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THE HUNT STREET POWER STATION, CINCINNATI, OHIO

By Bert L. Baldwin, M. E.

In 1889 the Cincinnati Street Railway Company erected its first electric plant, reconstructing one of its brick stables at Brighton and forming a very respectable power plant, which operated the Colerain avenue line, which was the first division equipped with electric motors by this company. At this plant and over this line many experiments were made to determine the actual value of the electric system before it was more generally adopted, and the experience gained in constructing this plant was used a year later, when it was decided to build a large central plant. The site selected for this central plant is almost exactly in the center of the city, and located among the hills, so as to feed, as directly as possible, the heavy grades which it is necessary to overcome in order to reach the resident portion of Cincinnati. These grades on an average are about a mile long, and vary from 5 to 9 per cent.

FIG. 1.—INTERIOR OF BOILER ROOM, SHOWING STOKERS—CINCINNATI

At the time of building this plant the works of the various electric manufacturing companies, as well as the few large electric plants, that were in operation throughout the East, were visited, and the Thomson-Houston Electric Company's D. 62 generator was selected as the most satisfactory electric unit in service at that time; larger units had been built, but were giving more or less trouble.

The Hunt street generating station was designed to accommodate this type of generators, and was laid out in the manner shown by Fig. 2; the first equipment consisting of three Corliss engines, belted to receiving shafts and arranged with cross key couplings, so that the line shafting could be driven by different engines, thereby giving a certain amount of reserve in the engine power; sixteen D. 62 generators were driven from the line shafting, which was arranged with driving pulleys, keyed directly to the same and each having a dead pulley, which was free to revolve upon a quill or sleeve supported by independent sleeve stands. In stopping a generator the belt was shifted from the driving pulley on to the dead pulley which supported the belt without being subjected to wear; each dead pulley was arranged with a simple form of friction clutch, whereby it could be coupled to its driving pulley at such times as it was necessary to cause them to revolve so as to be able to shift the belts from the dead to the driving pulleys.

As stated before, Fig. 2 shows the original equipment of the station, while the dotted lines show the arrange-

ment for future extension, it being supposed that it would never be necessary to furnish more than 2000 h.p. from this station. Additional machinery was added from time to time as the load increased, until the plant was carrying loads which allowed for very little or no reserve in boiler, engine or generator capacity; then came the most trying portion of the work, that of reconstructing the plant to one of a different type, substituting the more modern type

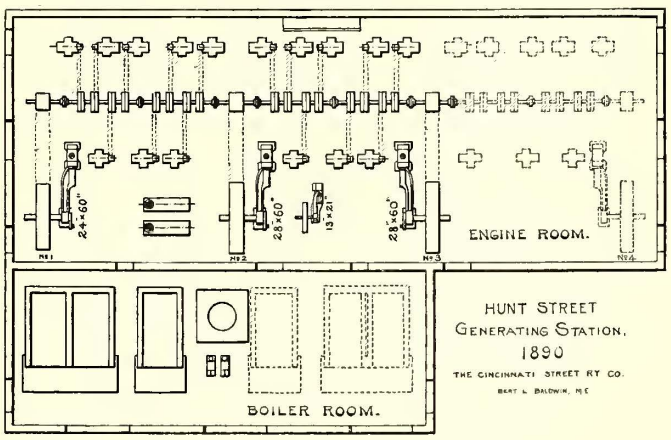


FIG. 2.—PLAN OF OLD STATION

of generators for the small belt units. This work had to be done without in any manner interfering with the continuous operation of the plant. The line shafting, small generators and simple Corliss engines were all retired from service and the present compound non-condensing engines with direct belted or direct connected generators were put in operation. The steam pressure was increased to 150 lbs., so as to obtain the most satisfactory results, with the non-condensing engines.

The engraving, Fig. 3, shows the general appearance of the engine room, taken while the foundations for the first direct connected units were being built. This foundation was built between the old No. 2 and No. 3 Corliss engines, so that the plant was only crippled to the extent of retiring three small generators during this operation.

The plant of the generating station, as shown by Fig. 4, together with the cross section, Fig. 5, shows the present arrangement of the plant, which is arranged in the best manner possible, considering the fact that the various units were put in position, sandwiched in between the old engines, so as not to cause delays in the service. Figs. 6 and 7 are interior views of the engine room as it looks at present, while Fig. 8 shows the exterior of the building.

In the original plant, where there were only a few boilers, it was an easy matter to dump coal directly in front of the boiler room, but when it came to extending the boiler house so as to accommodate additional boilers, it was found advisable to have an elevated driveway from which coal could be dumped directly in front of the boilers as well as through certain trap doors into the space below this driveway which formed a storage of sufficient capacity to carry several days' supply of coal and be able to bridge over holidays or unlooked-for delays in the delivery of coal. As shown by Fig. 4, the small fans with their engines, which are used in operating the American stokers, and the firemen's toilet room are located under this driveway, at points where coal storage is not needed.

The boilers are of the horizontal water tube type, as built by the Babcock & Wilcox Company and the Abendroth & Root Manufacturing Company, each boiler containing about 3600 sq. ft. of heating surface with a rated capacity of 330 h.p., but in actual service and in connection with the engine shown, they develop 500 h.p. per boiler.

There are two steam mains, which are located upon opposite sides of the dividing wall between boiler and engine rooms, and are known respectively as the "boiler room main" and the "engine room main"; these have separate connections to each boiler and engine and form a complete duplicate system. This system of piping proved very useful during the year 1891, when the fly wheel upon the No. 2 Corliss engine burst and cut the engine room main in two; this accident caused considerable damage to the building and machinery, but as soon as the debris was cleared away and new wire connections made the other engines were

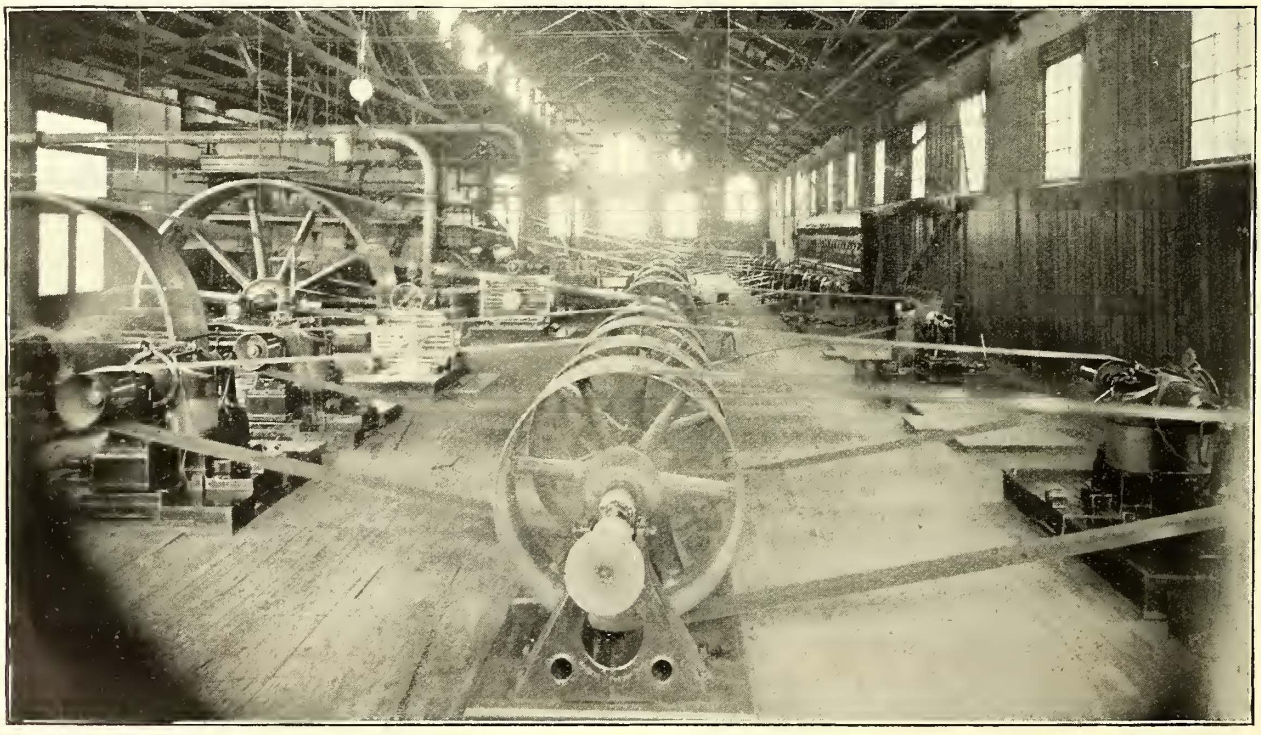


FIG. 3.—INTERIOR OF OLD STATION, SHOWING BELTED GENERATORS

ready for work, being supplied with steam from the boiler room main.

The feed water piping systems, pumps, heaters, etc., are also arranged in duplicate, and water is supplied to the plant through two separate water meters, which are connected to different lines of the city's water mains, so that up to the present time there has never been a condition under which it was necessary to shut down the plant.

The first six boilers were equipped with Murphy smokeless furnaces, some of which have been in constant service since the plant first started, except while their boilers were being cleaned, and with the excellent chimney draft, the latter amounting to 1 1-8 ins. water pressure, the original furnaces and arches are still in service and good condition. Bituminous nut and slack coal is used as fuel, and with the exception of a very faint vapor no smoke is

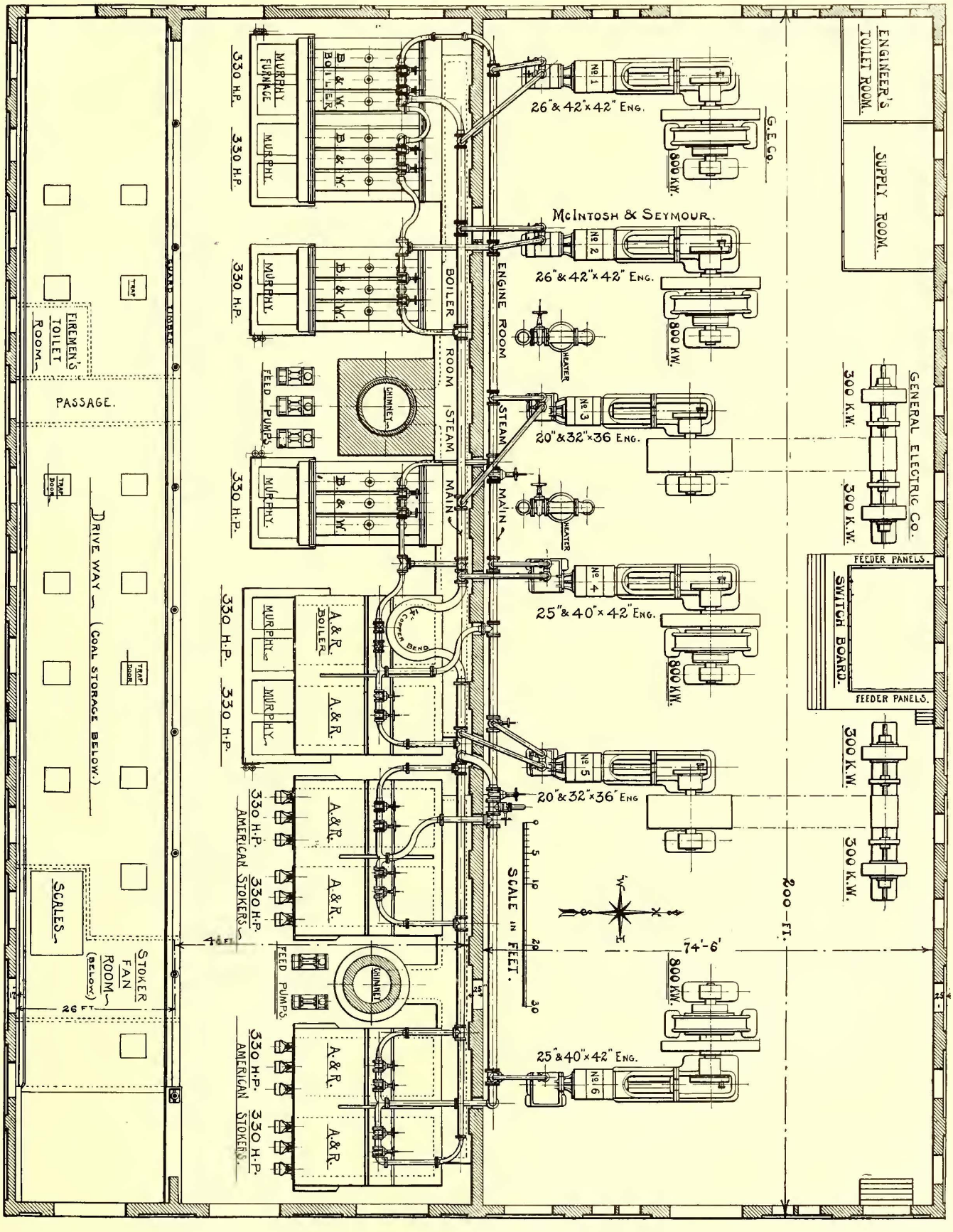


FIG. 4.—PLAN OF PRESENT STATION—CINCINNATI

noticed escaping from the chimney used in connection with these boilers.

The boilers, which were erected and put in service the first of this year, are equipped with the latest design of American stokers, which are of the under feed type; a view of this portion of the boiler room being shown by Fig. 1. These furnaces are connected to a self-sustaining brick-lined steel chimney, and the draft is supplemented by two Sturtevant fans driven by small vertical engines, as it is necessary to force the air through deep beds of coal. To the high pressure and gridiron valves upon the low pressure cylinders. Each of these engines has its governor carried upon a short shaft, which is driven from the crank by means of a drag link, thus keeping the eccentrics and all valve gear away from the fly wheel side of engine. This was found to be advisable, as it reduced the liability of oil working into the fly wheel and armatures on the direct connected units, as well as placing the governors where they were more accessible. These engines are so well known as not to require special description.

