, Ont. Its makers claim for it simplicity of construction, economy and reliability to a high degree.

The working principle of the new lubricator can be understood by reference to the letters. Of these D and C represent the filler plug and the gauge glass chamber respectively. An air outlet is cast through this chamber directly



into the oil reservoir so that in filling the cup there is no oil running over the sides.

The style of glasses used here and also in "I," is a ground plate disc perfectly clear and practically non-breakable."

The letters "K" and "L" illustrate the combined regulating valve and drain cock, both operated separately but combined in the one stem. Both drain valves "L" and "B" are fitted with a special stop lock and will only unscrew to a certain point, which prevents shaking off through the jarring and vibration of the engine, a common source of trouble in lubricators.

The Penberthy Sight Feed Lubricators are made of the best steam metal, are carefully assembled and tested at the factory before sending out and are guaranteed to give the best of satisfaction to the user.

PERSONAL MENTION.

Mr. John Palmer, of the United Fire Brick Co., Pittsburgh, Pa., has been spending a few days on a business trip in Canada. Mr. Palmer, who had not visited this country for about three years, expressed pleasure in noting that Canada had not suffered nearly so severely from the depression as did the United States, especially such industrial centres as Pittsburgh.

Mr. Wm. C. McGhie, engineer of the Rolph & Clark lithographing works, Toronto, has been appointed chairman of the examining board for stationary engineers under the Ontario Government. As Mr. McGhie is one of the most efficient engineers in Ontario, and as he is very popular, being vice-president of the C.A.S.E., this appointment meets with general favor. Mr. McGhie's brother succeeds him in charge of the Rolph & Clark power plant.

BRITISH COLUMBIA MINERAL OUTPUT.

The mineral output of British Columbia for 1907 was valued at $25,882,560, being an increase of $902,014 over that of 1906. The following table, which gives the different items of the products, shows that the increase was entirely in coal and coke, there being a decided falling off in the output of gold, silver, lead, and copper.

The value of the total products of the mines of the province up to the end of 1907 is given as $299,526,282. Coal makes the largest showing, viz, a total of $86,972,551, followed by placer gold at $69,549,103 and by lode gold at $45,070,717.

For the calendar year 1907 there was a decrease in placer gold of $120,400 and in lode gold of $575,619; total decrease in gold production $696,019, while in silver production the decrease was $193,495. In lead there was a decrease in output of 4,669,514 pounds. The copper mines were run only nine months of the last year, owing partly to shortage of coke, but later in consequence of financial depression, with the result that the total output for the year was 40,832,720 pounds, or 2,157,768 pounds less than in 1906.

		1906.		1907.	
		Quantity.	Value.	Quantity.	Value.
Gold placer	ounces		$948,400	41,450	$828,000
Gold lode	do	224,027	4,630,639	196,179	4,055,020
Silver	do	2,990,262	1,897,320	2,745,448	1,703,825
Lead	pounds	52,408,217	2,667,578	47,738,703	2,291,458
Copper	do	42,990,488	8,288,565	40,832,720	8,166,544
Coal	tons	1,517,303	4,551,909	1,800,067	6,300,235
Coke	do	199,227	996,135	222,913	1,337,478
Other minerals			1,000,000		1,200,000
			24,980,546		25,882,560

The gross production of coal in 1907 in the province was 2,219,608 tons, of 2,240 pounds each, of which 44,760 tons were added to stock, leaving a total consumption of 2,174,-848 tons of coal. Of this amount 916,262 tons were sold for consumption in Canada, 651,076 tons for export to the United States, and 22,038 for export to other countries, making for 1907 the total coal sales 1,589,376 tons; of the balance of the coal, 419,541 tons were used in making coke and 165,931 tons under colliery boilers, etc.

No iron ore is mined in the province; the only attempt thereat, at Quasino Sound, Vancouver Island, has been found unprofitable and abandoned. The mining of zinc ore is also practically at a standstill.

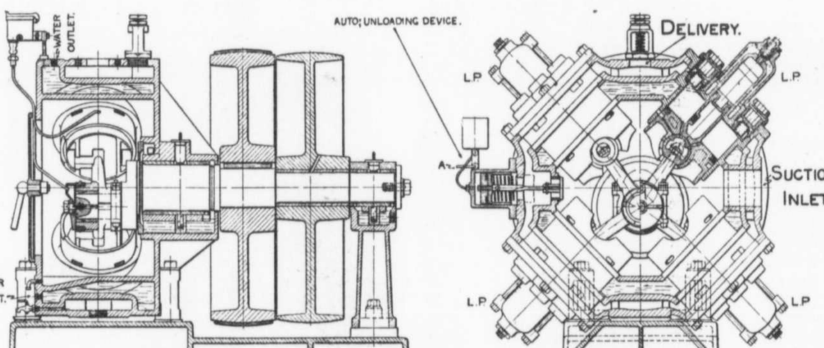
The "Reavell" High Speed Air Compressor

One of the most interesting machines shown in Machinery Hall at the Canadian National Exhibition, Toronto, was the Reavell patent quadruplex air compressor shown by J. F. B. Vandeleur, 3 Dineen Building, Toronto.

This compressor is a product of Reavell & Co., Ipswich, England. This firm was established nine years ago for the construction of high speed engines and air compressors.

Having a plant equipped with the most modern tools and specializing on the above lines, particularly on air compressors for electric driving, the company have developed the quadruplex compressor, which they construct under Reavell's patents, until this machine now occupies the front rank in all industries where electric driving, the modern aid to cheap production, has been adopted.

To those of our readers who may not be familiar with its construction, the accompanying sectional illustration will make it clear.



SECTION OF STANDARD BELT-DRIVEN SINGLE-STAGE AIR COMPRESSOR.

It will be seen that the Reavell compressor has four cylinders arranged radially in a circular-shaped casing, as shown in the sectional illustration on this page.

Each of the four cylinders is fitted with a trunk piston, and the four connecting rods are all driven by a common crank-pin. The casing contains an annular space through which the cylinders pass, and which is used as a water jacket. Each cylinder forms, as it were, a separate single-acting compressor, and as they all deliver into a common delivery passage, a practically continuous delivery of air is secured, because the compressor, owing to the pressure being always in one direction, can be run at relatively high speeds.

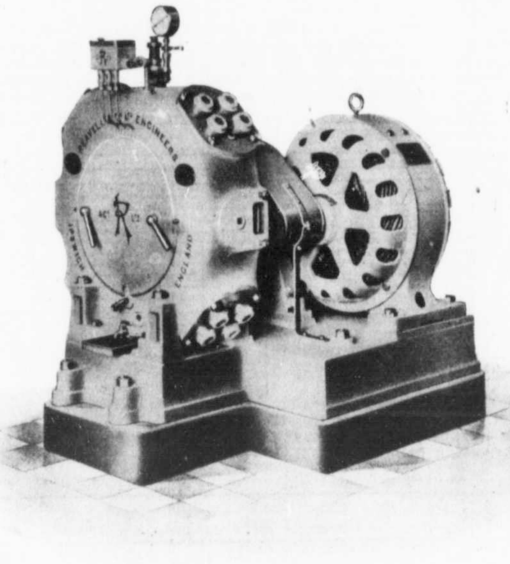


Fig. 2—Single-ended air compressor, driven by electric motor through gearing

The section through the shaft bearing and casing shows clearly the circumferential delivery port. The section through the cylinders shows a small balance or pilot piston, which is fitted to the larger sizes of these single stage compressors, in order to obtain the constant thrust which is the special feature of this compressor, as it ensures silent working, even after wear has taken place.

The compressor has no suction valves, air being admitted above each piston by means of a port in the latter, which coincides with a similar port in the top of each connecting rod, during the suction stroke; and near the end of this stroke the piston overruns the ports cut through the cylinder wall, as shown, thus making direct communication between the cylinder and the inside of the compressor casing, which is arranged to form a suction chamber.

This feature alone results in a gain of at least 5 per cent. in the volumetric efficiency, as compared with compressors having spring-loaded valves, the cylinders being filled with air at atmospheric pressure at each stroke, instead of a reduced pressure due to the resistance of the valve springs.

A special feature about the construction of this quadruplex compressor is the simplicity of construction and the ease with which the machine may be dissected for examination or repair, for on removing the nut which retains the end cap on the crank-pin, the whole of the connecting rods and pistons can be removed without the use of a spanner.

The connecting rods are of forged steel and the gudgeons of hard cast iron accurately ground.

The arrangement of cylinders in this compressor makes it particularly suitable for electric driving. The torque on the shaft is practically constant, and this enables the motor to work efficiently, and without sparking.

In small machines a standard high-speed motor is used, and the compressor is driven by gear wheels.

Illustration 2 shows one of these machines, which for mining work is frequently fitted with wheels attached directly to the bed to make the whole machine portable.

Larger machines have motors of a slow-speed type, so that they may be directly coupled to the compressor, enabling gears to be dispensed with.

There are then only two bearings for the motor and compressor together, the field magnet castings being bolted direct to the bed-plate which carries the compressor, while the commutator is built up on a sleeve and fits on to the compressor shaft.

The ample bearings provided on the compressor, together with the motor outer bearing, carry the weight of the revolving armature, and also sustain the pressure due to the working of the compressor, and are provided with ring oiling, as is usual in modern dynamo practice. Illustration 3 shows one of these machines.

For high pressures two or more of the cylinders are put in series with inter-coolers placed in between so as to divide the work of compression into a number of stages, depending on the final delivery pressure.

Large numbers of these machines have been made of the three-stage type for pressures up to 2,000 lbs. pressure per square inch.

Since the introduction of this machine, more than 1,000 have been built, and they are largely used in mining, in engineering and shipbuilding for pneumatic tools, in chemical works, in hotels and factories for water lifting by the air lift system, and in other industries too numerous to mention where compressed air in various forms is used.