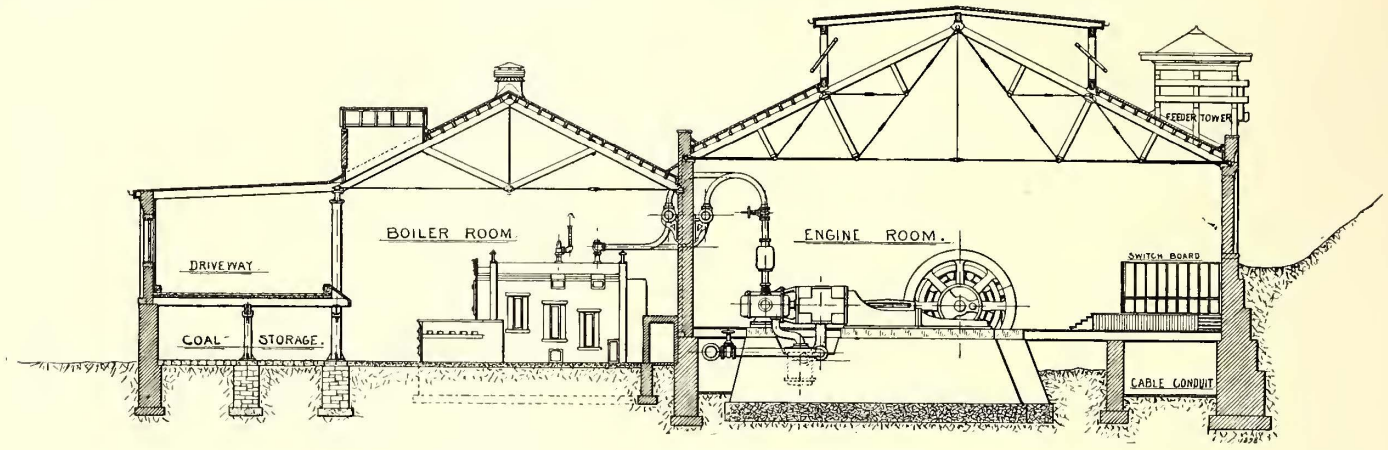


FIG. 5.—CROSS-SECTION OF PRESENT STATION

those who have never seen this type of stokers in service it seems strange to see a bed of coal on the grates from 16 to 20 ins. in depth with the incandescent coke on top and the green coal forced up by the stokers from below, all smoke and gases being forced to pass through the incandescent fuel and forming almost perfect combustion. The refuse taken from these furnaces is perfectly free from combustible of any description, and with the exception of a short period of time each day, when the firemen are breaking down the fires and removing such clinkers as may have formed during the previous day, there is no smoke apparent escaping from the chimney connected with these furnaces.

The engines used in this plant at present were all built by McIntosh, Seymour & Co. They are of the sizes shown upon the drawing and of the compound non-condensing type. Nos. 1 and 2 engines have gridiron valves upon both high and low pressure cylinders, while the balance of the engines have piston valves upon

The generators are all of the General Electric Company's standard type; the 800 k.w. direct connected units being of the 10-pole pattern and operated at a speed of 100 r.p.m., while the double 300 k.w. units are speeded at 400 r.p.m.

The switchboards and feeder panels are of a General Electric Company's standard pattern, being made of an enameled slate with the usual type of modern instruments mounted upon same. The generators and switchboard are connected with insulated cables carried in suitable conduits below the engine room floor, while the main feeder wires are carried from their panels up into the wiring tower, which is shown upon roof of building.

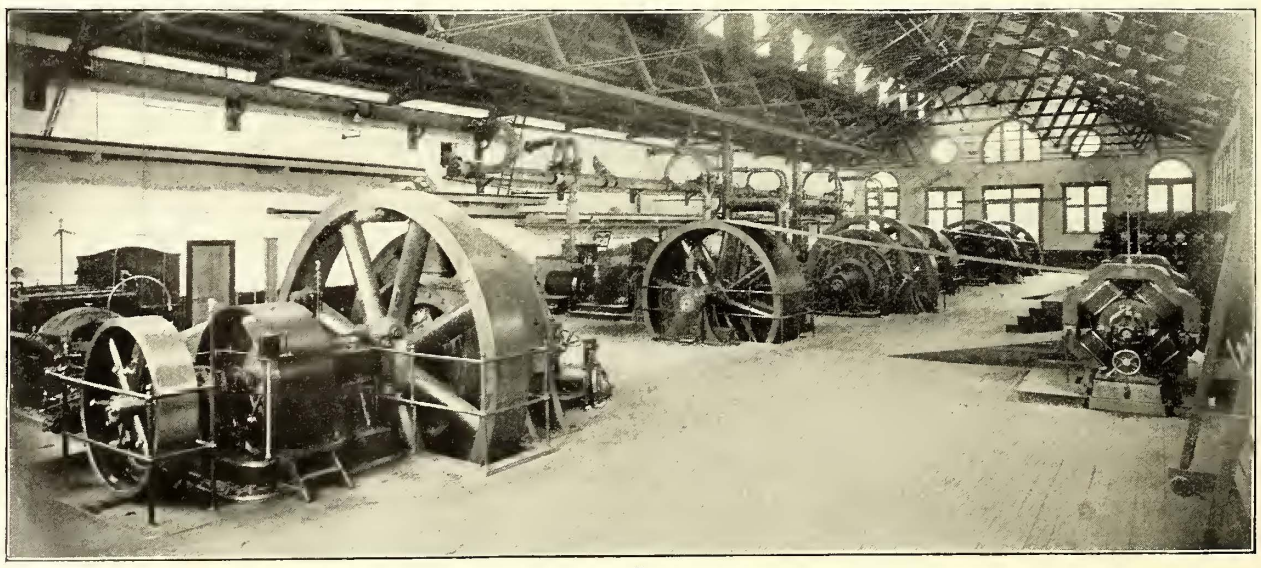


FIG. 6.—INTERIOR OF HUNT STREET STATION

This station is kept in continuous operation, as a number of cars are run upon various lines throughout the entire night, so that the station loads vary from about 400 amps. during the midnight run to between 5000 and 6000 amps. during the heavy travel.

To a person unacquainted with the condition of affairs in Cincinnati it would seem very bad engineering to build a plant on top of a hill, in a city that has a large river flowing past its southern border. But the Ohio River is a very poor thing to depend upon, as about twice each year "she goes on a boom" and rises 65 or 70 ft. above her low water level, and the plant that is built above the high water mark is so far away from the edge of the river, as well as so high above the river's usual level, that it would cost more to handle the water for condensing purposes than would be saved in fuel economy. Again, as before stated, this plant is located where it can feed a large number of heavy grades with the least amount of feeder wire, and in the double trolley system, as used in Cincinnati, with an equal number of positive and negative cables, it is very important to keep these feeders as short as possible. Within a radius of one mile from this point there are no less than six heavy grades, which in some instances make a demand upon power house as high as 180 amps. per car.

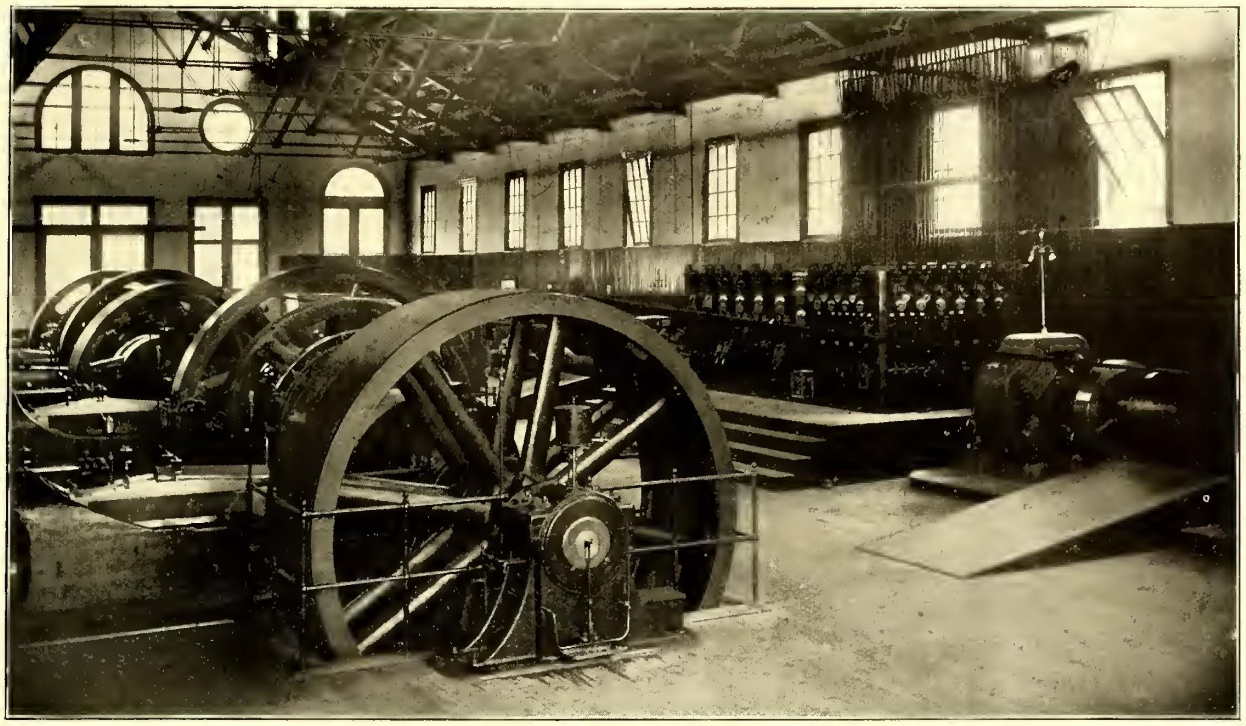


FIG. 7.—SWITCHBOARD AND CONNECTIONS

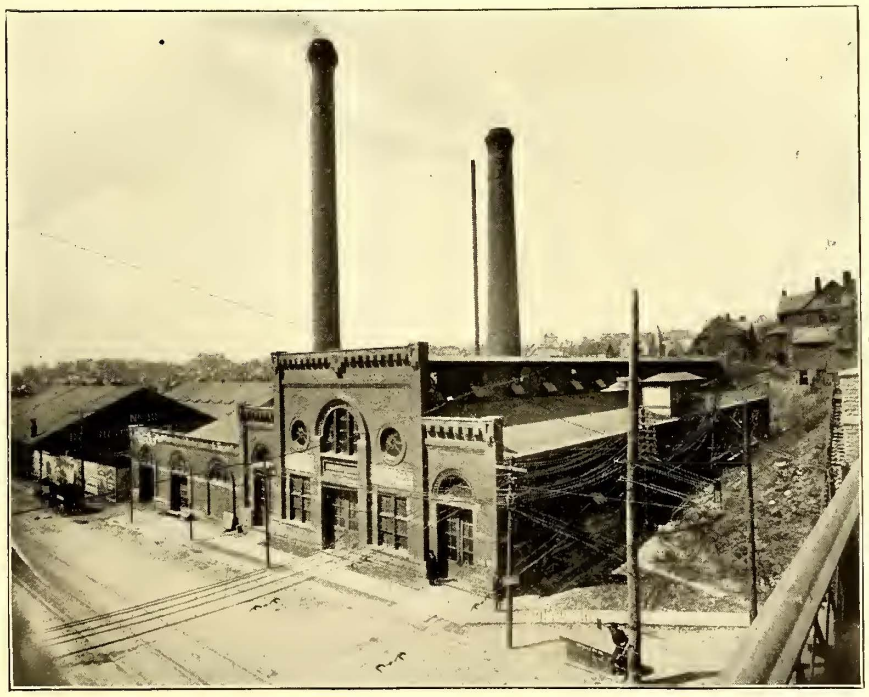


FIG. 8.—EXTERIOR OF HUNT STREET STATION

The foregoing plans are not intended to illustrate what would be considered as the most modern type of generating station design, in all its details, but are intended to show what can be done in the way of remodeling an old plant and at the same time utilize, as far as possible, buildings and piping systems. The "evolution" of this plant is by no means complete, as there are other changes under consideration, which may be the subject of an "annex" to this article at some future date.

The facts, as they are before us, are that there are a few cities abroad which own and operate their street railway systems with more or less indifferent results, and only one of which, Glasgow, that can properly be called a financial success; and yet there are those who would have American cities, regardless of differences of conditions and institutions, plunge blindly into the acquisition and operation of 15,000 miles of street railway tracks, because Glasgow operates 73 miles successfully.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

The science of municipal government in this country is crude. Our methods are expensive and our government inefficient. The burden has become oppressive, and nearly every city in the land is making some efforts to reform, and there are no cities where the same is not necessary.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

Engines for Electric Railway Power Stations*

By Charles E. Emery, Ph. D.

It is believed that the principal features of American practice, in the construction of large engines of the Corliss type and of that rapidly growing class known as intermediate or medium speed engines, have been fairly presented in the two preceding papers.** On account of the length of the previous articles it was only attempted to describe the largest engines of the Corliss type, and as illustrations were not ready for other engines in that and the intermediate classes, it has been decided to conclude this series of articles by presenting other examples of such engines, together with a number of high-speed engines which are provided with valve gear adapted also for medium speeds.