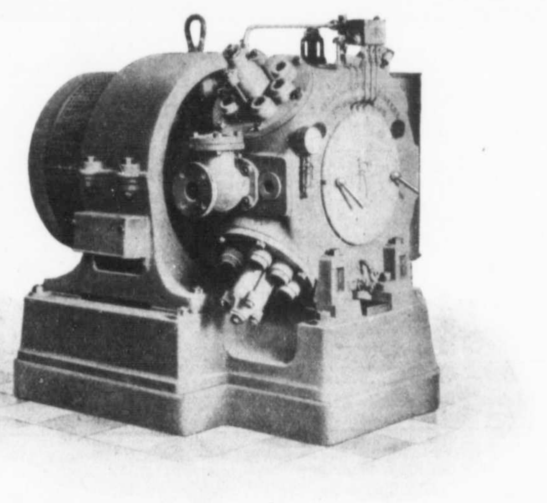


Fig. 3—Single-ended direct coupled motor-driven compressor.

An attractive pamphlet of 32 pages is issued by the company to anyone interested, on application to Mr. J. F. B. Vandeleur, 3 Dineen Buildings, Toronto.

How to Keep Tab on the Cost of Power

BY J. G. OULD IN THE PRACTICAL ENGINEER.

The planning of a system for the business of operating a power plant is much like getting a suit of clothes. It is possible for you to go to the store and see a suit which you like as to its cut and appearance, and when tried on find it a good fit, but the chances are a system. To have it right, it must be built to order, and even then it may that it would be the other way about and it would have to be pulled out here, drawn in there, and altered somewhere else before it could be made to fit your particular style of anatomy. So with be the better for a change once in a while. The thought underlying this is, one cannot make a system by the yard and cut it off as required by different people.

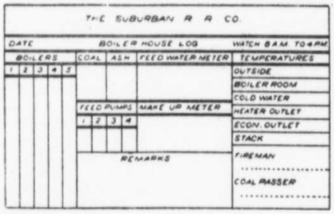


Fig. 1.—Sample Record for Boiler Room.

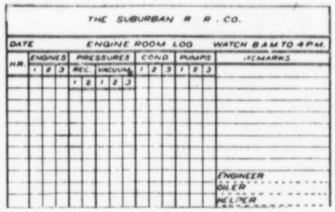


Fig. 2.—Keeping Track of Engine Performance.

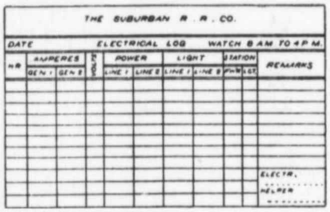


Fig. 3.—Electrical Log.

System may be defined "as that method of doing work whereby the required results are obtained with the greatest efficiency and least expenditure of labor." It is possible, however, to have such a complicated system that it defeats its own ends; therefore, it should be as simple as one can make it for the purpose in hand.

The question of interest on the investment, depreciation and other fixed charges may or may not be in the province of the operating engineer, depending on circumstances. Although the operating department has a very great deal of interest in the depreciation account, since it depends in very large part on it as to the amount to be yearly charged off. If the machinery is not properly cared for, it certainly will wear or tear out much quicker than if carefully attended to. The operating department is concerned for the most part in supplying power at the smallest possible cost per unit and at the same time giving the best possible service.

By way of illustration let us suppose a suburban power station, giving out direct current for trolley and lighting service, to have a capacity of 3,500 k. w., this in engines and a turbine direct connected to generators. The engines have jet and the turbine surface condensers with steam driven auxiliaries. Water is taken from a river.

I give the above data since a description of a plant such as this has just been given me, and there are many

DATE — MONTHLY DATA OF STEAM & ELECTRIC PLANT

COAL, LB .000000	000.00 NET TONS
ASHES, " 000 CANS 00000	00.00
" % TO COAL BURNED	00.00
COAL USED 1907	00.00
" " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
DAYS UNDER STEAM 1907	00.00
" " " 1908	00.00
AVERAGE COAL PER DAY 1907	00.00
" " " " 1908	00 00
DIFFERENCE IN FAVOR OF :- 1908	00.00
FEED WATER 1907	000 00
" " 1908	000.00
DIFFERENCE :-	
FEED WATER PER DAY 1907	00.00
" " " " 1908	00.00
DIFFERENCE	
FEED PER LB. OF COAL 1907	00.00
" " " " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
FEED PER LB. OF COMBUST 1907	00.00
" " " " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
WATER, CU. FT. USED 1907	00.00
" METER 1 0000	
" " 2 0000 1908	00.00
DIFFERENCE IN FAVOR OF :- 1907	00.00
WATER PER DAY 1907	00.00
" " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1907	00.00
MAKE UP METER 1907	00.00
" " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
MAKE UP PER DAY 1907	00.00
" " " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
GAS, CU. FT. 1907	00.00
" METER 1 0000	
" " 2 0000 1908	00.00
DIFFERENCE IN FAVOR OF :- 1907	00.00
GAS, PER DAY 1907	00.00
" " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1907	00.00
PUMP COUNTERS 1907	00.00
" " PUMP NO. 5 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
COUNTER PER DAY 1907	00.00
" " " 1908	00.00
DIFFERENCE IN FAVOR OF :- 1908	00.00
ICE CANS 1908	00.00

COST OF COAL AT 0.00 PER TON	000	00		
" " ASH REMOVAL	000	00		
" " OIL	0	00		
" " PACKING	0	00		
" " WASTE	0	00		
" " GENERAL SUPPLIES	0	00	000	00
SALARIES	00	00	000	00
TOTAL FOR THE MONTH :-			000	00
TOTAL COST, MARCH 1907			000	00
DIFFERENCE IN FAVOR OF :- 1908			000	00
COST PER WORKING DAY 1907	00	00		
" " " " 1908	00	00		
DIFFERENCE IN FAVOR OF :- 1908	0	00		
COST OF COAL MARCH 1907 — AT $ 0.00 PER TON			000	00
COST OF COAL MARCH 1908 — AT $ 0.00 PER TON			000	00
DIFFERENCE IN FAVOR OF :- 1907			00	00
COST OF COAL TO EVAPORATE — 1000 LBS. OF WATER		00.00	CTS.	
COST OF ASH TO EVAPORATE — 1000 LBS. OF WATER		00.00		
TOTAL COST PER 1000 1908		00.00		
" , PER 1000, MARCH 1907		00.00		
DIFFERENCE IN FAVOR OF :- 1908		00.00		
GAS 1907			00	00
GAS 1908			00	00
DIFFERENCE IN FAVOR OF 1907			0	00

Fig. 4.—Monthly Record for Power Plant.

such plants throughout the country, so what applies to this may help more than one. Supposing we are to take charge of such a plant, to operate it. What sort of a scheme is best to get in close touch with it and its needs?

One of the most important things to know is what each piece of machinery does, for how long, at what efficiency in comparison with standard work; also with reference to other apparatus of the same sort in the plant. To keep track of these things a series of printed blanks are needed. It depends on the size of the plant and the number of hours it is operated as to whether it is best to have all the data on one sheet or on several. In the one in question there are so many items it would seem best to have several blanks, each one for a special purpose. The plant being operated 24 hours per day, with three watches, it is a matter of choice as to whether it is best to put all the data for the day on one sheet, or to have a separate sheet for each watch.

Boiler Room Record.

Let us begin with boilers. Figure 1 will serve as an illustration. An X mark under the boiler number shows it to be in use, A—that it was shut down in that watch. The time may be indicated under the mark, or in the place for remarks. Coal ought always to be weighed. The blank can be arranged to have the weights as weighed, or only the total for the watch, as in the illustration. An ordinary school slate ruled with a scriber or the point of a knife, is a good tally sheet for the fireman to use when weighing coal or ash, the total from the slate being put on the blank.

Ash cannot well be weighed for the reason that it is more or less wet. But you can get a good idea of the weight by weighing a number of receptacles, wheelbarrow or whatever it may be you use to carry the ash away full of dry ash. Then divide the total amount by the number of receptacles and you get the average weight. Of course you would subtract the weight of the holders from the total weight when making your test.

When one looks at such sheets every day, he soon notes any change in percentage of the ash to coal burned even without calculation, and so by comparing the coal, ash and water evaporated can quickly note a change in quality of coal or firing.

The record also shows the number of hours each boiler is in use, and insures that they are used in proper turn. If it was noticed that No. 1 feed pump was used only half as often as the others, it would be a sign that it needed attention.

A register of the amount of "make up" for the feed is often of value in pointing out trouble, for if your load is about as usual and your make up goes higher than usual, you possibily have a leak somewhere, perhaps in the closed heater some of the tubes are leaking.

If the make up meter shows much less, it may be that the tubes of the surface condenser are leaking, and the circulating water getting in with the feed. The finding of faults by means of meters and the daily registration of their readings, before the fault becomes large, is one of the reasons for doing work of this kind.

The regular keeping of temperatures is often of much help in finding the cause of trouble. They may be taken every hour or as often as thought necessary, but ought always to be taken at some fixed time. Of course the very best way is to have automatic recording thermometers, but this is a refinement which many do not care to pay for.

If the load is normal and the heater does not heat the water to the usual temperature, it is possible that the heater is dirty. The same may be said of the economizer. The scrapers might have stopped, or a portion of the apparatus become broken. A change of the usual temperature would show the need for investigation. Many other things suggest themselves to you, but enough has been said to explain its use. There is no reason why the fireman cannot keep this log as a part of his regular routine. Under remarks may be noted anything out of the ordinary, poor coal, much dirt in the coal, leaks, the hour a fire was started in a certain boiler and so on. It is often of use to know who was on watch six months ago, when such and such a thing happened. For this reason the names of the men on watch ought always to be on the blank.

Keeping Tab in Engine Room.

It is necessary to know what the engines are doing, so then a blank such as Fig. 2 may help to keep track of their performances. If the plant is arranged so that each engine with its condenser and auxiliaries makes a complete unit and cannot be cross connected with the others, then the condenser heading may be cut out, for in such a case the engine generator and auxiliaries would come under 1, 2 or 3 as the case might be. The object is to find out the amount of work done by the various machines. If one does it more efficiently than the other, then the lack should be inquired into. This is specially true of the auxiliaries if they are in duplicate, and you get better results from one set than you do with the other. On this blank can be arranged a space for the wattmeter readings, or, depending on the amount of data needed, on another blank such as Fig. 3.