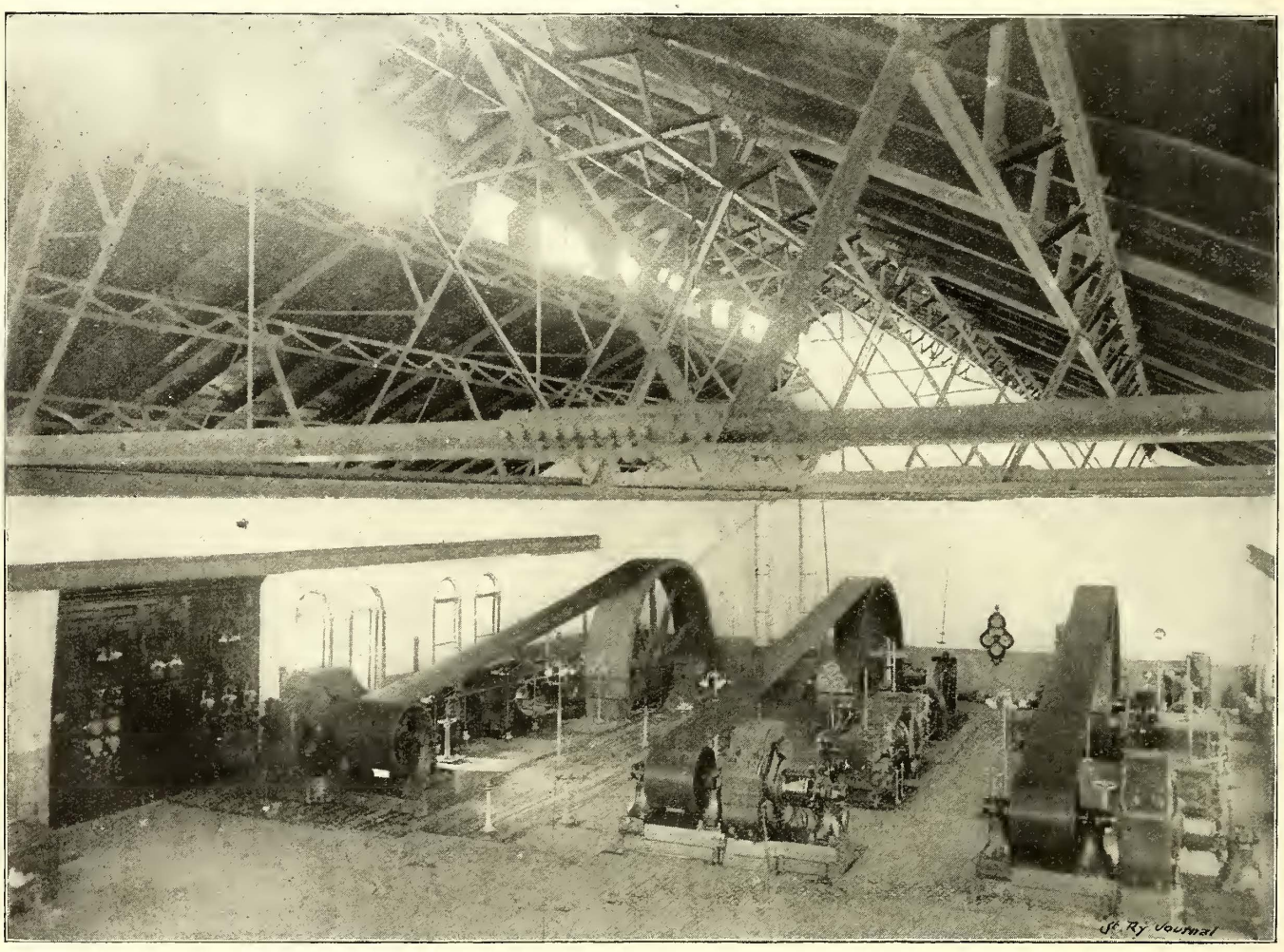
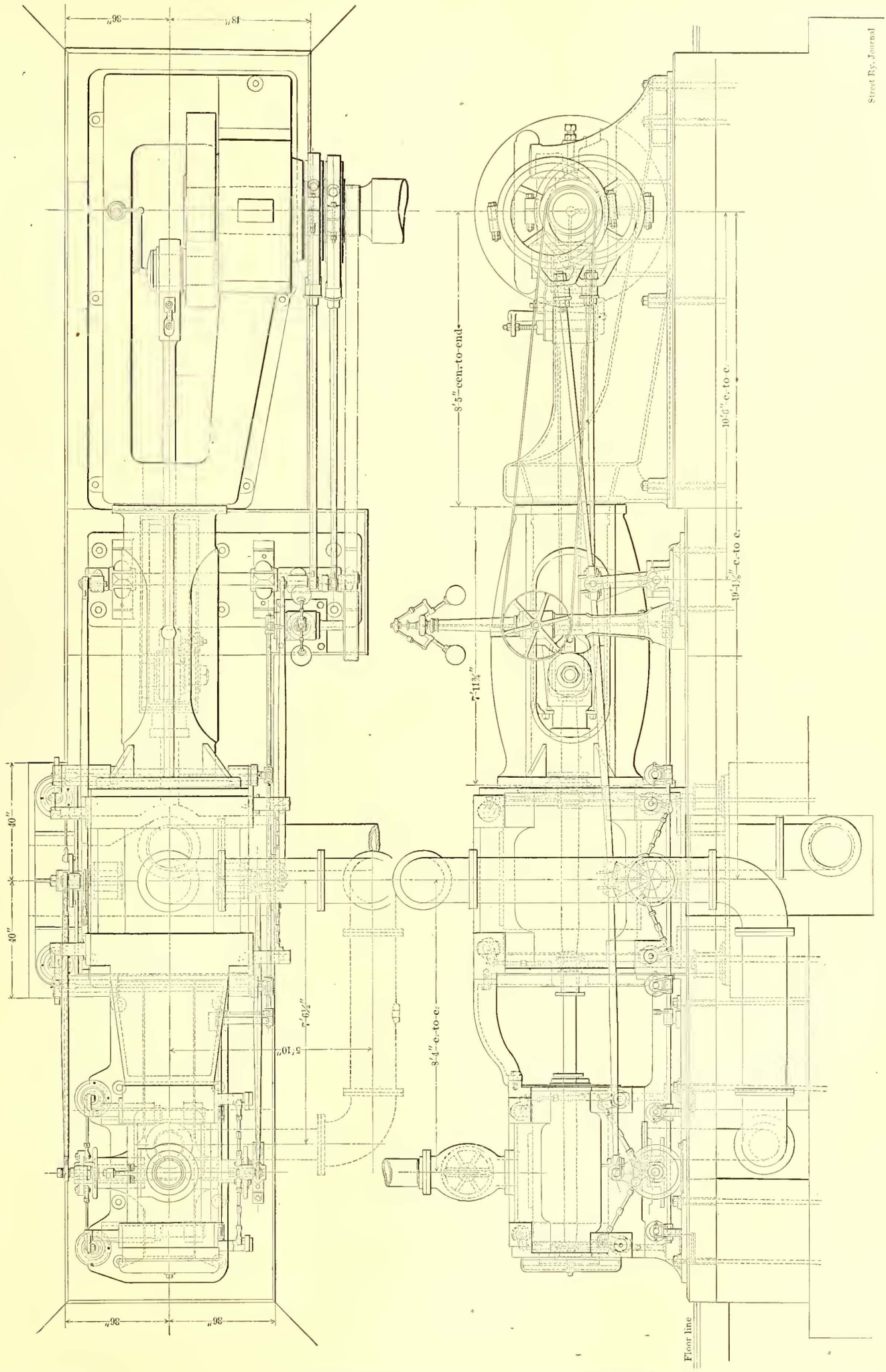


FIG. 55.—DIXON-CORLISS TANDEM COMPOUND ENGINES AT ASTORIA, N. Y.

The Engines of the Wright Steam Engine Works.

The engines built by this company are first selected (without favor to them or prejudice to others, as previously explained under similar circumstances), on account of the prominence in steam engineering of William Wright, the founder of this establishment. He was well known a number of years ago as a prominent mechanical engineer who had produced many novel designs requiring the exercise of unusual patience and ingenuity. Speaking from recollection only, without attempting a historical sketch, one early important work which comes to mind is the design of the large beam pumping engines for the Ridgewood Station, Brooklyn. In this type of engine no fly-wheel was employed, but a certain degree of expansion was nevertheless obtained, on the same principle as the Cornish engine, by a system of moving heavy masses which required to be started at the beginning of the stroke and gave out their energy at the end. These engines were completed by Messrs. Woodruff & Beach of Hartford, Ct., in the year 1859, and two of the same were running substantially in their original form at the last advices, a third one having been altered by the addition of a fly-wheel. The engines were noted for the beauty of the design as well as from the fact that they were among the largest pumping engines that had been attempted in this country previous to that date. A curious illustration of the fondness of Mr. Wright for novelties was shown in an engine adapted for a gunboat at the beginning of the late war, in which the cylinders were sections of a hollow ring, each with a corresponding flat bar piston rod bent to a semicircle, with ends attached to a beam which connected to a crank. The cylinders were bored by simply revolving a tool in a frame swinging around the beam center and all the facings referred to the same center. In this engine, therefore, the ordinary slides were omitted and compactness was assured, though the system was not generally adopted. Mr. Wright at the Woodruff & Beach establishment and finally as engineer of the works he founded and mentioned in the heading, designed a large number of automatic cut-off engines and few of the early ones were of the same design. He evidently had endeav-

*Continued from the Street Railway Journal of January, 1898.
**Street Railway Journal, October, 1897, and January, 1898.



FIGS. 56 AND 57.—PLAN AND SIDE ELEVATION OF WRIGHT TANDEM COMPOUND ENGINE—CONEY ISLAND & BROOKLYN RAILROAD

ored to exhaust all the different methods by which an automatic cut-off could be successfully operated, the type finally adopted and which may be seen in all parts of the country, being generally one with exhaust valves of the Corliss type under the cylinder and vertical gridiron valves at the side near the ends of the cylinder released by the same valve gear below the chest which operated the exhaust valves. The general features of this system were embodied in large compound engines after they came in vogue, an example of which may be seen in the Jewell flouring mills, Brooklyn.

The conservatism of purchasers and commercial considerations involving the cost of manufacture, always tend to bring about a certain degree of uniformity in all machinery designed for the same purpose, and this is true of

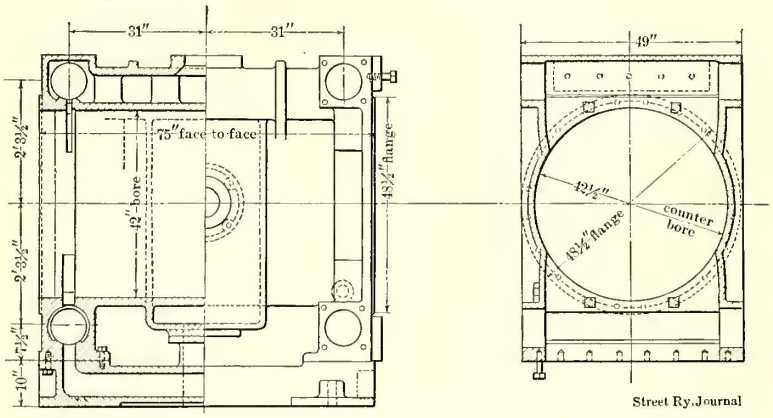


FIG. 58.—LOW PRESSURE CYLINDER OF 22 IN. AND 42 IN. × 48 IN. TANDEM COMPOUND ENGINE

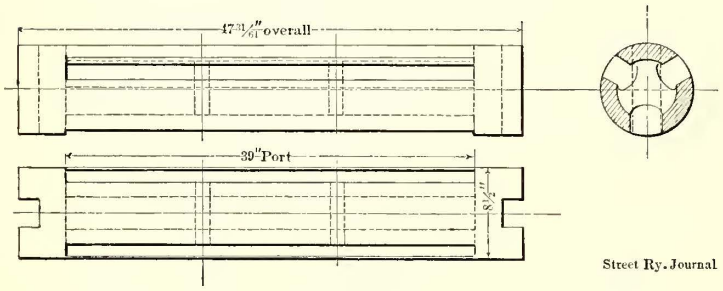


FIG. 59.—STEAM VALVE FOR 42 IN. L. P. CYLINDER

the engines manufactured by this company for electric railway power stations. There are now two general types of engine manufactured by the company for this purpose, known as the Dixon-Corliss engine and the Wright engine, both well designed, with massive construction and pleasing outlines embodying many features of similarity among themselves and a general resemblance to the larger engines already described.

The engraving Fig. 55 represents three of the Dixon-Corliss tandem compound engines erected in the station of the New York & Queens County Railroad Company at Astoria, N. Y. The Wright Engine Company has furnished for this station two of these engines 22 ins. and 42 ins. x 48 ins., operated at a speed of 75 r.p.m. The weight of each engine is 120,000 lbs. The wheel is 22 ft. in diameter, with 56 ins. face and weighs 80,000 lbs., the rim being in ten sections. The company has also furnished the same station one 20 ins. and 38 ins. x 48 ins., and two 18 ins. and 34 ins. x 48 ins. tandem compound belted engines and one 22 ins. and 40 ins. x 48 ins. tandem compound engine directly connected to a 500 k.w. General Electric dynamo.

Figs. 56 and 57 represent respectively a plan view and a side elevation of a Wright tandem Corliss engine directly connected to an 800 k.w. dynamo and operating the Coney Island & Brooklyn Railroad at Smith and Ninth streets, Brooklyn, N. Y. The cylinders are 26 ins. and 46 ins. diameter x 42 ins. stroke. The engine runs at a speed of 85 r.p.m. Weight of engine is 125,000 lbs.; weight of wheel, 50,000 lbs.

It is to be regretted that the manufacturers have neglected to point out the distinctive features of their two engines. It will be observed, however, that in the Dixon-Corliss engine all the valves on each cylinder are operated from a wrist-plate as in the original Corliss practice, both being connected to one eccentric. In the Wright engine the exhaust valves of each engine are operated by one eccentric through independent wrist-plates dropped near the level of the floor and the steam valves are arranged on the other or crank side of the engine and operated by a separate eccentric and rock-shaft, the motion of the governor being imparted to a longitudinal rock-shaft and motion transferred to the other side of the cylinder at suitable points.

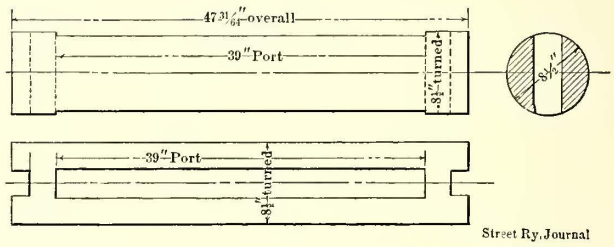


FIG. 60.—EXHAUST VALVE FOR 42 IN. L. P. CYLINDER

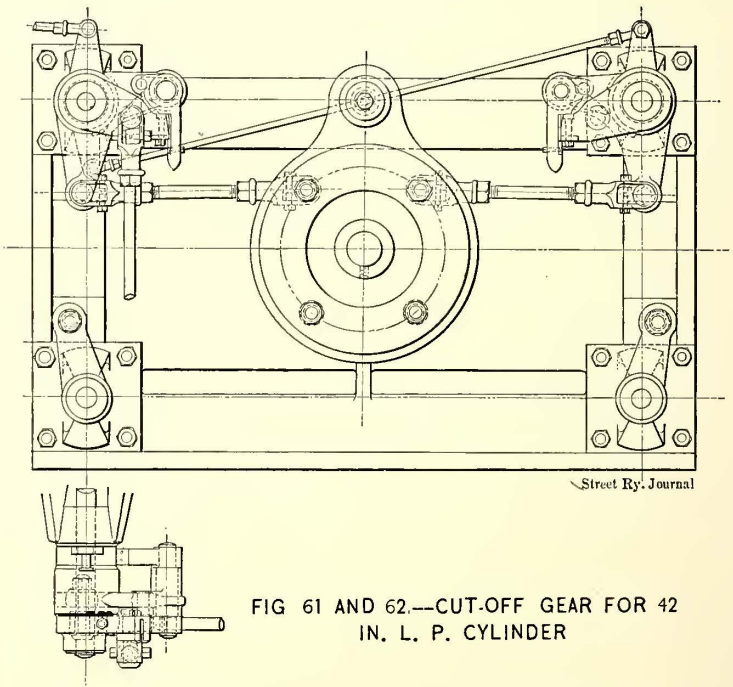


FIG 61 AND 62.—CUT-OFF GEAR FOR 42 IN. L. P. CYLINDER

Fig. 58 shows two views of the 42 ins. cylinder of the Dixon-Corliss engine. Fig. 59 represents three views of the steam valves, and Fig. 60 three corresponding views of the exhaust valves of this engine. Fig. 61 is a side elevation, and Fig. 62 a plan view of the cut-off gear of this engine.