This blank can be extended at will. If there are recording wattmeters for each line, they may each have a space. In this event it may not be necessary to put down the amperes and voltage except to keep a check on the wattmeters. The headings, power, light, station, may not have recording meters for each division, but will have ammeters. If there be a special man to take charge

DATE

DAILY DATA OF STEAM & ELECTRIC PLANT

HR.	BOILERS		STEAM		ELECTRICAL					VENTILATION				REFRIGERATION									ELEV. PUMP	
					DYNAMOS						MOTORS						BRINE		TEMP.					
AM.	1	2	BOILER PRESS.	BK PRESS.	1	2	3	AMP.	VOLTS.	F. ENG.	1	2	3	GEN.	AM. PMP.	BR. PMP.	IN	OUT	C.R.	OUT SIDE	CW. IN	CW. OUT	5	6
7:00																								
7:30																								
8:00																								
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6:00																								
6:30																								
7:00																								
P.M.																								

COAL			ASH			REMARKS
DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL	

WATER		
METER I	METER II	TOTAL USED
MAKE UP METER		
ICE	METER III	TOTAL USED
GAS		
METER I	METER II	TOTAL USED
PUMP COUNTERS		
COUNTER 5	COUNTER 6	TOTAL

FIG. 5.

of the operation of the electrical apparatus, he should keep this log and his name be on the blank.

At the end of the month, the totals from the various data sheets should be tabulated and compared with the same month of the previous year. At the end of the year the grand total should be made up. This may be illustrated by Fig. 4, which is a copy of a monthly sheet used in a plant under the care of the writer. It is a very different plant and used for a different work from the one we have under consideration, but the idea is the same. The electrical load is very even, so no mention of it is made on this sheet. The data for this sheet is taken from Fig. 5.

Record of Supplies and Repairs.

Many of the stores are carelessly or even wilfully wasted. For this reason close watch must be kept on them. The easiest way is to have a card system, using 3 x 5 cards, such as Fig. 6. Some one person should be directly responsible for the storeroom. A set of cards may be kept for each watch if found necessary, using different colors to distinguish the one watch from the other. Such material as packing, es, ially in the small sizes, could be given out of store in fixed amounts, say 1-4 or 1-2 pound, and entered against the person or machine for which it was issued. This prevents such an entry as "one ring of packing 2-oz.," and keeps track all the same. This system acts as a continual stock taker. Of course it is necessary to verify the cards every so often by actually counting or weighing the goods, and so detect any possible error. This is much easier than keeping a stock book, and one can always insert a new article without disturbing any of the other items. An ordinary A to Z set of index cards will help to locate the various items, which may be arranged in alphabetical order, or under divisions.

Repairs.

Bills for material, repairs, etc., can be easily taken care of by the use of ordinary 3 x 5 cards. Write headings

ARTICLE - OIL - CYLINDER PRICE 40¢

07 - 08

DATE	QUANTITY REC'D	GIVEN OUT	ON HAND	DATE	FOR	COST
MARCH 1			54			
" 4	100		154			
" 4		10	144		MAIN ENGINE	4 00

Fig. 6.—Method of Listing Supplies.

on the cards, Engineers' Supplies, Oil-Waste, Repairs to Boilers, Brickwork, Engines, Piping, etc., Coal, and as many divisions as are necessary to meet your case. If you are asked to give a yearly report to be used as part of the general report, it is well to keep your divisions in accord with the divisions under which they are placed in the general report.

Fig. 7 will give an idea of how this may be carried out. The number over the amount is the number of the bill for the year, put in consecutive order. The No. 1826 is the order number. The number of the bill is also on the check sent in payment and placed on this bill when O. K.'d. If you write your own orders, or have a copy of them on file, if you desire details of the account, turn to the order by number, and you have it right away. The number bill (order number also on the bill) will also be easy to find, and then you have the whole affair before you.

A monthly statement of cost can be made up from your various sheets something after the fashion of the right

REPAIRS ENGINES

07-08

		148
MARCH 13	BALL AND WOOD NO. 1826	$ 68 49

FIG. 7. SAMPLE REPAIR CARD

side of Fig. 4. In this case we have to pay for the removal of our ashes at a fixed rate per can. In the suburban plant, if it takes the time of one man to wheel away the ash, his time should be counted as ash expense, unless it be preferred to put it in as wages. The item general supplies does not include tools or repairs. They come in on another account. The item refers to regular supplies outside of those specially mentioned.

ASH TICKET

DATE ....190...

CANS OF ASHES.................................

" " SOOT ....

" " REFUSE ....

TOTAL: ....

DRIVER ....

Fig. 8.—Ash Ticket.

Figure 8 shows the ash ticket signed by the driver when carting away ashes. A carbon copy is made at the same time and kept as a check. Bills are made out from these tickets. They prevent disputes.

Where your output is practically all electricity a record of coal per k. w. hr. should be kept. The total monthly cost divided by the total k. w. hr. will give the cost per k. w. hr.

The cost of water may also be put in the account as a separate item. If taken from a river, the estimated cost of pumping may be taken (from counter on pump) or the cost simply charged up to auxiliary machinery.

All of the foregoing is more or less general, although the writer has kept the suburban power station in mind while writing. To get up a thorough working system for a special plant one should study it on the spot. As far as possible it is well to have all blanks of uniform size for convenience of filing.

When ordering parts for the machinery, one ought always to be careful to give the shop number, style, size, etc., as found on the name plate. In this book a record should be made of every piece of machinery.

Work out the constants for each engine, that is to say, find the power of the engine with a m. e. p. of 1 lb. Then when you take your indicator cards and obtain the true m. e. p. all you have to do is to multiply it by the constant, and there you are. This avoids going over the same work many times. The size of all piston rods, with the depth of their stuffing boxes, should also be made, as well as the size and kind of packing for each rod and the weight to pack the box. This work may be done at odd times. It is worth the work for the time it saves. A saving of one per cent. of the gross charges for operating such a plant as we have had in mind is such a sum as justifies a good deal of work in getting up a system or whatever is necessary to attain this result.

The Engineer a Gentleman

By J. C. Thorpe in Power and the Engineer.

To those who have gone aside a little from the course of regular engineering business to consider the engineer in his relation to men and things about him, some little misgiving has been experienced, when attention has been directed to the methods of lax morality and careless professional life that are too often smiled upon by men of the profession.

It has long been the opinion of the writer that the ethical side of engineering has received too little attention. In the close confinement to business affairs, and in the strenuous struggle for industrial supremacy, character building has been greatly neglected by many of those of influence in the engineering profession. It is not with the thought that anything particularly new will be presented here, but rather that a few points which all have considered more or less from time to time, may be again brought to attention and emphasized.

Who and What is the Engineer?

Before considering the engineer, let us note something of the history of engineering, or better, perhaps, some of the steps in its development, and that we may approach on common and well understood ground, let us decide just who and what an engineer is. As a brief definition and a comprehensive one, I like to think of Tregold's definition: "An engineer is one who directs the great sources of power in nature for the use and convenience of man." Surely no better and no more inspiring field is given for men's work. And yet it is only within recent years that the engineer has lived on the same plane with the lawyer or teacher; it has not been a great many years that the followers of engineering have breathed the same air with the clergymen. But have the lawyer, teacher or minister a more gloriously fruitful field of labor? I think not.

Most of us have been taught to think of engineering as a comparatively new profession; that its history has extended over but a limited number of years. And, these impression are based on fact, in so far as they relate to the recent phenomenal growth of the science. But let us look back. In our histories of the middle ages much space was given up to the records of the pontiffs or bridge builders, and even in those early times were recorded the labors of the chief engineer of maintenance of way, as the records of the pontifex maximus, the chief bridge builder, bear witness. This labor of bridge building was of such importance that it was considered essentially the field for men of learning, and we find the priests leading in this work as in teaching, preaching and ministering. It was necessary that these labors of such great public interest should be intrusted to men of scholarly and gentlemanly attainments. And yet, since that early day, when problems of infinitely greater complexity have arisen, it has been thought that scholarship, temperance and integrity are not essential to the successful engineer. On the contrary, lax morals, intemperance and flexibility of conscience have been passed over without serious comment, if not, indeed, smiled upon.

It is interesting to note that a prosperous engineering society flourished during the early days of the Roman Empire, when the "Fratres Pontifici," Brotherhood of Bridge Builders, was organized by a band of monks who chose as their particular work the building and repairing of bridges. Many an old bridge and ancient cathedral stand to-day as the witness to the thoroughness and efficiency with which these and other engineers of their time did their work. In the process of time the extent of the work increased so rapidly that specialization became necessary, and the monks, the men of letters to whom the world had looked as the chief lords of knowledge, withdrew to their sacred works of love and mercy and others appeared to build the bridges and buildings, and attend to the arts of the times. The engineer became merely an artisan with little if any book learning, depending upon precedent and physical strength to accomplish his designs.

Importance of Hearty and Sincere Co-operation.

The organization of these Benedictine monks emphasized an essential factor in successful engineering work which ought not to be passed over without comment. This brotherhood of engineers appreciated the all-importance of hearty and sincere co-operation for the successful termination of any great industrial work. It should be the aim of every engineer and of every engineering student to foster and encourage the spirit of constant striving for the best good of all—the spirit which constantly seeks the better things of life. Standards of right living should be upheld that shall make every engineer of the greatest possible good to the world of men and things about him. He should see beyond his own sphere of activities and come into close touch with those who have preceded him, as well as with those of his own time. It is only with this point of view that the least injury shall happen and the greatest benefit result to all.

The essential deep sympathy and wide outlook will come only as broad knowledge is gained. The engineer must not be learned in his profession only, but in history, political science, etc., as well. He must know everything about his own, and something about everything. For, as the engineer stands before the world as the equal in rank of the philosophers, lawyers, doctors and preachers, will he not be looked to for an example of right living as a citizen and as a man ? I believe that the right is not his to seclude himself from society, politics and affairs of general importance, saying that the engineer must always be the serious, self-centered, preoccupied individual that some tell us he must be. A lofty conception of universal brotherhood and happiness should keep him from being hedged about in this manner, The realm of the engineer's work is such as to inspire him to strive at all times to add his mite, however small it may be, to the store of happiness of the whole world.