It will be seen that motion from the wrist-plate is imparted to one arm of a bell crank mounted concentrically with the valve stem and that the other arm carries a pendent grab claw which engages with the end of a lever attached to the valve stem, which lever is through a link connected to the dash-pot. A tripping cam is also mounted concentrically with each steam valve and moved by the

governor so as to vary the cut-off between desired limits by adjusting a cam to meet sooner or later an inclined arm attached to the grab claw. Corresponding cams are also provided to trip the grab claw at the other extreme of motion, that is when the governor falls, and thus stop the engine in case of the breakage of the governor belt. It will be obesrved that the portions of the grab claw and valve arm which engage together are provided with removable steel plates.

ENGINES OF NEWBURGH ICE MACHINE AND ENGINE COMPANY.

Although this company has been in operation only two years, it has already furnished two large compound engines for electric railway work, one of 600 to 700 h.p., in the Poughkeepsie Electric Light Station, and one of 800 to 900 h.p. in the Steinway Electric Company's plant. The engines are known as the Whitehill-Corliss type of engines, and the half tone Fig. 63 shows a tandem compound engine of this type directly connected to a railway electric generator.

The engraving Fig. 64 shows a perspective view of a Whitehill-Corliss engine with the cylinder end in the foreground. Fig. 65 is also a perspective view of a similar engine with the main pillow block in the foreground, the shaft being broken away for clearness of illustration.

Fig. 66 shows a plan view, and a corresponding side view of the cylinder and framing of a 30 ins. x 60 ins. Whitehill-Corliss engine. The pillow block bed-plate is designated by the manufacturers as the Tangye or heavy duty bed-plate. As shown, it has a foundation bearing either side of the crank and the two branches unite together to a circular face connected through the guide casting to the cylinder. Fig. 67 illustrates the standard Whitehill-Corliss governor.

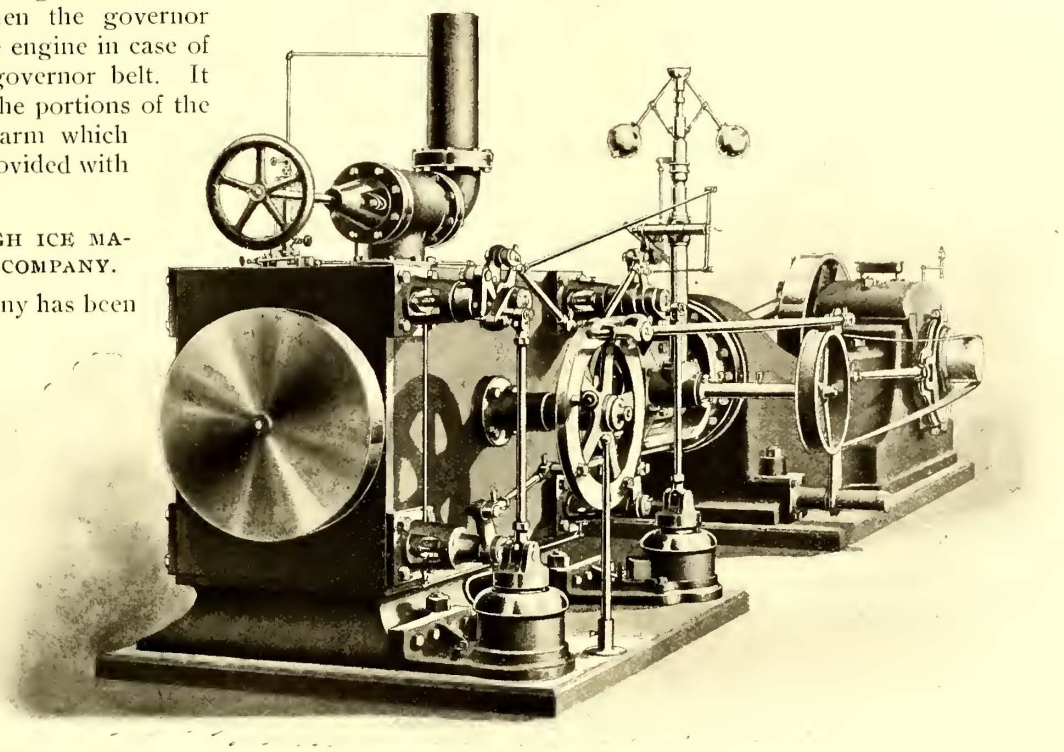


FIG. 64.—WHITEHILL-CORLISS ENGINE, CYLINDER END

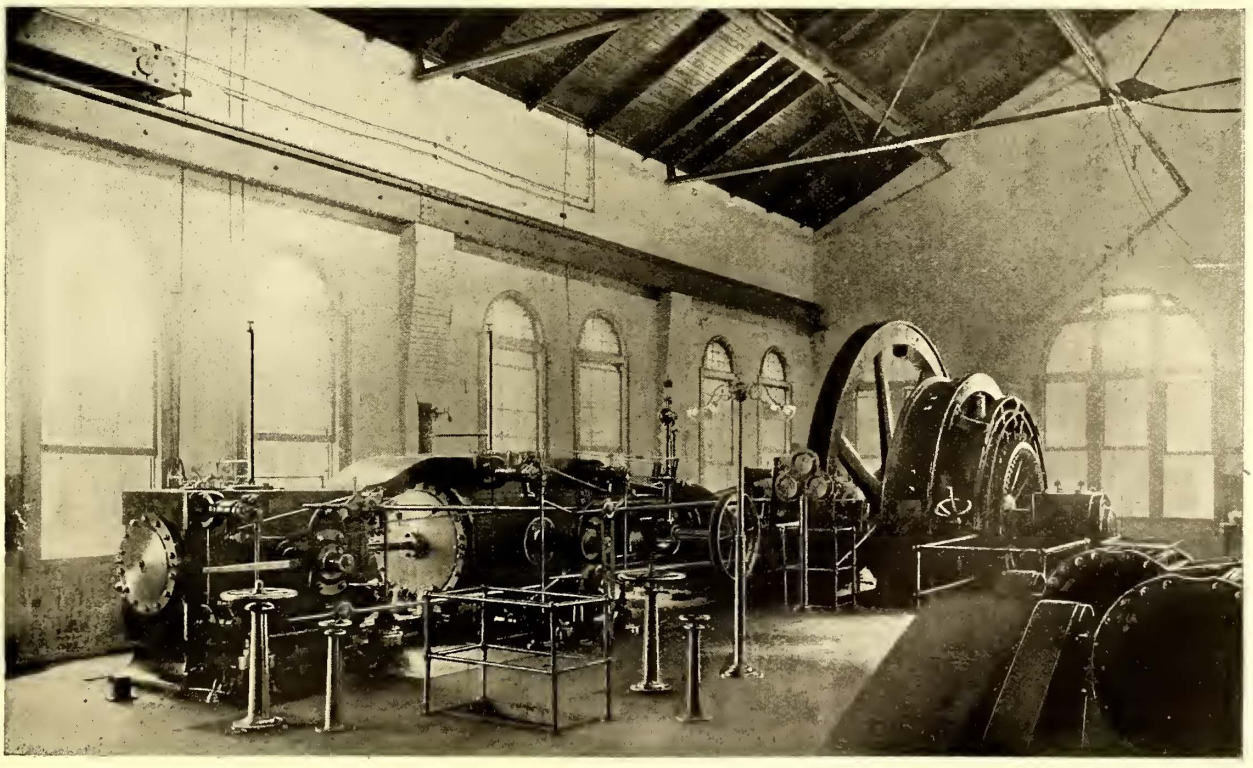


FIG. 63.—WHITEHILL-CORLISS TANDEM COMPOUND ENGINE DIRECTLY CONNECTED TO GENERATOR

Fig. 68 shows several views of a 30 ins. x 60 ins. Whitehill-Corliss cylinder. In Fig. 69 side and end views of a steam valve are shown at the top and of an exhaust valve at the bottom. Fig. 70 represents successively a

longitudinal section of 30 ins. piston; a face view of the same, half with and half without the follower, and details of the piston rod. The steam valves are operated by an independent eccentric when desired, double eccentrics being shown in Fig. 65. Fig. 71 represents in two views a

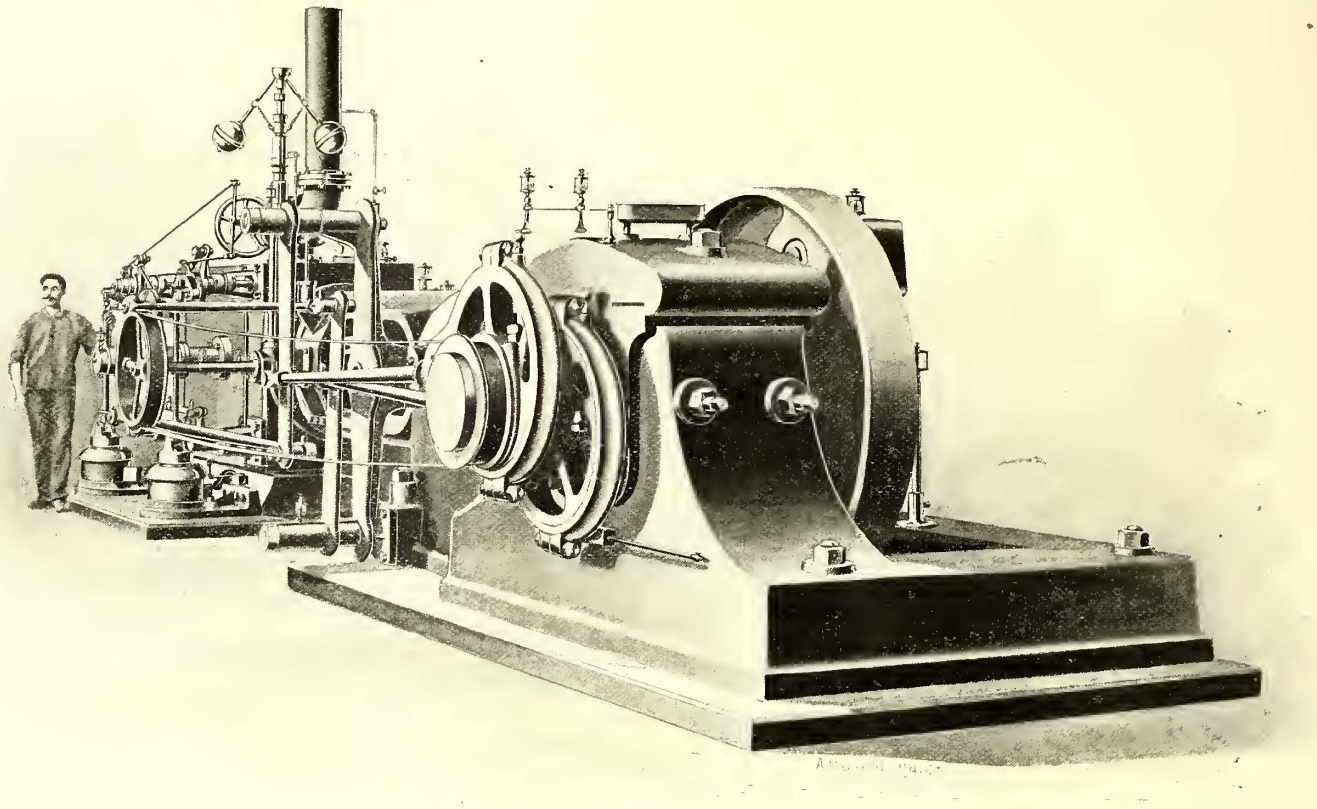


FIG. 65.—WHITEHILL-CORLISS ENGINE, PILLOW BLOCK END

connecting rod. Fig. 72 represents in three views the outboard pillow block. Fig. 73 represents in several views the details of the cross-head. Fig. 74 is a plan and vertical section of a dashpot showing independent vacuum and cushion chambers.

ENGINES OF THE RICE & SARGENT COMPANY

Before closing the subject of Corliss engines we desire to state that, through the mislaying of a circular, the principal details of the Rice & Sargent engine, illustrated in the first paper of this series, were not as fully described as they should have been. The company calls attention to the fact "that the independent eccentrics for steam and exhaust valves are provided as an integral part of the design instead of being used under compulsion in special cases only"; that the valves are multi-ported, giving larger port openings than usual, with extremely small travel of the valves; that there is no wrist-plate and that the steam valves are not driven by a wrist motion; that the cut-off has a range from 0 to $\frac{3}{4}$ stroke, and that the bed is a box section starting from the floor line. The extremely small travel of the valves and special features in the valve gear allow these engines to be operated at from 80 to 150 r.p.m., thereby placing the engine in the intermediate speed class when so desired. The manufacturers consider the distinctions so important that the engine should not be called a Corliss engine.