There is Need of the "Big" Man

Success and power in the life of an engineer, as in any life, are indications of energy, truthfulness, temperance, manly courage, self-respect and address. The engineer must be a man, true and strong. He must be not only scientific, scholarly and business-like, but healthy, erect and pure-minded, possessing "manner" as well as manners. In no profession is there greater need for the truly "big" man.

An engineering feat once undertaken must be prosecuted with unceasing vigor and enthusiasm until the end is attained. The tunnels under the river in Greater New York were not built by dilatory methods, nor was the harness of our great Niagara Falls designed and constructed by indifferent engineers. If success is to crown his efforts, the engineer must keep "everlastingly at it" until he attains, for there is no greater need in any profession than this for 'stick-to-it-iveness." This characteristic energy should be exhibited, not only in his work, but in his play as well. Other things being equal, that engineer will be the most successful who works while he works and plays while he plays, with all the vim and energy that a healthy mind and body can put forth.

No proverb is more golden, though perhaps none is more reviled in the broad field of engineering, than the one we have all known all our lives : "Honesty is the best policy." There is no one thing that will make for ultimate happiness and success so surely as unswerving devotion to the principles of truth and honesty. And, on the other hand, there is nothing that will so surely bring ruin to one's self and work as disregard of these principles. The engineer must be true to himself, his work and to the world. If he is false to himself, nothing is surer than the ruin of his work with its author. Great mistakes have been made in medicine, law, theology, etc., and false theories advanced that have stood for years, yes, hundreds of years, without their falsity being proved, but a similar condition is not to be imagined in engineering. Would the great bridges that have been built and which stand as living witnesses of the engineer's proficiency, have withstood the tests of time if constructed on a false theory of the strength of materials or design ? Certainly not, and so be sure that false engineers cannot endure.

Personae Honor.

The consideration of honesty as an essential part of an engineer's life should not be left without a plea for that, gentlemanly attribute, personal honor, that is being too little cultivated in this day when men are striving so fiercely for wealth and commercial supremacy. Such a quality of character must become a part of every true engineer. It should keep him above the advancements of those who are ever ready to offer inducements for professional influence. It should and will do away with the farce of so-called "expert testimony," when two engineers of similar training take opposite sides in a case in court, swearing to different effects from the same causes, the effect being influenced largely by the size of the interested party's pocketbook. Surely if the engineer is to maintain his position in the world where he has been placed by the great development of nature's forces, he must cultivate this princely attribute. It is only thus that he may expect to deserve, secure and hold the confidence of those who are looking to him from time to time to "do things."

The "Good Mixer."

The frequent records of discipline in the large industrial corporations of our country afford abundant evidence of the attitude against intemperance in the ranks of the employed. This hostility towards intemperate habits shows a very encouraging development along the line of all industrial pursuits, and should serve as a warning, especially to young engineers. The old theory that a "good mixer" is necessarily more or less intemperate, is rapidly losing ground. The history of railroad management and operation is particularly noteworthy in reference to this subject. Can anyone imagine that the president or general manager of any of our great trunk lines would demand, as an essential requirement of service, that the prospective employee give evidence of a tendency to dissipate ? In modern progressive industry, the intemperate man has no show with the alert, cleareyed, moral fellow with a healthy and vigorous mind. Though men are to be found occasionally, not strictly temperate, who are in commanding positions, they invariably require temperance in their employees. The "good mixer" of the present is, and for the future shall be, the well rounded man of ability, good address, and congenial temperament, but withal, of temperate habits in all points of life.

In the preface of one of our prominent engineering books the following paragraph appears : "A good engineer must be of inflexible integrity, sober, reliable, accurate, resolute, discreet, of cool and sound judgment, must have command of his temper, must have courage to resist and repeal attempts at intimidation; a firmness that is proof against solicitation, flattery or improper bias of any sort; must take an interest in his work; must be energetic, quick to decide, prompt to act, and must be fair and impartial as a judge on a bench." These wholsesome thoughts give more in detail those that have been discussed herein. These are the indications of high honor and gentlemanliness.

Living in the sphere of action in such close touch with nature's forces, the whole trend of the engineer's life should be influenced. Every day should make him a better and a "bigger" man. If this is not true, and his conduct is guided by a narrowed outlook and a shallow sympathy. If he is influenced by lax moral codes of living, he stands before the world a failure; he is not the engineer in truth, for he is not in touch with nature's great forces, and has not reached out to the wide fields of human service for which he was intended.

A New Principle in Vacuum Heating

By F. A. Simonds, Detroit, Mich.

All readers of the Power Edition are probably conversant with the standard principle of maintaining a partial vacuum in the return line of a two-pipe steam heating system to secure a more free and complete circulation of steam in the system, and which also secures other advantages that cannot be secured with the gravity return system.

They are also aware that all such systems are installed along practically the same lines, by the different firms that are at present installing the two-pipe vacuum system, and as a result the only advantage one company may have over another in this line, is in case that one has a vacuum valve that is more economical or that will give less trouble than the others.

The point of economy in any vacuum valve, can only be from the fact that such valve will take care of the air and water of condensation from the radiator to which it is connected, with less waste of steam than the other valves offered.

The freedom from trouble in one make of vacuum valve, over another would be in case one valve was so constructed as to be less liable to clog or foul with scale or other foreign matter that is carried into the valve with the water.

The only improvements in vacuum steam heating systems, over the original Williams vacuum system which was brought out many years ago, have been along the two points above mentioned, "steam waste and trouble with valves," and as a result the only difference in the type of system is in the valves and a few minor details as to equipment.

On account of a recent radical change, involving a new principle in connection with the two-pipe vacuum system, and the desire of progressive architects, engineers and heating contractors to keep posted on improvements along this line, a brief review of the similarity of present vacuum systems has been given, as an introduction to a brief description of the Improved system.

Any person that has operated the standard vacuum system has learned that it is necessary to use a condenser of some kind in the return line close to the vacuum pump (generally a jet or spray of cold water), in order to condense the steam that may leak through the vacuum valves, but in any case to condense the vapor that forms from the hot water of condensation when it is discharged into the lower pressure of the partial vacuum maintained in the return lines.

This re-evaporation from the condensation, is a factor of more importance than the heating engineer is aware of and if the vapor from such is used, as it can be, in an independent unit of radiation in the rooms to be heated, it greatly increases the steam economy of the system, over the former plan of destroying such vapor by a jet of cold water at the vacuum pump for the sake of maintaining the vacuum in the return line. Also insures the discharge of water from the vacuum pump, which is later put back in the boiler, not being over-cooled, as is usual when an attendant does not want to be troubled with adjusting the amount of injection water admitted to the condenser, and, naturally admits more than is really necessary, which reduces the temperature of the feed water to boiler (in an independent heating plant), and necessitates a waste of the additional water as it cannot all be used in the boiler.

In order to overcome this waste of heat units, a patented method embracing this new principle has been brought out along the vacuum line of heating, and to distinguish it from the former vacuum plan of heating has been termed the Compound System of Vacuum Heating, as it follows the same general plan as the compound engine and with a relative economy when comparing the compound engine to the simple engine. For the same reason the old plan of vacuum heating can be termed the Simple System of Vacuum Heating.

With the compound system the radiation is divided into Primary and Secondary sections.

The Primary radiation is connected to the steam supply and has a vacuum valve on return from same as usual with the simple system, instead, however, of discharging from the vacuum valve direct to the return line, this valve discharges its water into the secondary section, which is under the same partial vacuum as the return lines, and really a part of such.

The water of condensation being from 208 degrees to 210 degrees (if the system is operating under atmospheric pressure), will, in part, re-evaporate, owing to its heat, under this lower pressure, and the vapor from such re-evaporation will heat the secondary radiation.

This vapor being condensed in the secondary radiation, will pass to the vacuum pump as solid water, and no injection water being required in condenser will have a higher temperature when entering the boiler again, than possible with the simple vacuum system and its attending cold injection water in condenser, and usually such return water to boiler has a higher temperature than return water from a gravity system of any extent, as while more units of heat are used up in the radiation of the compound system, the water after leaving the secondary radiation, moves very rapidly in the return lines, owing to the influence of the vacuum pump, and the total heat lost in the return line is a great deal less than in the gravity return, where the water, after leaving the radiation moves very slowly, through the large return (which is usually under ground, under floor, or in the coldest part of the building), back to the boiler, as, although the main is large, the water travels through it only at a speed corresponding to the small amount of water discharged into it from the laterals, and is giving up its heat during the entire time it is passing through the return lines. As a result of this Compounding of the radiation, and only supplying the primary section with steam from the main, the steam mains, risers and feeders can be much smaller than usual with the simple system.

In this regard, it may be mentioned that the proportion of Primary and Secondary radiation, found to give the best results under average condition, that is, a pressure in the steam mains of zero to one quarter pound above atmosphere and with eight to ten inches of vacuum in returns, is two-thirds and one-third, the Primary having double the radiation of the Secondary. To better show how the mains, risers, etc., can be made smaller than usual, it is only necessary to say that in figuring for such, the Primary radiation only is considered, thus, if a building calls for three thousand square feet of radiation, and plans were made to compound it fully, the mains would only be figured for the two-thousand square feet of (Primary) radiation, and each riser and feeder figured on the same basis, as the Secondary radiation is heated entirely from the re-evaporation of the water of condensation of the Primary radiation.

All of the advantages of the Simple Vacuum System are secured in this Compound system, together with the increased enonomy in fuel, also the advantages of smaller pipes and consequent saving in first cost.

In order to secure the proper results in the secondary radiation, certain rules for connecting into the same must be observed. Compounding can be accomplished on many different combinations to fit the conditions.

For cast iron radiation the two sections, Primary and Secondary, can be used in one unit, or the Compound Radiator, and Pipe coils can be built to compound one into another, or two into one, and many other ways, according to conditions.

This Compound System has been installed in many buildings in the United States for the past three years with universal satisfaction. There is also a system in operation in Canada. The owners of the patents in both countries have, however, decided to dispose of the Canadian patents and devote their entire attention to the United States.

Anyone desiring to get into a clean, safe and pleasant business, should write the Simonds Heating & Specialty Co., 106 Washington avenue, Detroit, Mich., for particulars.