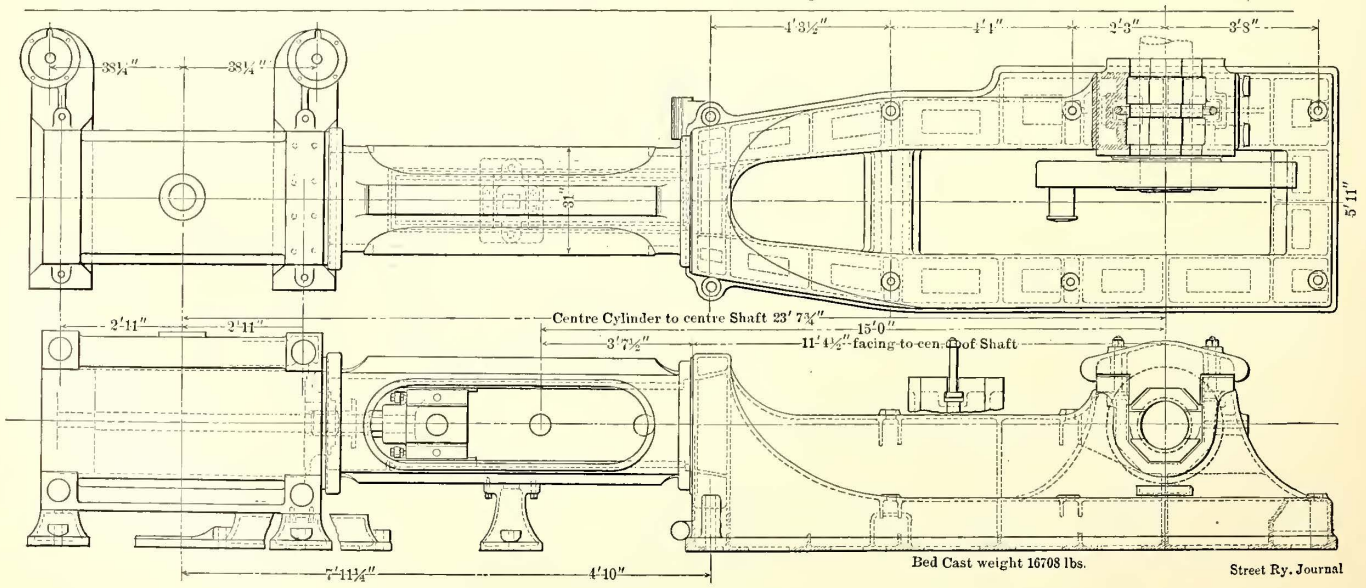


FIG. 66.—PLAN AND SIDE ELEVATION OF FRAMING—WHITEHILL-CORLISS ENGINE

STEEL CRANK SHAFTS OF THE BETHLEHEM IRON COMPANY

In the first article, October, 1897, the necessity of providing rigid shafts for engine dynamos was carefully pointed out, some illustrations given of relative sizes and

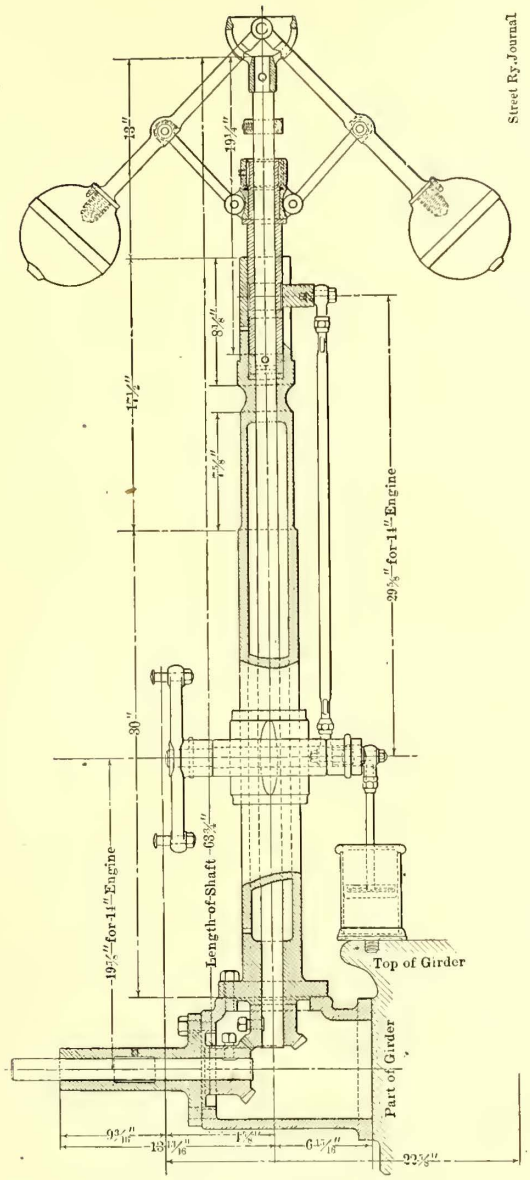


FIG. 67.—STANDARD GOVERNOR

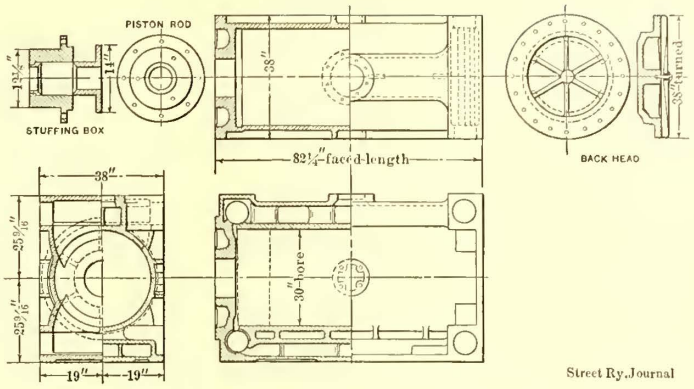


FIG. 68.—30 IN. × 60 IN. CYLINDER

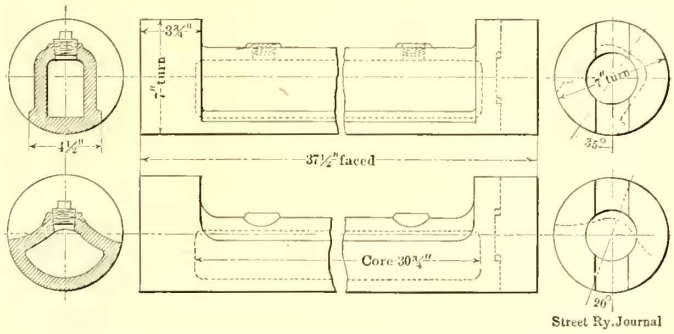


FIG. 69.—STEAM VALVE FOR 30 IN. CYLINDER

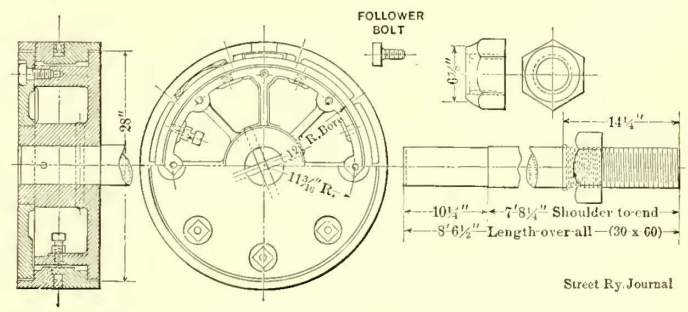


FIG. 70.—PISTON, FOLLOWER AND ROD

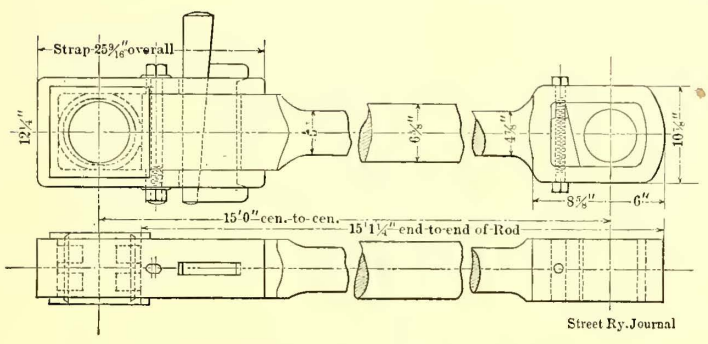


FIG. 71.—CONNECTING ROD FOR 30 IN. CYLINDER

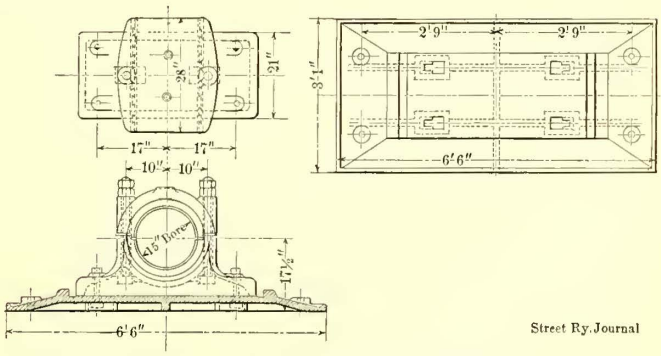


FIG. 72.—OUTBOARD PILLOW BLOCK

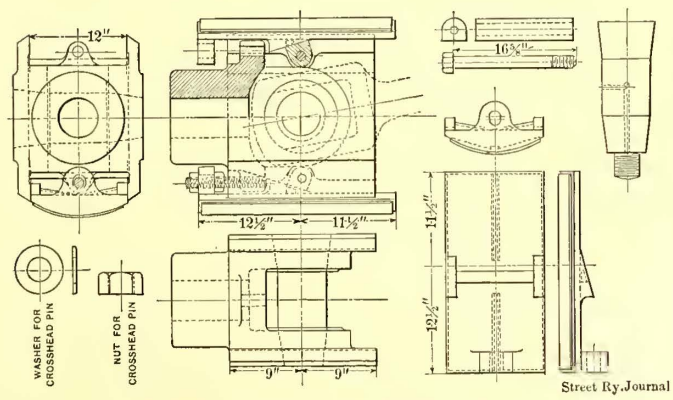


FIG. 73.—DETAILS OF CROSS HEAD

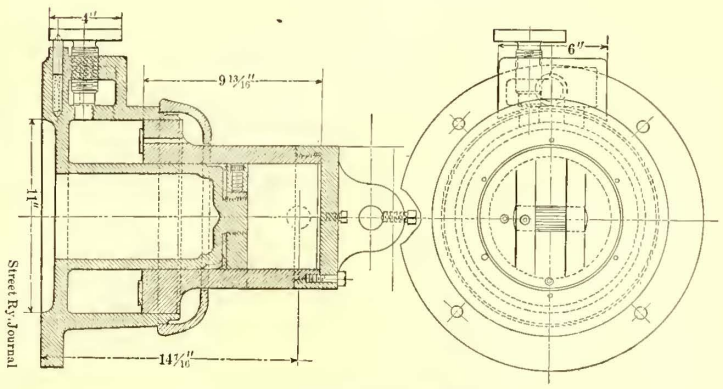


FIG. 74.—DETAILS OF DASH POT

causes of failure, concluding with the recommendation, page 614, that hollow-tempered steel shafts be used for the purpose. At first thought it might be considered that tempered steel was not the best material for the moving parts of an engine, particularly for a shaft subject to varying strains. The tempering referred to does not, however, mean hardening, at least to such an extent as is required for tools. It has, however, been found that a mild uniform temper greatly increases the strength and stiffness of steel used in construction. So long as a piece of constructive material simply springs through limits well within the limit of elasticity, no injury occurs, but if the material be strained repeatedly nearly to the limit of elasticity it is found that it becomes fatigued and that a slight movement among the fibres takes place, which, once initiated, insures final destruction sooner or later. The tie-bolts of a large hydraulic press in New York are renewed periodically after a certain number of years, as it is found that owing to the repeated application of high tensile strains they will break within a month or so after the interval fixed. Mr. Metcalf, the steel manufacturer, found that connecting rods operated at high speeds lasted much longer when made of steel with a considerable percentage of carbon than if made of the softer varieties of steel. It is known that the wearing properties of rails are improved in the same way. The tempering of steel shafts depends upon a similar principle. The elastic limit is raised, and therefore higher strains can be applied before there will be any movement of the particles one upon another, and still the temper can be so low that even in case of an unusual overstrain the parts will bend before they will break.

It is customary in the manufacture of watches, particularly abroad, to temper the steel wire moderately before it is turned, for the reason that the steel in its soft state is torn by the tools, leaving a rough surface, whereas when slightly tempered the cut is smooth and the pivots and axles are readily brought to size and take a high polish.

The method of tempering developed on a sufficiently large scale to answer for gun forgings has at the Bethlehem Iron Works, Pa., been also applied in the manufacture of steel shafting, which is made hollow so as to remove portions of the metal imperfectly worked, and permit the introduction of a mandrel during the hammering operation. The opening, moreover, facilitates the operation of tempering. Shafts of this kind have been made for a number of years for the United States Navy, the holes being purposely made quite large to reduce the weight to a minimum and yet retain the strength of the portions of larger diameter. Shafts of this kind were used also for the pumping engines at the Calumet & Hecla mines as far back as the year 1889. The Bethlehem Iron Company has furnished a photograph of which an engraving is shown in Fig. 75, which represents a highly finished hollow shaft ordered some time since for a direct connected railroad generator. More recently it has been determined to furnish the large engines to be erected in New York city for the Metropolitan Street Railway with hollow steel shafts 36 ins. in diameter with holes 16 ins. in diameter through them, thus securing the necessry stiffness precisely in the way pointed out in the first paper.

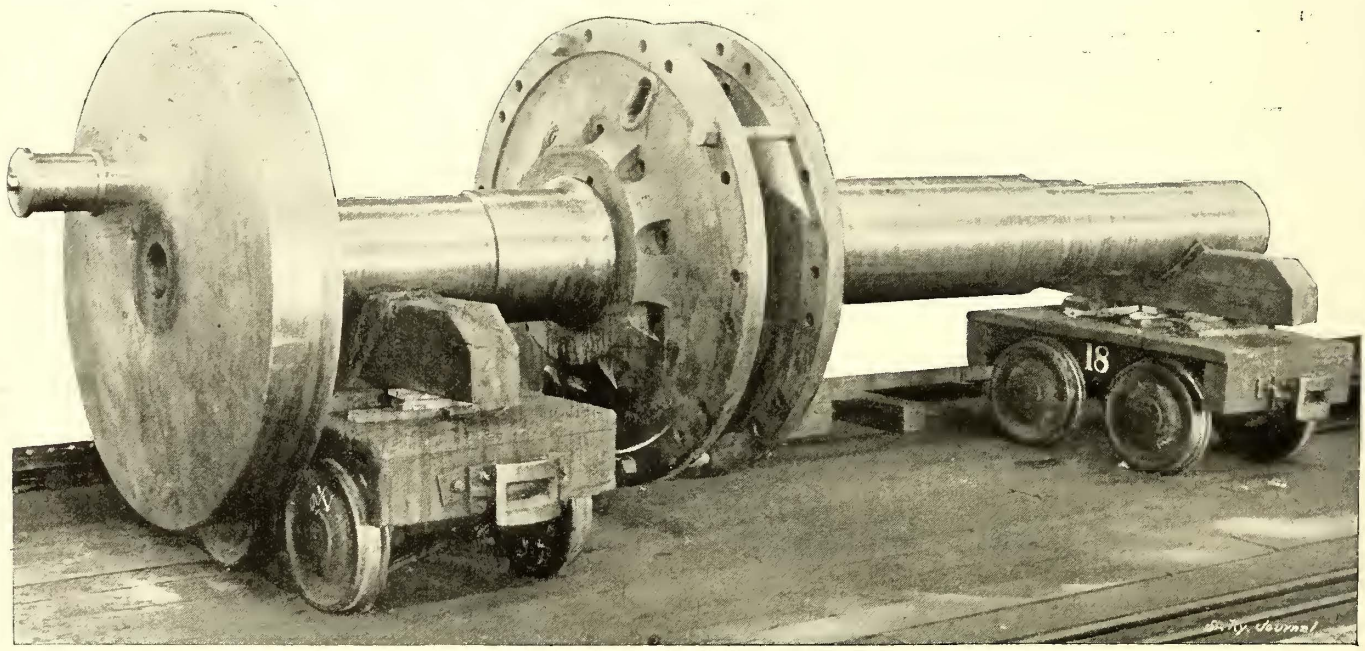


FIG. 75.—TEMPERED STEEL HOLLOW SHAFT FOR ENGINE OPERATING RAILWAY GENERATORS

ENGINES OF THE FITCHBURG STEAM ENGINE COMPANY.