Amatite

B ROOFING

THIS advertisement will bring to your attention the *best and cheapest ready roofing* on the market. Here is how we prove it the best.

In the first place Amatite is made in one standard thickness, whereas other ready roofings range from a thin, flimsy half-ply to a three-ply thickness.

The three-ply thickness (which, by the way, is only one sheet of felt) is the only kind that can be compared with Amatite.

But right here is the point. Amatite is better made, has better water-proofing material, and weighs more per square foot than the three-ply grade of other makes, and *costs much less.*

These facts make Amatite the most desirable roofing made.

But in addition to its superiority in material and manufacture, Amatite has one distinction which makes it stand out above all others. *It has a real mineral surface.*

It is hardly necessary to state the advantages of such a mineral surface, the freedom from painting or coating, the perfect protection against all kinds of weather, the great durability.

This mineral surface is embedded in a layer of Pitch, *the greatest known waterproofing material.* Beneath this in turn are two layers of the best grade of wool felt—cemented together by more Pitch, making the whole a roofing that is *absolutely waterproof.*

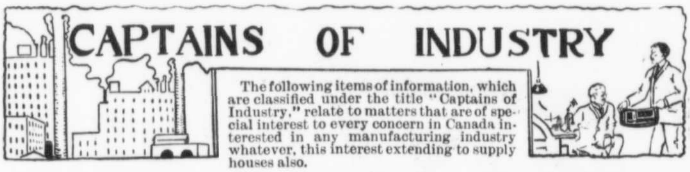
No other ready roofing can compare with this mineral-surfaced, waterproof, weatherproof, durable roof. That's why we say—*Don't buy your roofing until you have seen Amatite.*

Free Sample & Booklet

Send for Free Booklet and Sample to-day. It will pay you to get acquainted with Amatite. Address nearest office.

Paterson Manufacturing Co., Limited

Toronto Montreal Winnipeg St.John, N.B. Halifax, N.S.



CAPTAINS OF INDUSTRY

The following items of information, which are classified under the title "Captains of Industry," relate to matters that are of special interest to every concern in Canada interested in any manufacturing industry whatever, this interest extending to supply houses also.

The Canadian Northern Railway are considering the construction of a new line between Toronto and Buffalo, N.Y.

Plans are being considered for the reconstruction of the power plant of the Togona Water & Light Co., at Sault Ste. Marie, Ont., which was destroyed by fire in May.

A four-story warehouse will be erected on Clinton Street, Toronto, by the Imperial Storage Co., Toronto.

J. H. Jackson, engineer, Niagara Falls, Ont., is preparing plans for a macadam boulevard, 16 miles in length, to be constructed between Queen Victoria Park and Fort Erie, Niagara Falls.

The Grand Trunk Railway will build another large addition to their car shops at Port Huron, Ont.

The creamery at Pickering, Ont., owned by F. L. Green, recently destroyed by fire, will be rebuilt at once.

A tack and nail factory will be established at Galt, Ont., by G. P. Clapp and J. Eatough, of Montreal.

A dam will be constructed across the Montreal River at Latchford, Ont.

A flour and feed mill will be built at Magnetawan, Ont., by J. Schadie, Magnetawan, Ont.

A new collegiate institute will probably be erected at Brantford, Ont.

A new high school will be erected at Dundas, Ont.

The construction of a telephone system at Dunedin, Ont., will be undertaken at once by the recently incorporated Noisy River Telephone Co.

A new Carnegie Library building will be erected at West Toronto, Ont.

The congregation of St. James' Methodist Church, Peterborough, Ont., will erect a new edifice.

A new jail will be erected at Parry Sound, Ont.

A new public building will be erected at Welland, Ont.

A part of the business section of Havelock, Ont., has been destroyed by fire.

The Smart-Turner Machine Co., Hamilton, Ont., are supplying the corporation of Hamilton with a duplex pump for the sewerage disposal works.

The Canadian Pacific Railway have placed an order for 85,000 tons of 85-pound rails with the Lake Superior Corporation, Sault Ste. Marie, Ont. This will probably mean the return to work of 1,500 men.

The Canadian Northern Railway have decided to build the 550 mile gap in the system between Sudbury and Port Arthur, Ont.

A fire broke out recently in West Toronto, Ont., destroying a portion of the Union stock Yards and a number of dwelling houses.

The Canadian Pacific Railway bridge near Schreiber, Ont., recently destroyed by fire has been rebuilt.

The Dominion Hammock Mfg. Co., Limited Dunnville, Ont., have been incorporated with a capital of $40,000, to manufacture hammocks, tapestry, curtains, etc. The provisional directors include J. J. Camelford, A. Camelford and T. Camelford, Dunnville, Ont.

The Canadian Lead Mining & Smelting Co., Limited, Kingston, Ont., have been incorporated with a capital of $400,000, to carry on a mining and smelting business. The provisional directors include G. A. McGowan, L. L. Henderson and D. Murray, Kingston, Ont.

The C. R. Wilmott Co., Limited, Milton, Ont., have been incorporated with a capital of $200,000, to manufacture agricultural implements, stoves, furnaces, etc. The provisional directors include C. R. Willmott, W. G. Patrick, and G. T. Pepall, Toronto, Ont.

The Ontario Silica Co., Limited, Windsor, Ont., have been incorporated with a capital of $100,000, to carry on a mining and manufacturing business. The provisional directors include C. E. Green, H. Clay and G. J. Leggatt, Windsor, Ont.

Grey's Siding Development, Limited, Toronto, Ont., have been incorporated with a capital of $100,000 to carry on a mining, milling and reduction business. The provisional directors include C. S. MacInnes, C. C. Robinson and E. B. Ryckman, Toronto.

The Montreal River Development Co., Limited, North Bay, Ont., have been incorporated with a capital of $40,000 to carry on a mining business. The provisional directors include A. Torrance, Ottawa, and W. Morgan, G. W. Leach, North Bay, Ont.

A post office and customs office will be built at Welland, Ont.

A post office will be built at Owen Sound, Ont.

The Peterborough Show Case Co., Peterborough, Ont., have secured factory premises in that city, and in addition to show cases will build door fixtures and cabinet ware, etc.

An addition will be built to the spike mill of the Hamilton Steel & Iron Co., at Hamilton, Ont.

Tolton Bros., Guelph, Ont., manufacturers of agricultural implements, will build an addition to their works.

The business of James A. Cline, Limited, furniture manufacturers, Stratford, Ont., has been taken over by Morlock & Cline, Limited, and removed to Guelph, Ont.

The Canada Metal Co., Limited, Toronto, will erect a new foundry building and chimney stack on Fraser Ave., Toronto.

The World Newspaper Co., Toronto, will probably erect a building on the north side of Richmond St., Toronto.

A brick veneer warehouse will be erected on Hickey St., Ottawa, Ont., by Messrs. Pearson & Co., Ottawa.

A part of the business section of Cobalt, Ont., has been recently destroyed by fire.

Mr. A. T. Stewart, Toronto, will erect a pair of two-story and attic semi-detached brick stores and dwellings at College St., Toronto.

A fire recently destroyed a part of the business section of L'Orignal, Ont. Loss about $20,000.

A new school will be erected at Ingersoll, Ont.

It is proposed to erect a five-room addition to the Clinton St. school, Toronto.

Robert N. Taylor & Bro., Chelsea Ave., Toronto, have been granted a permit for the erection of a two-story brick store and dwelling on the corner of Bloor St. and Symington Ave., at a cost of $2,800. Architect, Geo. Lee.

A part of the business section of St. Remi, Que., including Ladine's store, St. Marie store and hotel, has been destroyed by fire. Loss $150,000.

The Finance Committee, Montreal, Que., will expend $20,000 for new water pipes.

Mr. John Lebrun's dry goods store at Halifax, N.S., has been destroyed by fire. Loss $25,000.

The Post Office at Halifax, N.S., will be altered at an estimated cost of $100,000.

A low water wharf will be constructed at Burton, N.B.

Anderson's furniture factory, Newcastle, N.B., was completely destroyed by fire.

The Enterprise Foundry Co., St. John, N.B., will rebuild their plant at Sackville at once, which was recently destroyed by fire.

A warehouse will be built at Chatham, N.B., by Randolph & Sons, Fredericton, N.B.

A. C. Allan's carriage factory at Newcastle, N.B., was recently destroyed by fire.

A new school will be erected at Chebucto road, Halifax, N.S.

A mattress factory will be erected at Pictou, N.S., by W. Ingraham, Glace Bay, C.B.

The Icelandic Lutherans, of Winnipeg, Man., will erect an academy in that city, cost about $20,000.

The Portage Exhibition Association will erect a new racing stable, paddocks, and grand stand at Portage la Prairie, Man.

General Superintendent Jamieson has completed arrangements for the erection of a new round house at Minnedosa, Man., to replace the one recently destroyed by fire.

The Canadian Pacific Railway will spend $29,000 on remodelling the depot and freight sheds at Portage la Prairie, Man.

An elevator will be erected at Estevan, Sask., by Stromwold & Co., Mohall, N.D.

Telephone lines will be extended from Regina to Saskatoon and from Regina to Antler, Sask.

The Jackson Engraving Co., Winnipeg, Man., have assigned to the Western Trust Co., Winnipeg.

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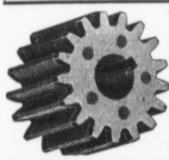

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Wendt & Hancock, Daysland, Alta., will erect a pump factory in that town.

A new high school will be erected at Yorkton, Sask.

A flax mill will be established at Saskatoon, Sask., by Douglas, Piper & Johnston of the same city.

The Government will erect a new immigration hall at Wilkie, Sask.

A new warehouse for the Provincial Railways and Telephone Department will be built at Regina, Sask.

The Sunny Belt Grain & Elevator Co., Lethbridge, Alta., have purchased the elevators of A. L. Foster & Co., at Cardston, Raley and Coaldall, Alta., and will erect other elevators at various points.

A new bank building will be erected at Medicine Hat, Alta., by the Merchants Bank of Canada.

A new waterworks system will be installed at Kelowna, B.C.

A new jail will be erected at Ladysmith, B.C.

The Cooke Lumber Co., Nelson, B.C., will erect a saw mill in that place.