The engines manufactured by this firm are provided with an automatic valve gear, securing large openings and quick cut-off by positive mechanism, which is adapted for speeds higher than a releasing valve gear so that the engines may be placed in the intermediate or medium speed class. These engines have been extensively used for electric lighting and street railway work, but the illustrations refer generally to an engine employed for another purpose in Lowell, Mass.

The engraving Fig. 76 is a view from the side opposite the crank of one of these engines, and the engraving Fig. 77 is a similar view on a smaller scale, showing the same engine in place in a building. The further fly-wheel belongs to another engine.

The engine is of the tandem compound type, with cylinders 20 ins. and 38 ins. diameter with 42 ins. stroke, and operates at a speed of 100 r.p.m. with a steam pressure of 125 lbs. The shaft bearings are 14 ins. diameter and 26 ins. long; wheel, 15½ ft. in diameter; crank pin, 8 ins. diameter, 8 ins. long; cross-head pin, 6 ins. diameter, 6½ ins. long; cross-head gibs, 10 ins. wide, 23 ins. long, of phosphor bronze running in bored guides; piston rod, 4½ ins.

diameter; total floor space taken from center of shaft to end of engine, 26 ft. 4 ins. Engine rated at about 700 h.p., though good for 1,000 h.p.

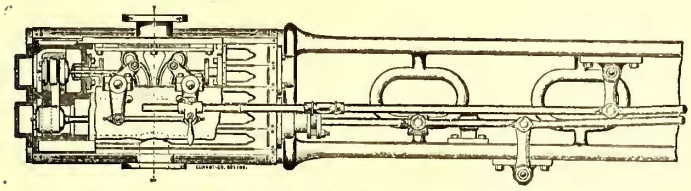


FIG. 78.—VALVE AND VALVE GEAR OF FITCHBURG ENGINE

The valve gear of this engine is novel and exceedingly interesting. Referring to Fig. 78, it will be seen that there are two independent piston steam valves and two connected piston exhaust valves, the former being double ported. The exhaust valves are operated independently by a link adjustable while the engine is in motion. The steam valves are operated by a fly-wheel governor, the motion of the eccentric being transmitted to rock shafts situated below and between the two steam valves. Grooved cams are secured to the ends of the valve stems, the grooves being concentric with the center of the rock shaft for about two-thirds of the movement of the latter and radial thereto with transition curves for the remaining movement. The operating eccentric is shifted across the shaft, giving a motion equivalent to that of the link motion with lead constant or decreasing to mid position, as arranged. The consequence is that the rock arm moves in the concentric portion of the slot and does not open the steam valve until the main piston nearly reaches the end of its stroke, when the operating pin and roller on the rock shaft simply enters the radial portion of the slot, throws the valve wide open, except for the short points of cut-off, and on the return movement promptly closes it when the motion of the valve is stopped as the operating roller on the rock arm enters the concentric portion of the slot. The angles of the rock arm levers are also so adjusted that a motion similar to that derived from the Corliss wrist-plate also influences the result. The eccentric of the shaft governor is pivoted at opposite sides of the shaft so that the center of such eccentric describes a straight line across the shaft instead of a curve as is customary, the carrying arms being extended beyond their pivots and weighted so as to balance the eccentric at all points. The centrifugal weights and springs are independent and capable of adjustment to permit less than one-half per cent variation in speed. No dash-pots are employed, but the arms carrying the eccentric are checked by spring washers which give a slight resistance and prevent oscillation. It will be observed that there is no load on the eccentric and valve gear except at the moment of opening and closing a valve and this occurs when the eccentric is near the end of its movement and exerting its greatest power so that the governor is at no time overloaded. The manufacturers report that the governor acts so sensitively that an electric lighting generator and a railway generator have been operated at the same time by the same engine without causing the lights to flicker, although the variation in the railway load was greater than the rated power of the engine. The piston valves are made adjustable in diameter to take up all wear. It is reported that the valves soon become glossed and remain tight for an indefinite period, and that a set of valves in use eight years on an engine which had received slight atten-

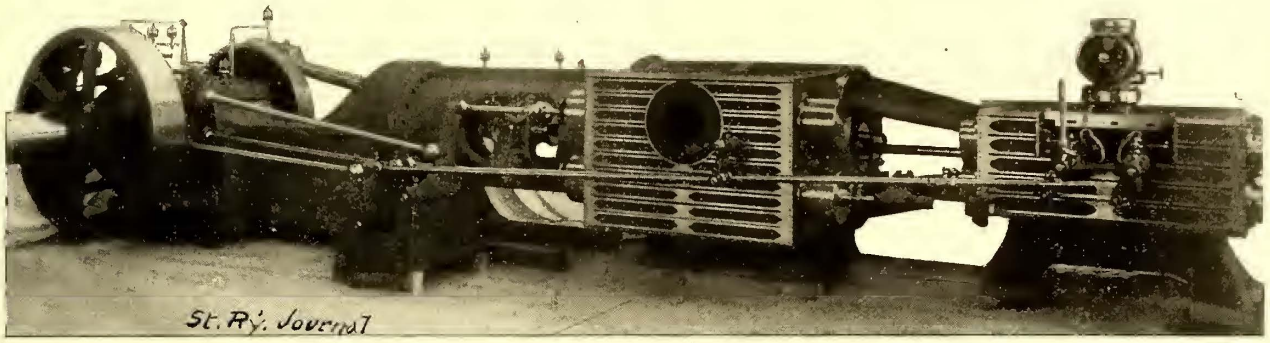


FIG. 76.—FITCHBURG 20 IN. AND 38 IN. × 42 IN. TANDEM COMPOUND ENGINE

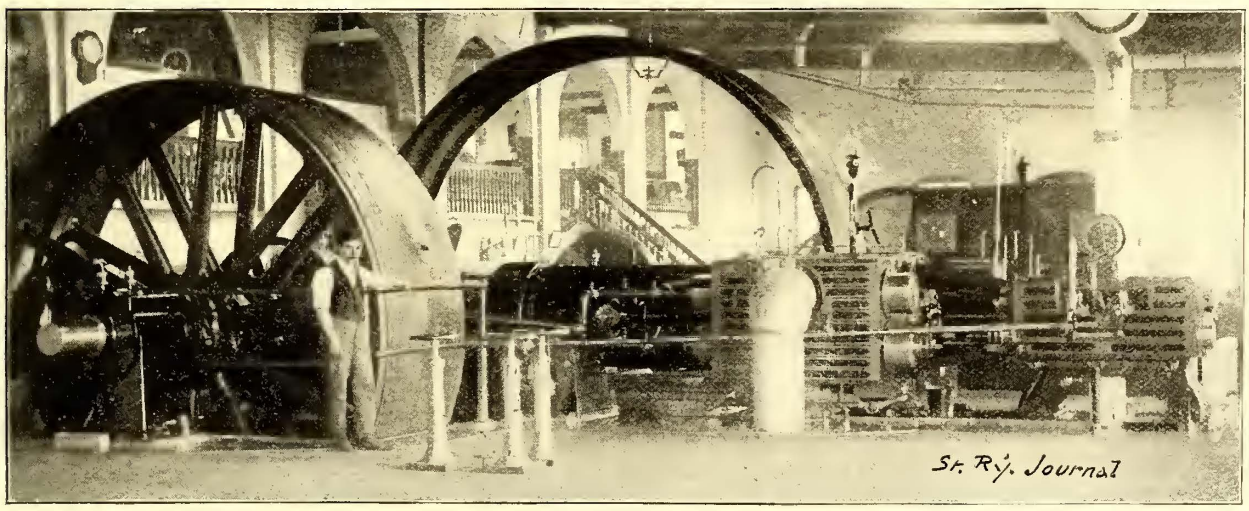


FIG. 77.—FITCHBURG 20. IN. AND 38 IN. X 42 IN. TANDEM COMPOUND ENGINE

tion were recently examined and on being adjusted were absolutely tight. The valve shells are surrounded by live steam at all times so that there is no unequal expansion to cause sticking of the valves. The friction of the valves is independent of the steam pressure. The steam pressure on the valve rod, with an area of only 3-10 of an inch, is sufficient to keep the cam at all times against the operating roller so that the gear runs absolutely quiet at all speeds.

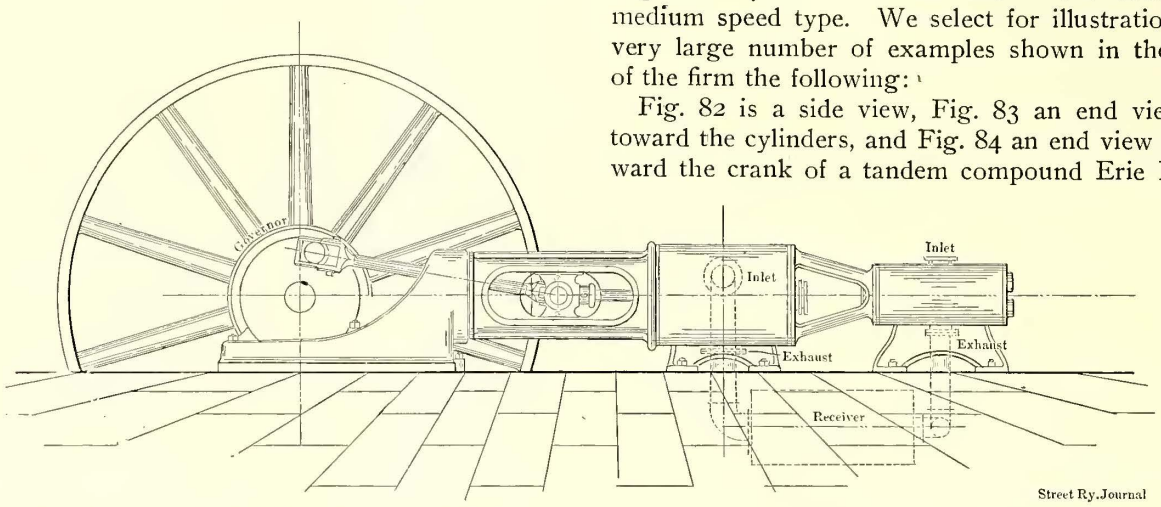
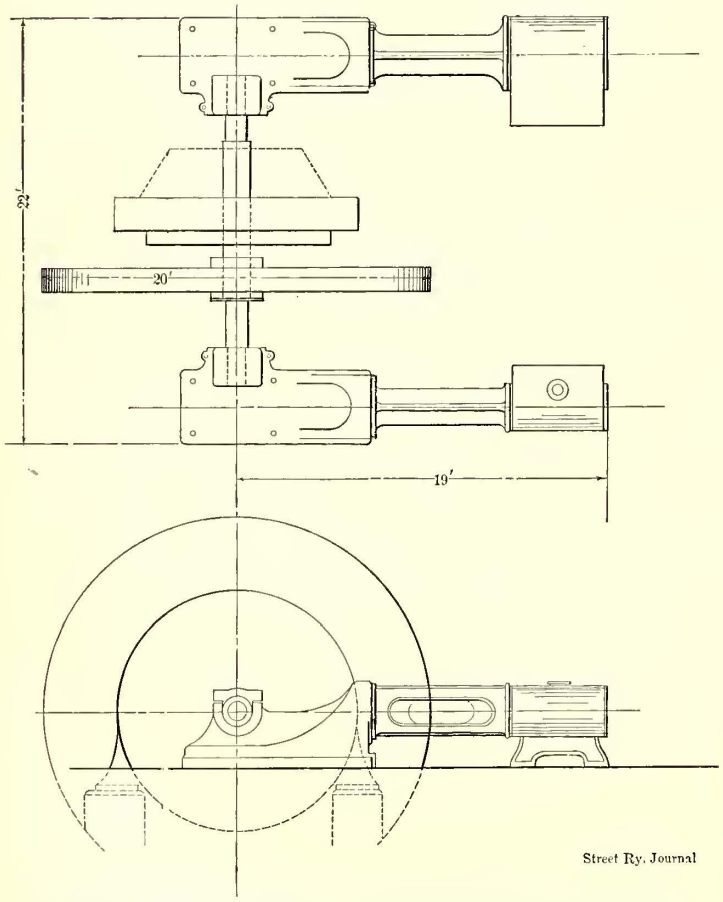


FIG 79.—ELEVATION OF 20 IN. AND 38 IN. × 40 IN. FITCHBURG TANDEM COMPOUND ENGINE



FIGS. 80 AND 81.—PLAN AND ELEVATION OF 20 IN. AND 38 IN. × 42 IN. FITCHBURG CROSS COMPOUND ENGINE

It is claimed that the operation of the valves is as prompt as that of a releasing valve gear, and is accomplished with very many less pieces. The exhaust ports are on a line with the bottom of the cylinder so as to drain the same. The clearance is from 2½ per cent to 3¼ per cent. Fig. 79 shows this engine in elevation. Figs. 80 and 81 show the arrangement of the cylinders and dynamo for a cross compound engine.

ENGINES OF THE BALL ENGINE COMPANY

This firm has manufactured a very large number of engines of various kinds. Most of the engines are of the high speed type, which, with the particular valve gear and other details employed, is considered by the company advantageous. The valve gear is, however, well adapted for moderate speeds and is sometimes so operated that the engines may also be classed as of the intermediate or medium speed type. We select for illustration from the very large number of examples shown in the catalogue of the firm the following:

Fig. 82 is a side view, Fig. 83 an end view, looking toward the cylinders, and Fig. 84 an end view looking toward the crank of a tandem compound Erie Ball engine directly connected to an electric generator. The size of this engine is given in a subsequent table.

The engraving Fig. 85 represents an exterior view of a cross-compound Erie Ball engine referred to in a subsequent table.

Fig. 86 is an engraving of a vertical cross-compound Erie Ball engine, and Fig. 87 a sectional view of the same. The size of this engine is given subsequently. It will be noted that the bases of the frames are inclosed so as to prevent the oil from flying about to cause waste and untidiness. The sub-base carries a third bearing outside the frame.

These engines are all of the single valve type with the cut-off automatically regulated for simple engines, and

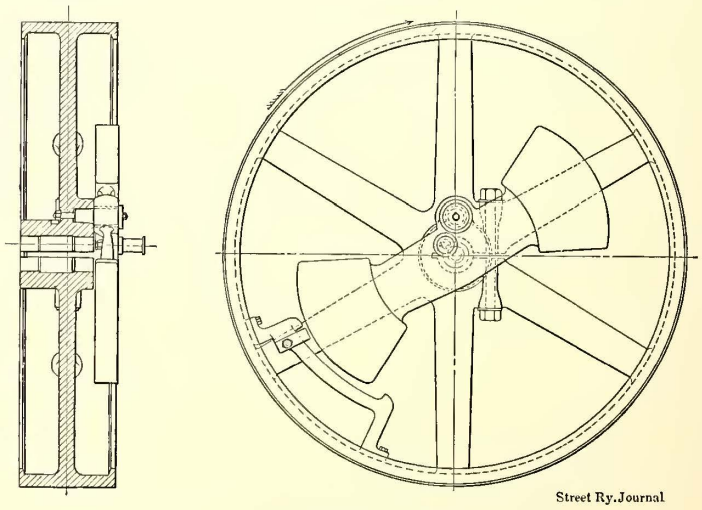
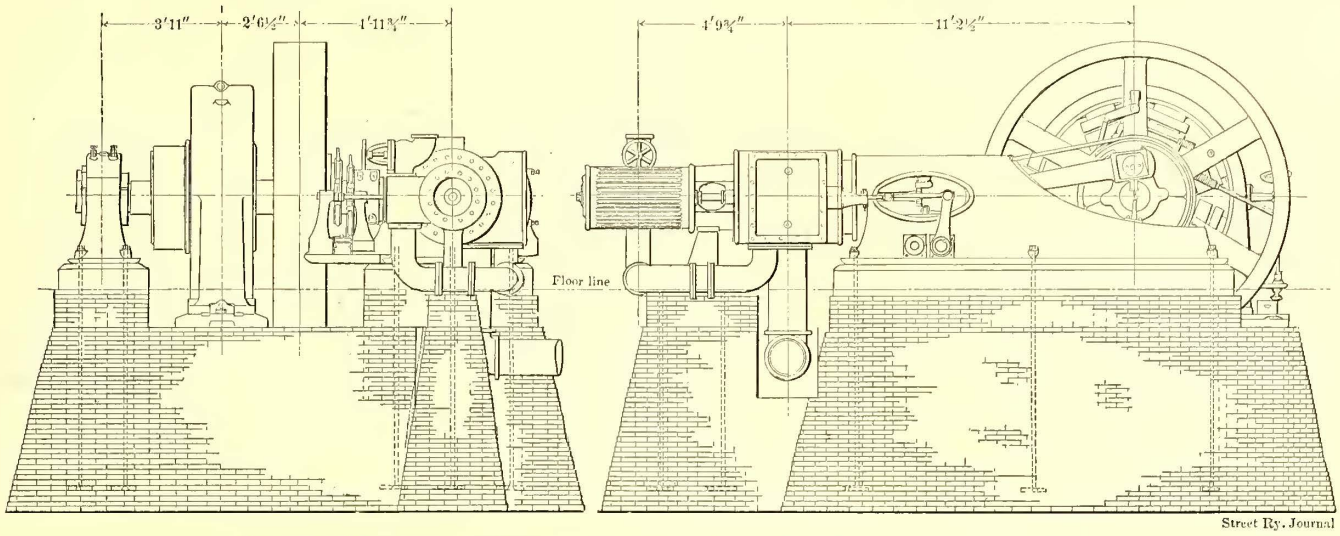


FIG. 90.—BALL GOVERNOR WITHOUT SPRINGS

for the high pressure cylinder of compound engines, by means of a fly-wheel governor shifting an eccentric across the shaft and operating directly a lap valve. At shorter cut-offs the angle required to move the valve through the laps, as the throw is decreased, forms a larger proportion of the whole angular movement and consequently the steam is cut off shorter, the lead remaining constant or decreasing to mid position so as to avoid racing at light

loads. The valve employed is, however, not a piston valve, or the equivalent of the same, viz.: a rigid one moving between scraped surfaces separated at a fixed distance. It is, on the contrary, a double slide valve with parallel faces provided with a piston projection on one part in a suitable cylinder on the other, so that the valve is so



FIGS 82 AND 83.—BALL 18 IN AND 30 IN. × 24 IN TANDEM COMPOUND ENGINE

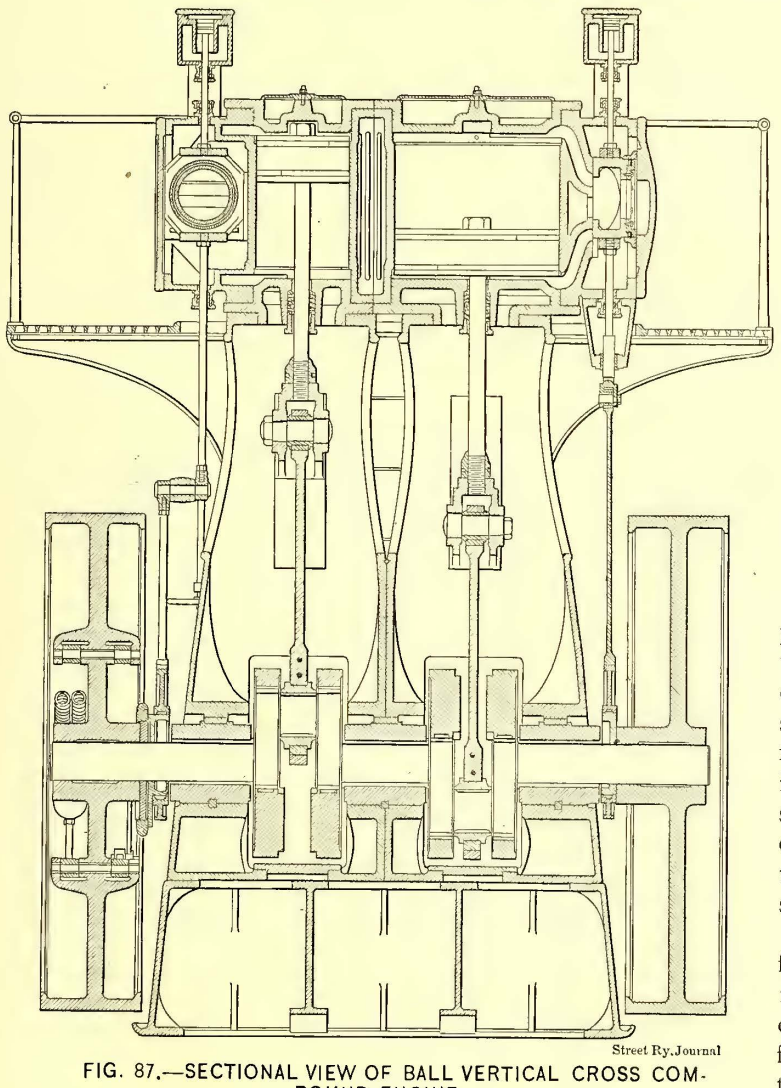


FIG. 87.—SECTIONAL VIEW OF BALL VERTICAL CROSS COMPOUND ENGINE

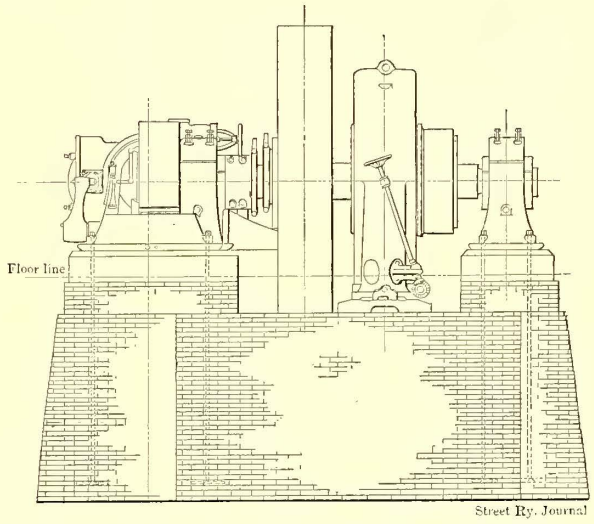


FIG. 84.—END ELEVATION OF TANDEM COMPOUND ENGINE, CRANK END

nearly balanced that it can be handled satisfactorily by a crank governor, but is still held to its seat with sufficient force to obtain absolute tightness. The valve seats are arranged in planes either radial or normal to the cylinder as convenient and shown clearly in Fig. 87. The details of construction of the valve are shown clearly in Figs. 88 and 89, from which it will be seen that both parts of the valve operate with relation to cylinder ports which are joined together before entering the cylinders. Fig. 87 also shows the customary method employed by this company of operating the valves of a compound engine. The valve of the low pressure cylinder is operated by an independent eccentric, whereas the valves of the high pressure cylinder are operated by an eccentric shifted by a fly-wheel governor. In vertical engines of the type shown in this view the weight of the valves is balanced by pressure on pistons in cylinders supported above the valve chambers; the difference between the atmosphere and vacuum being available for condensing engines and direct steam pressure for non-condensing engines.

The catalogue of the company shows that different forms of the shaft governor have been employed, but the more recent one is illustrated in Fig. 90, in which, however, the springs are omitted. Moreover, this particular form operates an overhanging pin instead of an eccentric, but the principle remains the same. The pin or eccentric is carried by a single large bar weighted at the ends and pivoted eccentrically relative to center of shaft so that the center of the operating pin or eccentric will swing across the shaft, producing the variable valve motion of the link and fly-wheel cut-offs in general. The

heavy operating bar with weighted ends serves two purposes. Being hung eccentrically, the joint action of the centrifugal force generated by the overpoise and the retracting force of the usual springs shortens the cut-off as the speed is increased, and vice versa. Again, the whole weight is so nearly balanced each side of the center that it acts by its inertia to revolve around its supporting center and shorten the cut-off if the engine moves ahead of average speed, on account of reduction of load, and on the contrary will itself move ahead relatively to the fly-wheel and lengthen the cut-off in case the speed is decreased by the application of load. This form of governor, therefore, acts even during part of a revolution and has been developed so as to secure very close regulation. The dimensions and weights of three examples of engines built by this firm are given in the following table:

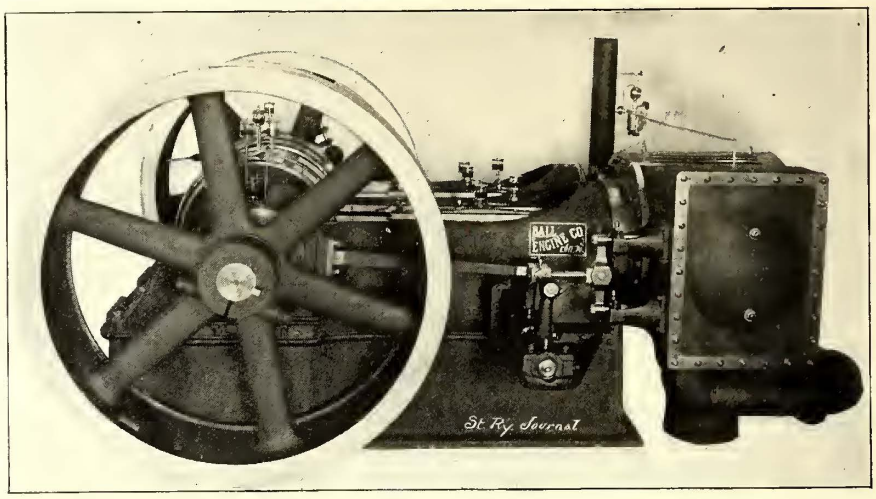


FIG. 85.—BALL HORIZONTAL CROSS COMPOUND ENGINE

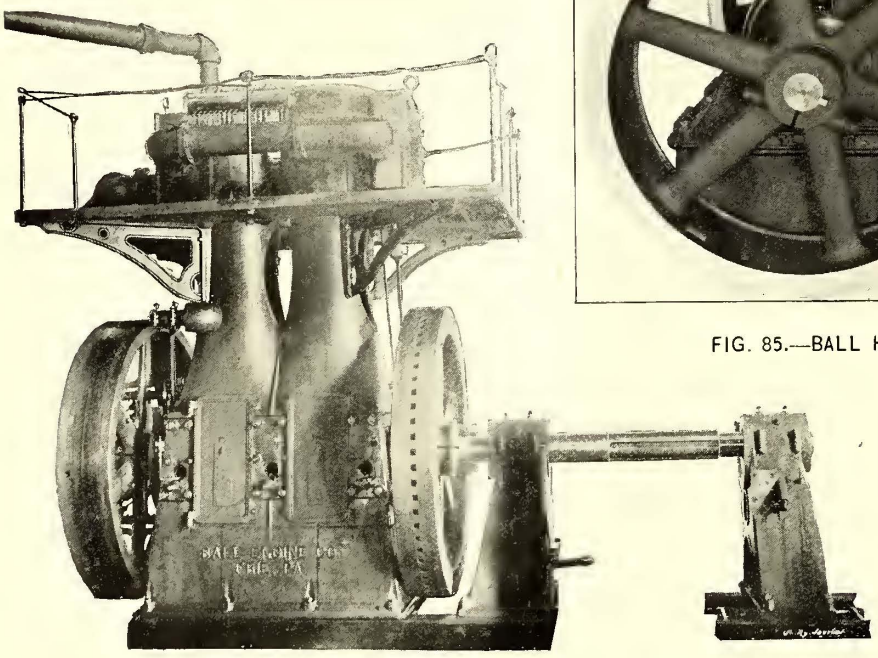


FIG. 86.—BALL VERTICAL CROSS COMPOUND ENGINE

The side crank engine is comparatively new type, but has been employed for operating dynamos for the transmission of electrical energy at the Apollo Iron & Steel Works, Vandergrift, Pa.

ENGINES OF THE WATERTOWN STEAM ENGINE COMPANY.

This company has made a specialty of high speed engines of various types, directly connected to electric generators of different kinds, and it is claimed that more exact regulation can be obtained with this type of engine than with a belted engine. It is the custom of the company to balance the entire weight of the reciprocating parts by the crank discs attached to the main shaft. The balancing discs are adjusted to position by the means of right and left-hand threads without the use of a soft metal. They can be removed in a short time, and as quickly replaced in precisely the same position. The construction of these discs is such as to create an air suction about the crank pin, tending to keep it cool.