A $20,000 plant for the manufacture of white lead will be erected at Victoria, B.C., by F. W. Morris of that city.

The opera house at Nelson, B.C., will be remodelled shortly.

Morison Suspension Furnaces for Internal Furnace Boilers

Designers and builders of boilers, as well as engineers generally, will be interested in the seventh edition of a book entitled "Morison Suspension Furnaces for Internal Furnace Boilers," just issued by the Continental Iron Works, Borough of Brooklyn, New York City.

The book deals with the use of the Morison Suspension Furnaces, of which the Continental Iron Works is the sole manufacturer in the United States, in connection with land boilers only, in contradistinction to the application of Morison Suspension Furnaces for marine purposes. It is a finely compiled and printed volume of nearly seventy pages, bound in a serviceable cover.

There is a fund of valuable data, with numerous illustrations,including a number of important installations of Internal Furnace Boilers using Morison Suspension Furnaces, together with details of design and construction, tables of pressure and thickness, and rules for calculating same.

The designs shown are for land boilers ranging from 50 h. p to 300 h. p, and are intended to meet general requirements, it being explained that where boilers are designed to work under other than normal conditions the designs are offered by way of suggestion only.

A form of specification for Internal Furnace Tubular Boilers, which accompanies the design, should prove an important aid.

In the latter part of the book is a partial list of installations of Internal Furnace Boilers fitted with Morison Suspension Furnaces, many of which are repeat orders, demonstrating the satisfaction this type of steam generator gives.

This is followed by illustrations and full information regarding the Morison patent furnace fronts and doors for economical and rapid firing, and which are also made only by the Continental Iron Works.

Engineers, architects and boiler manufacturers will find this book of great assistance to them in the design and lay out of steam power plants.

The book is printed by H. Edwards Rowland, New York City, and a feature of the text is a clever adaptation of photographs, showing various applications of the Morrison furnace.

Economic Considerations on the Management of Plant.

Address by W. H. Patchell, President of the Association of Engineers in Charge at Bombay, India.

As the majority of the members of this association are engaged in the supervision and operation of existing plants, rather than in the design and erection of new work, a few thoughts concerning the economical operation of plant may be more profitable than an academical dissertation on design.

In these days of hurry and stress there is a great tendency to cut the time of apprenticeship in the shops too short, but very great importance must be attached to this part of a man's training, not only because it gives a knowledge of the practical side of his duties which can be obtained in no other way, but it gives what is equally important to an engineer—a knowledge of men at the time of life when the student is most likely to benefit by it, and is not too old to have the two sides of the question duly impressed on him. No man can learn to work a machine by reading books, and he is even less able to get the best out of the human machine by academical research.

A common fault is manifest by the close attention to the detail of one particular point while the rest of the concern runs wild, and, for the time being, unheeded. A skilful leader will know all that is going on, point out to his staff the lines on which they are to work, and help them individually to fill in the detail while leaving them to develop themselves in doing so. Men who have come to the top are neither those who have found it necessary to do every job themselves—this only occurs in those who are unable to impart knowledge to others—nor are they those who sit in an office writing memoranda to their staff. An American Government official lately put the matter in a few words that are well worth quoting : "To attain to the highest success as an engineer you must not be the type of man who knows how to do things but cannot tell others how to do them—the man who gets knowledge abundantly but can apply it only through his own fingers. Instead of directing your energy simply to increasing your own output by 50 or even 100 per cent. it is far better—you make yourself more useful to the world—by using your energy to increase the output of each of 100 men by 10 per cent. The world recognizes this by awarding the prizes to the administrators."

In spite of tempting offers from authorized undertakers, either municipal or company, and the well-seasoned allurements of the promoters of bulk supply schemes, the majority of large institutions still generate their own supply. In many cases the amount of steam used for the electric light engines is small as compared with the amount used for heating and other purposes, so that even in the event of electricity being bought outside, the domestic demands for steam would prohibit the shutting down of the boiler plant. In several American cities steam is supplied through mains laid in the streets, and in some cases operated as a byproduct by electric supply companies. In some cities private plants have been taken over by the electric supply companies who have undertaken the heating business, with results satisfactory to both sides, but there are at present no records of such service being undertaken in this country. The present price of coal and the thirst for information displayed by the Local Government Board render economical working of the whole of their plant more than ever important to engineers-in-charge.

Water Supply

Water is often taken from the mains when it might more profitably be taken from a well on the premises. Twenty years ago the number of tube wells in the London basin was very small. The older class of well sinkers stoutly maintained the necessity of a costly sunk well, with perhaps a tube or tubes at the bottom of it. Gradually, however, the bored well proved its reliability, and the low price and simplicity of the system has led to a popularity which some years ago would have appeared impossible, or at any rate quite improbable. Direct-acting steam well pumps are in many cases looked upon as "steam eaters," and the disadvantage of having to draw the rods and bucket has led to the adoption of geared pumps, or, when the water supply is plentiful, of the air-lift system, which can claim a record for capacity, and couples reliability with the advantage of having all the working parts on the surface, and an economy at any rate well within the range of commercial requirements. When a change from supply from the mains to a well on the premises is contemplated, the class of water obtainable in each case must be considered. Questions of pollution and sand must also be considered as mentioned in the discussion of Mr. Shenton's paper on "Small Water Supplies," read before this association last year. In many cases an air-lift or a borehole pump may be driven from an existing large engine, and the extra cost of working the pump is hardly perceptible. Even when a special en-

gine is employed the cost of fuel on a well-designed plant is small.

Of course, it is impossiible to forecast exactly what supply will be obtained from a tube well, and perhaps the old sunk well was convenient, as it was easy to drive from the bottom of it either for prospecting or increasing the yield, but for moderate supplies the bored well appears to be the cheaper project. An instance of the uncertainty is shown in the case of two 13-in. wells within 100 yards of each other. One borehole yields 4,000 gallons for an hour or so, when the yield gradually falls to 2,000 gallons and remains constant at that point. The other borehole yields 27,000 gallons continuously. In this case the air-compressor is high speed driven by an electric motor taking 40 k.w. when liifting 27,000 gallons per hour, 96 ft. to the surface. In one case, where a gas-producer plant and engine drives a compound equipment consisting of an air-lift pump, which raises the water 120 ft. to the surface, and of a plunger pump, which drives the water to a reservoir at a head of 180 ft., the cost of fuel used when raising 11,500,000 gallons of water has been under £27, or .55d. per 1,000 gallons. On the same site a three-throw deep-well pump driven by an engine using town gas pumped 17,000,000 gallons at a cost for fuel of 1.26d. per 1,000 gallons pumped. The town gas was charged at 3s. 3d. per 1,000 cubic feet. At another place an air-lift pump driven by a motor taking 68.5 k.w. is lifting 17,300 gallons per hour 262 ft.

Water softening is much too large a subject to be handled in one paragraph, as the various systems would have to be dealt with in detail. One system was described by Mr. Lassen before this association in 1905, and it is only my desire now to remind members that it is not economical to feed impure water into a boiler. If the water is of a scale-forming nature, the loss in heat is very serious owing to the deposit of scale on the tubes or plates. If only sludge or a concentrated solution of salts is formed, the loss in blowing down is also great, although in these latter cases the cost of labor in cleaning is less than when hard scale has to be removed. One of the simplest and most efficient forms of purifier is the open heater. Many varieties are on the market, differing rather in the application than in principle. When such a type can be used, it is certainly preferable to a system which turns the pump-room into a whitewash factory, with an uncertain outlet for the byproducts. I believe one of the strongest arguments in favor of our present London water supply is the low death rate which is quoted to show its special suitability to our uses. We have only to return home from a visit to districts more favorably situated to realize how hard our lives are, and to wish that more consideration was paid to those who use soap or evaporate the water and less to those who die!

Fuel.

The great rise in the price of coal has necessitated the consideration of the more economical use of it and of the possibility of using cheaper qualities. Many users who previously burned "large" have found relief in the use of "small" or "nuts," not only in connection with mechanical stokers, but also for hand-fired boilers. Where the draught is poor or the grates small, necessitating a large combustion per square foot, a grade of fuel which will permit an ample amount of air to pass through it is essential. There are several forms of firebar designed to burn small coal, but a bar of the usual shape with small air-spaces will serve very well witih a normal draught if the stoker can only be persuaded to keep his fires thin. Thin firing is especially important with small Welsh of the drier kinds, as if a mistake is then made and the fire worked too thick, the application of the pricker only results in making matters worse, and the fire is quickly poked out. Steam jets under the grates form a simple, though rather noisy, means of assisting the draught, but unless the nozzles are carefully watched the proportion of steam blown under the grates to that evaporated by the boiler assumes most uneconomical dimensions, 12 to 15 per cent. being by no means unusual. The jets are also apt to cause local heating and damage to the boiler plates and firebars.

Where the draught can be assisted by a fan, it will be found much more economical than the steam jet method. Forced draught has an advantage as regards the size of the fan required, as the air blown under the grates alone has to be handled, while an induced-draught fan has to handle the same weight of air, in addition to the gases of combustion, at a higher temperature, and consequently increased volume. The induced-draught system is generally preferred where the chimney draught only has to be assisted occasionally, such as on peak loads, and it has the advantage that the ashpans then need no alteration, but may be left open, and there is no chance of flames being blown out of the firedoor. It has a disadvantage, however, when dry Welsh coal is being burned, as grit is more likely to be ejected from the chimney. The regulation of the draught by the dampers has not received the attention it deserves. Automatic regulators have been placed on the market, but the sale of them must have been small, as they are rarely met with. To get the best results when hand-firing, the air admission, and also the chimney dampers, need careful manipulation, and this is a strong point in favor of mechanical stoking, as then the ideal conditions of long runs without opening the doors may be realized.

Gas analysis has of late years received attention, though for many years it was ignored alike by experts when testing steam boilers and by the users of boilers; it is only of late years that the percentage of CO_2 in the flue gases has been recorded on boiler tests. Thousands of tons of coal are wasted yearly by the neglect of the subject. The average amount of CO_2 in the gases may be taken at about 7 per cent., which means a loss of 26 per cent. in the calorific value of the fuel. Greater care would increase the percentage of CO_2 to, say, 12 per cent., which means a loss of 15 per cent. only, and would represent a saving of 10 per cent., which would quickly pay for the apparatus involved. The benefit of recording the CO_2 in the flue gases was first realized in Germany, whence the earlier types of instruments were developed. Since their introduction into this country, many of the faults in the earlier types have been eliminated, and some of those now on the market merit a much larger recognition than has yet been accorded to them. In many German works it has long been the custom to pay the stokers a premium on the amount of CO_2 recorded, with beneficial results. A sight hole to enable a stoker to see the combustion without opening the firedoor is a very useful adjunct to a furnace, as an intelligent stoker soon notes what color indicates that the boiler is doing its best, and learns how to regulate his operations to obtain that color. When boilers are set in battery the whole can only be placed in the front, but the best place is at the side behind the bridge.

Purchase of fuel by analysis is very important, but when we consider the ease with which coal merchants can sell their stock, it is not surprising that they do not generally view the system with favor, and resent the incorporation of such clauses in their contracts. More united effort will be needed to get them educated up to this equitable method of buying fuel. Experience gained by several years trial has proved to me that sampling and analysis may be done quite commercially under a contract which states the amount of volatile hydrocarbons and ash allowable, with a penalty if the amount of ash is exceeded. Air leakage through boiler settings is a common cause of low efficiency, not only in the case of water-tube boilers, but also in shell boilers of every type, excepting the wet-back marine. Asbestos rope is a most useful draught stopper when either built in between the brickwork and the boiler, or caulked lightly in afterwards. It is sufficiently elastic to allow the boiler to expand when hot without moving the brickwork. Cracks in walls should be promptly stopped. In some cases where the ashpans are fitted with doors, the stokers are apt to regulate the draught by them, and to leave the full chimney suction on the boiler and setting. It is better practice to regulate by the outlet damper.

Mechanical stokers have, unfortunately, too often been recommended like patent medicines, but the purchasers have found that stokers doing excellent service under certain boilers are useless under others. Of late years much more thought and skill has been applied to the problem, with a resultant gain to all concerned. Even now, due to competition, the makers' estimates are apt to be too sanguine, and best results not only in economy of fuel, but particularly as regards repairs, may often be obtained when working the machines below their rated capacity. When selecting a stoker more care than is sometimes displayed should be taken in choosing a type which will burn different classes, and certainly different sizes, of fuel. For instance, if a stoker is arranged to burn only clean nuts, as the market sometimes calls for more nuts than are made, the price is inflated. Smaller grades are tried, but the waste, due to riddling through the grates, is then excessive, and the lesser evil is to continue burning nuts, as the design of stoker has debarred the use of the cheaper fuel. Where only one or two boilers are in use no saving in labor can be made by the adoption of mechanical stokers, as the man who is necessary to tend the stokers might as well do the firing himself. A saving may, however, sometimes be effected on the class of fuel used, but

this saving must be very definite to be commercial, as the upkeep of the stoker has to be provided out of it.

Steam superheating, although increasing rapidly in favor, is still conspicuous by its absence in many plants where it could very readily be adopted with a distinct gain in economy. No matter whether the steam is to be used in an engine or for heating purposes, the gain due to superheating is very marked. The ill-effect of condensation in steam-pipes is cumulative, and the application of steam-traps to remove the water offers a fine field for further waste. Pipe covering is frequently only literally applied, all the flanges being left bare. Although gills and flanges are recognized as necessary adjuncts on radiator pipes, it is strange that when an attempt is made to prevent radiation from steam pipes these are the very parts which are usually left bare. The excuse is sometimes offered that leakage and the necessity for attention to joints prevents the adoption of cover to flanges. If the joints are properly made and the flanges stiff, they may be safely covered up and their existence almost forgotten. The water formed by condensation at a flange will often cause a leakage that would never have occurred if steam only had been present.

Water heating by economisers may be adopted where the draught is good, and the heat in the gases can be spared as in mechanical draught installations. An economiser, as was shown by Mr. Melville last session, is not only a direct source of economy in itself, but the hot feed water increases the evaporative capacity of the boiler, and, what is more important still, it prevents local cooling and so saves straining the boiler. Internal heating apparatus is again coming to the fore. Several types are now on the market which are, perhaps, more useful than novel. The older types of this apparatus gave trouble from water hammer when the pump was stopped. This fault must be carefully guarded against. The makers of later models deny any trouble of the kind. When economisers are used, care should be taken to prevent cold water being pumped into them, as it causes sweating and rapid deterioration.

Water heaters, both of the open and closed type, are most valuable in the case of non-condensing plants. An open heater will raise the temperature of the water to the temperature of the exhaust steam, as there is no loss due to the head necessary to drive the heat through the plates or tubes as occurs in a closed heater. The scale and deposit formed may be quickly removed from the trays upon which it settles, access being obtained by doors which only need to be exhaust-steam tight, no pipe joints or pressure joints have to be disturbed. The facility with which the water can give up the air absorbed in it is another point in favor of the open heater, as such air is apt to cause pitting in the boiler. An objection to open heaters is that they must be put in the suction side of the pumps and at some elevation above them, otherwise the hot water vapors under the pump bucket and the pump loses its water. Where the water is hard, special care should be taken to catch in a settling tank or filter any small crystals of lime which do not stick on the trays, otherwise the pumps may get badly cut. Closed heaters, whether of the plate or tubular type, very quickly drop in efficiency, due to the deposit of scale on the water side and oil on the steam side of the heating surfaces, and so increase the normal difference in temperature between the steam and water. They are much more difficult and costly to clean than open heaters, and so the evil cleaning day is kept off as long as possible.

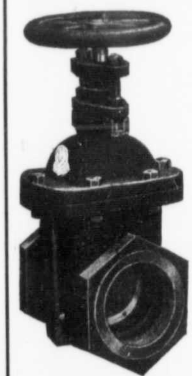
Air heating has been tried again and again, but it is very doubtful if it pays. Perhaps the greatest advantage it possesses is in the suppression of smoke, and in that field it certainly has an important place. Smoke prevention has been run hard both by fanatics and by those who are really anxious to see trade carried on upon a commercial basis with the least possible inconvenience either to the traders or their neighbors. All who have considered the matter will admit that,although black smoke means waste, it is not equally true that a smokeless chimney means economy. On a series of tests the lowest efficiency was recorded with a minimum amount of air, and the highest with a moderate amount of air, when some smoke was made. Every effort should be made to prevent the emission of smoke, the underlying principle of which is the admission of the proper quantity of air at the proper time, and the removal of cooling surfaces so far as is possible from the gases until combustion is complete, as if the temperature is lowered below the critical temperature, before combustion is effected, no amount of care in air regulation will prevent smoke. The Smoke Abatement Society made a step in the right direction when they last year started lectures for firemen, and the question has been handled in a very practical way by the Smoke Prevention Society in Hamburg, where carefully watched tests have educated the firemen and led to increases in efficiency up to 14 per cent., on hand-fired boilers.

The main causes of waste in the engine-room are steam-pipe condensation and leaky engine valves. The steam-pipes in a plant are very often out of all proportion to the actual requirements of the engines, not only in length but in diameter. Duplicate ring mains in the boiler-room and engine-room are common, but a proper arrangement of pipes and well-made joints does not call for such an expensive insurance against a shutdown. The benefit of shortening the path of the steam between the boiler and engine cannot be overestimated. Good lighting is conducive to economy in both engine and boiler rooms, as plant in a badly-lit room never gets properly looked after or cleaned. Why should it? It is no credit to the cleaner if it cannot be seen! Dirt is about the worst disease a plant can suffer from, as it invariably means neglect of small indications and warnings, timely attention to which would prevent the otherwise inevitable breakdown. Not only is the plant better cared for, but men all work better in cheerful surroundings and lose less time through sickness.

Tests.

It is an unfortunate fact that in many cases an engineer-in-charge does not really know what his plant is doing, and all for the want of tests, which he could carry out himself with very slight expense or inconvenience. Coal may be weighed without appreciably increasing the cost of handling it. Water may be measured by positive meters, which do not need much attention so long as they are not run at a high speed or cut by grit. An interesting and novel type of water-meter is Lea's notched weir, which is very simple and not likely to be put out of action by the causes that affect other water-meters. It is a very ingenious application of an indicating and recording attachment to measure the flow over a V notch, the value of which was first investigated by Prof. Jas. Thompson about 50 years ago. These two measurements, coal and water, give sufficient data for checking the cost of evaporation, which is the most important factor in the works cost of private plants. I believe that no single factor has contributed more to the economical running of electricity supply plants than the analysis and publication of their figures by the press, and I am sanguine enough to believe that if one of the members would collect data as to cost of evaporation in the plants under the charge of members of this association, and present them in the form of a paper, the result would be a healthy competitive stimulant to all concerned.

Engine tests appear to have had more fascination for experimenters than boiler tests, but comparison of records goes to show that there is not much difference in the efficiency of different types of boilers which vary largely in design; certainly the figures are not so far apart as are the results of tests of similar boilers worked under different conditions. This puts all the stronger emphasis on the necessity of an egnineer-in-charge knowing what his boilers are doing. The more a man knows of his plant the keener will he be to keep its performance up to the highest level obtainable. and nothing shows a staff the capabilities of a plant and secures confidence in it better than a few tests, the educational value of which on all concerned cannot be overestimated. So far as I have been able to find out, there does not appear to be much published on the cost of steam generation over long periods. In an appendix to the late Mr. Bryan Donkin's "Heat Efficiency of Steam Boilers," some useful figures are given. I would like here to remark how much those of us who are interested in boiler problems miss our late friend, to whom we were repeatedly indebted for useful hints and data. Two factories, Rothwell and Duneberg, were under the same management, and experiments seem to have been prompted by the high cost of evaporation at Rothwell in the previous year, which amounted to 19.4s. per 1,000 gallons. In the following year the cost was reduced to 13.63s. per 1,000 gallons at Rothwell and 10.81s. at Duneberg. Further experiments were made, and it is stated that the cost of evaporation fell 39 per cent. at Rothwell and 28 per cent. at Duneberg, representing for one year alone a gain of £6,000. In 1905 results of a ten weeks' test at Sheffield were reported by Mr. Fedden, which, with coal at 5s. 8d. per ton, worked out to 3.57s. per 1,000 gallons for coal only, and for coal, labor, etc., to 9.32s. These results both look excellent, but if they are translated into London figures with the same coal, they would be of the order of 7s. and 13s. 6d. respectively. In one of the works with which I was connected



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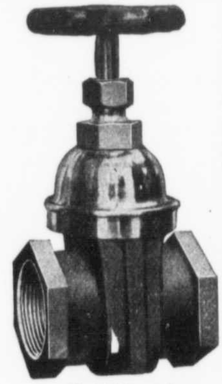

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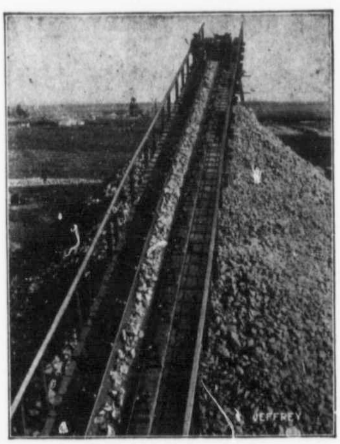

the cost over a year for coal only was 9.4s. per 1,000 gallons when the average cost of coal was 16s 10½d. per ton. Allowing for labor and repairs, the cost was 11.75s. per 1,000 gallons. On a month's test with coal at 13s. 3d. per ton the cost was 8.2s. per 1,000 gallons. The best day's test that I have had was with washed nut coal at 13s. per ton and of 13,800 B. Th. U. value, when the cost of evaporation per 1,000 gallons was 6.46s. on the net water, after allowing for the 7½ per cent. of the total water which was used for steam jets in connection with the stoker. The stoker itself was driven by an electric motor. With another type of stoker I have burned smudge coal costing 7s. per ton and of 10,400 B. Th. U. value, when the cost of evaporation was 3.82s. per 1,000 gallons. Various circumstances have combined which will, I believe, render a repetition of this figure impossible.

In carrying out experiments for practical use, care should be taken to ascertain beforehand that the samples and prices can be repeated in bulk, otherwise much time may be wasted. The capital cost, the working cost, and the maintenance of improvements must always be considered in connection with the saving to be effected by the alteration. For instance, I have known cases where condensing was applied under unfavorable conditions to a non-condensing plant, and the power taken in running the auxiliaries in connection with the condenser practically equalled the power saved on the main engines. This is not the reason why condensers have not been mentioned as possibly applicable and likely to effect a saving in existing plants; I have omitted them because generally the consideration of condensers, cooling towers, and the necessary auxiliaries in connection with them, would take more space than can be spared here, and their application would necessitate a greater upheaval of the existing conditions than I am contemplating.

Great economies may be effected in illumination by the use of the metallic filiment lamps now available, which also should especially appeal to those who find it necessary to extend the lighting circuits for new buildings, and are hampered by a fully-loaded plant. Approximate figures may be borne in mind indicating the difference between the two types—1 h.p.—200 c.p. with carbon-filament lamps or 500 c.p. with metal filaments. The two best known types at present on the market are the "Osram" and "Tantalum," taking 1.25 and 1.75 watts per candle-power respectively. An objection to the lamps which has not yet been overcome is the high price. The "Tantalum" can be fixed in any position, but the "Osram" must be placed vertical, while neither can yet be obtained for pressures above 130 volts. Higher pressure can only be used on these lamps in series, which is objectionable.

Gas Engine Engineers

By H. W. Jones in Gas Power.

Why is it that one man operating a 10 h.p. engine is called "engineer," and the man who controls a plant of 10,000 h.p. capacity and has under his care 500 human lives and many thousands of dollars of machinery, is also called "engineer ?" There are many kinds of engineers—electrical, mechanical, civil, locomotive, mining, consulting, steam engineers, etc. Now we have a comparatively new kind—gas engine engineers. Many say gas engines do not need engineers. If a 10 h.p. gas engine does not need an engineer, does a 1,000 h.p. gas engine need one ? If so, at what h.p. is the change made ? And why ?

I have met many men who operate gas engines; some are chief engineers in large buildings or in immense plants and some never saw a large gas engine. I believe no one will disagree when I say that the school of experience is the only one in which any engineer ever learns. (I mean any operator of engines.) A fireman on a locomotive must fire three to five years as a general thing before he gets an engine to run. A steam engineer's first and really most important duty is to see that his boilers are properly fired and properly cared for, this takes years of experience and study. Talk to a chief engineer of some big plant about plumbing, gas fitting, mill wrighting, electricity, hydraulics, the art of controlling men; talk pressures, strains, capacity of pipes, wires, or any question of dynamics; talk chemistry of coals, gases, etc., and we will find his conversation interesting; we will find he not only knows something of each subject, but that he studies them all so he can know more. They call this man an engineer, too.

If we had this kind of operators for all gas engines, in twenty years from date a steam engine would be a curiosity. Are we to continue to say gas engines do not need engineers ? There is no kind, class, or grade of men that are needed more in the world to-day than gas engine engineers. This applies to the use of city gas, natural gas, producer gas, gasoline, alcohol, distillate, crude oil, or any other fuel. The underlying principle of operation is the same. But what that is, and why, written in A. B. C. language, is what we want to know.

Men who are operating gas engines have all kinds of opportunities to study, to experiment, to learn, and to advance in their line, whether it is chosen or forced by circumstances. What are we doing to advance the cause of our employers ? Are we making a study of the engine ? Are we getting the best out of it ? Do we keep the engine up-to-date in cleanliness, and adjustments, or do we just "run" the engine haphazard ? If we do, we should not be surprised when the new(?) engineer takes charge. And we should not be disappointed when we apply for the position of engineer to have the employer say: "Why this engine requires thus and so," and then tell us what is needed is just what we ought to have posted ourselves on—but didn't. Men on the farm, at the sawmill, or at any plant, no matter how large, or how small, growth is the watchword. Horace Greely said: "Go west, young man, and grow up with the country." The wisdom of the above was not the "Go west" part, but the "Grow up with the country." Take a job running a gas engine and grow up with the industry. If the plant we run is not growing as fast as we are, get another job and grow up with it. To see a man with trained hands is good; to see a man with trained head is also good. But when we combine both trained head and trained hands this is a combination that can't be beaten. Do we who are fortunate enough to be operating gas engines realize the field that is open for us ? Do we realize our opportunities and are we getting out of them what we should ?

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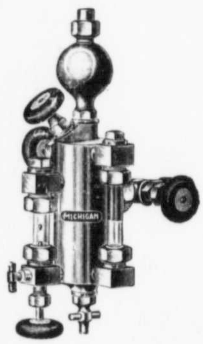

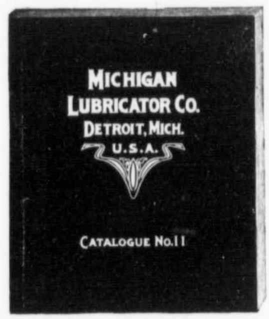

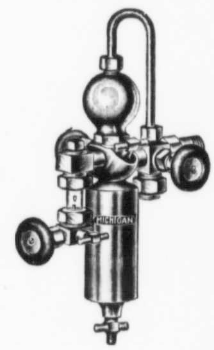

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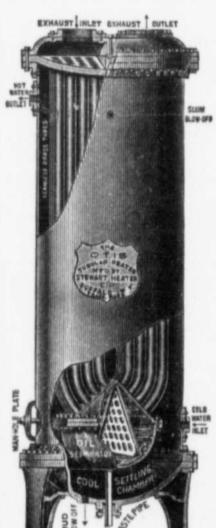

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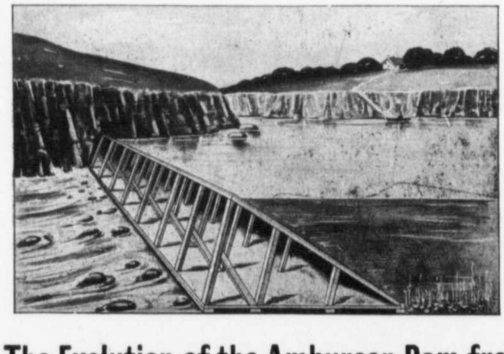

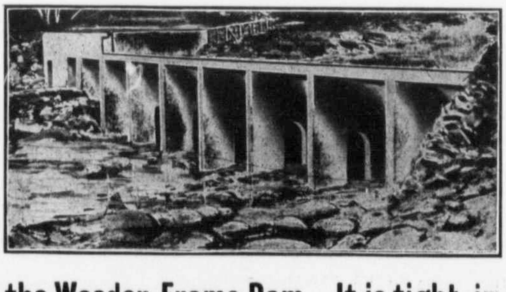

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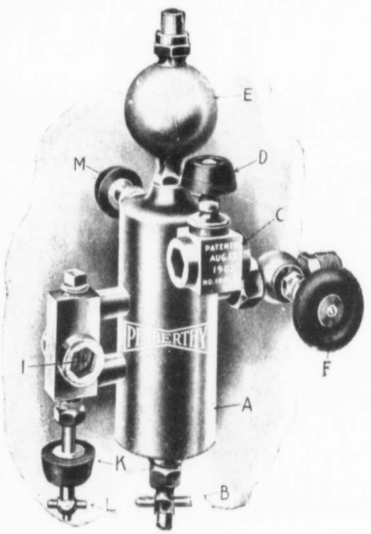

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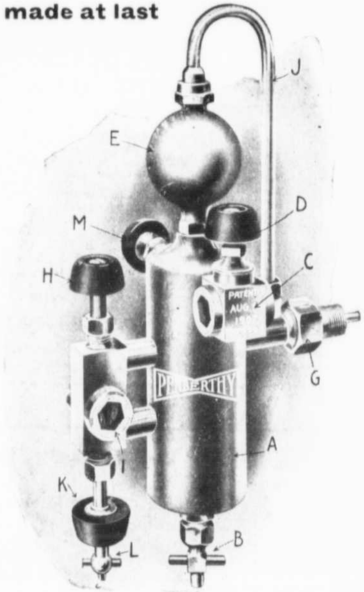

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