A horizontal section of a steam cylinder with four four-ported valves is shown in Fig. 91. These valves give

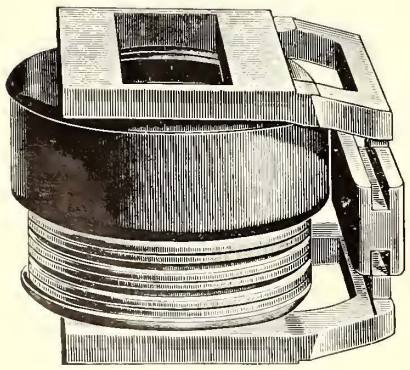


FIG. 89.—VALVE

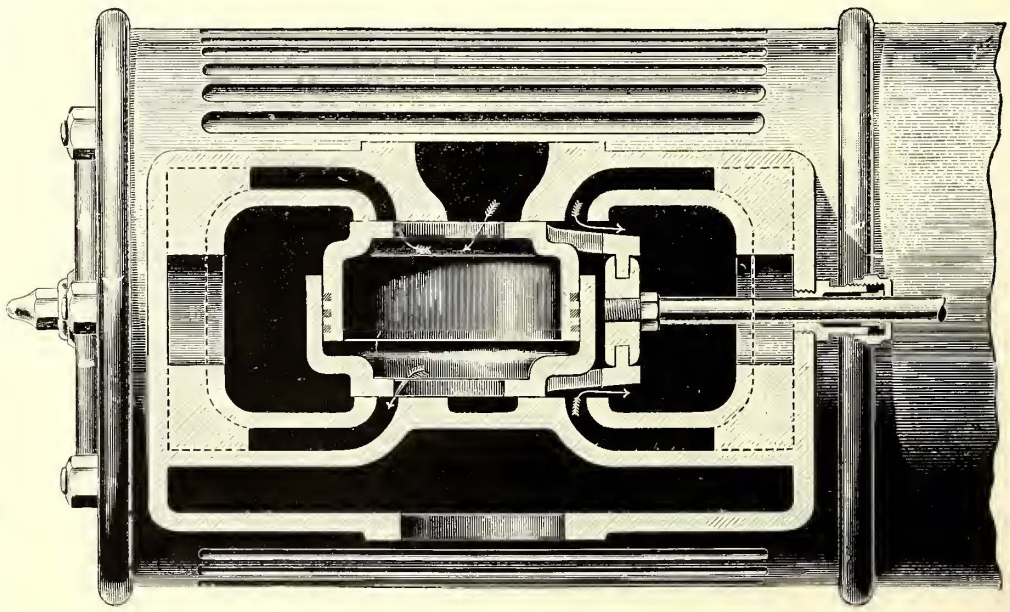


FIG. 88.—SECTION OF VALVE AND VALVE SEATS

	20 & 36 x 18 Cross Compound.	18 & 30 x 24 Tand. Side Crank.	18 & 30 x 18 Vert. Cross.
Total weight of engine (lbs.),	65,000	65,000	60,000
Total weight of wheels (lbs.),	15,000 (2)	15,000 (1)	14,000 (2)
Total economical h.p. capacity at 125 lbs. condensing..	680	410	470
Speed (r.p.m.).	220	150	220
Floor space (feet).....	16 x 12	24 x 14	10 x 8
Height (feet).....	....	....	14½

The company reports that it has furnished vertical en-

quick admission and closure, and secure a maximum port opening with minimum valve travel. The short and direct steam passages bring down the total clearance to the lowest point. The exhaust valves are operated independently of the steam valves, so that the compression is not increased, as steam is cut off shorter, as is the case with single valves.

Fig. 92 is a horizontal section of a tandem compound engine manufactured by this company, and Fig. 93 a top and side view on a small scale, showing the same engine connected to two electric generators. Fig. 93 shows lateral extensions of the bed-plate which carry the dynamos and the outer pillow blocks beyond the same. The valves

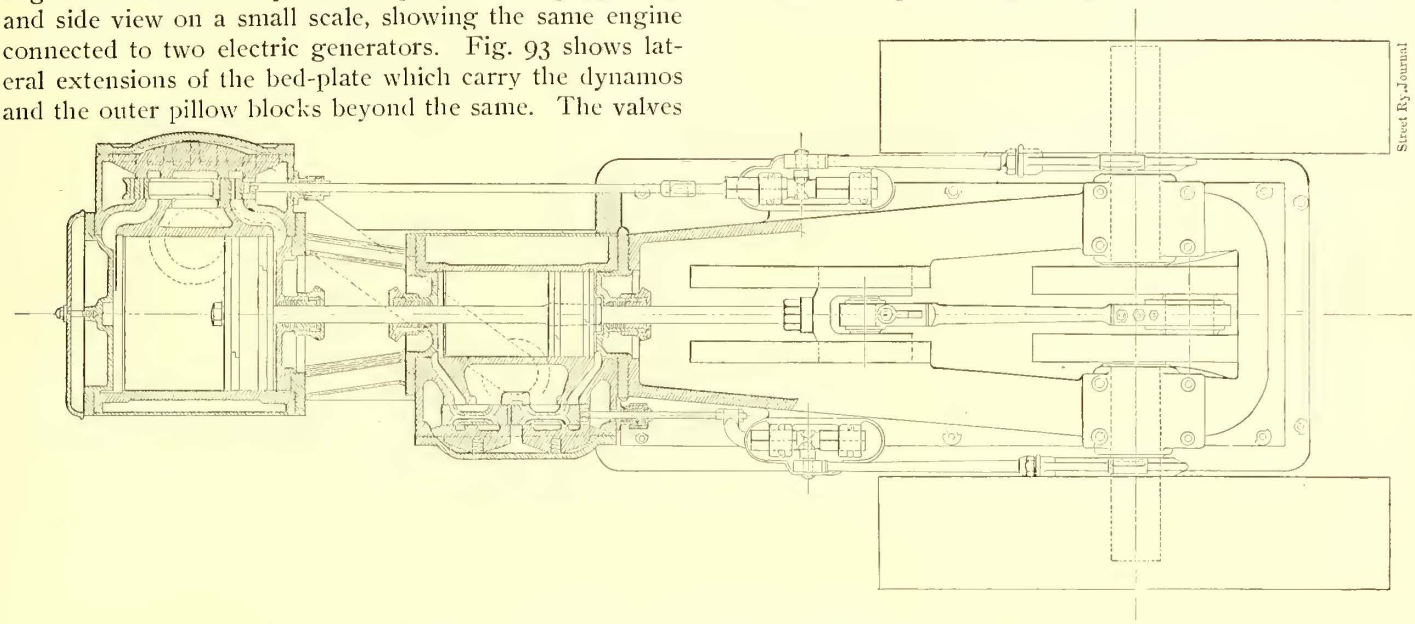


FIG. 92.—HORIZONTAL SECTION OF WATERTOWN TANDEM COMPOUND ENGINE

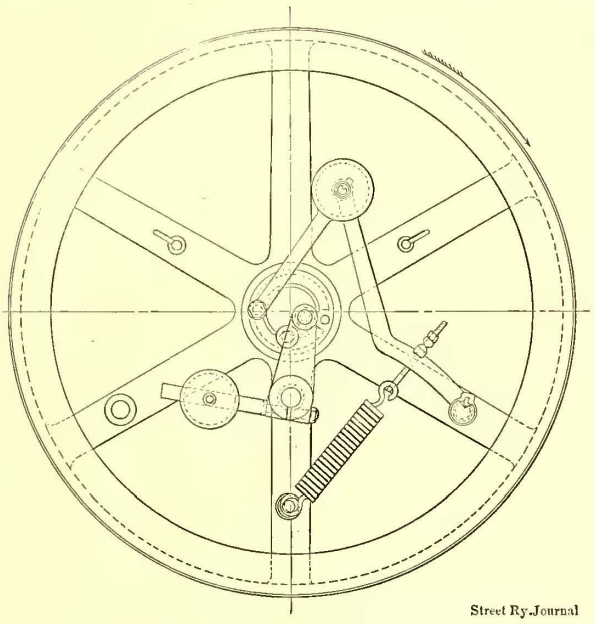


FIG. 94.—FLY-WHEEL GOVERNOR

oil reservoir below the bearing and that oil is continuously fed to the top of the shaft by means of rings lying loosely thereon and extending into the oil reservoir.

Dimensions and weights of engines are furnished as follows:

Simple 17 ins. x 18 ins. 4-valve engine: Total weight, 24,000 lbs.; do. of wheels, 9,000 lbs.; h.p. at 100 lbs.; steam pressure, 200; speed, 225 r.p.m.

Tandem compound engine, 13 ins. and 22 ins. x 14 ins.: Total weight, 22,000 lbs.; of wheels, 8,000 lbs.; h.p. at 125 lbs. pressure; without condenser, 200; speed, 250 r.p.m.

The company refers particularly to installations in the

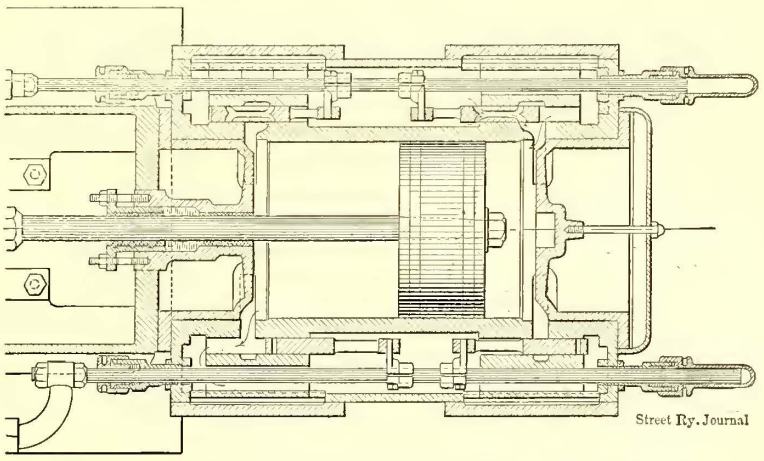


FIG. 91.—HORIZONTAL SECTION OF WATERTOWN 4-VALVE STEAM CYLINDER

shown in Fig. 92 are balanced by cover plates on the top, provided with recesses corresponding to those in the valve seat, and there are additional ports through the valve by means of which double ports are secured at the moment of admission and release. The valve on the high pressure cylinder is operated by a fly-wheel governor shown in Fig. 94, that on the low pressure cylinder by an independent eccentric.

Special pains have been taken in the construction of these engines to prevent the waste of oil. Every part requiring oil has a separate independent oiling device. Figs. 95 and 96 represent longitudinal and cross sections of a main bearing, from which it will be seen that there is an

power house of the Cortland & Homer Street Railway Company, Homer, N. Y., and that of the Port-Norfolk Railway Company, Norfolk, Va.

THE "DICK & CHURCH" ENGINES OF THE PHOENIX IRON WORKS COMPANY, MEADVILLE, PA.

This company manufactures the "Dick & Church" automatic cut-off engines. The simple engines are examples of well-designed high speed engines with single piston valves of an improved type, operated by a shaft governor. A horizontal and vertical section of the typical cylinder and valve chamber of these engines are shown in Figs. 97 and 98. It will be observed that the main pis-

ton is of considerable length, so as to give ample wearing surface. The piston valve is arranged below the center of the cylinder so as to drain the latter during exhaust. The steam chamber is arranged to jacket the valve seats with live steam so that they expand before the valve and pre-

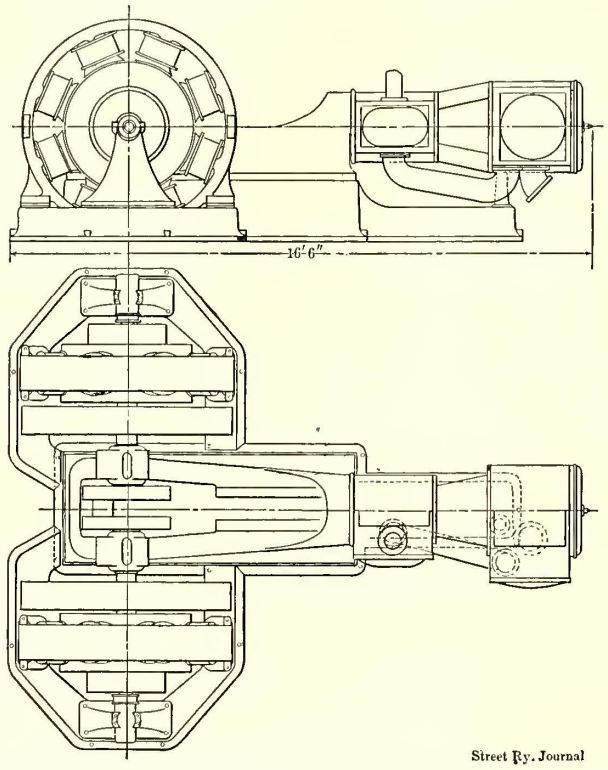
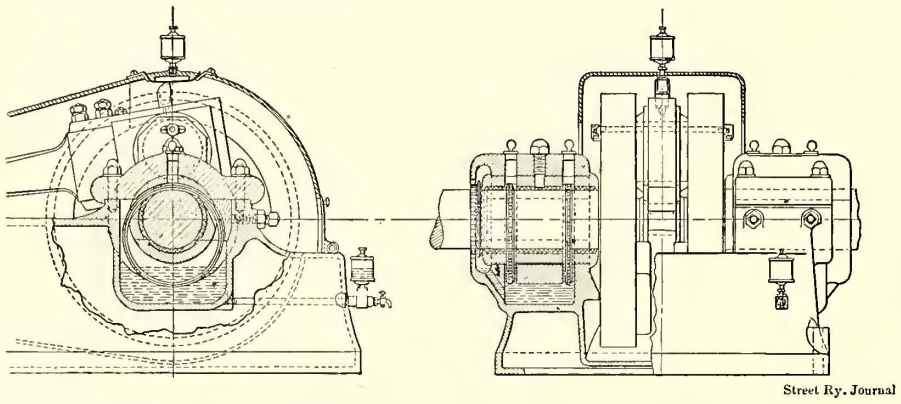


FIG. 93.—WATERTOWN 13 IN. AND 24 IN. × 16 IN. TANDEM COMPOUND ENGINE

vent sticking. The valve is provided with four discs, the two outer ones only acting as valves. The two inner ones are in skeleton form so as to permit the exhaust steam to pass through them, their office being simply to support the valve centrally and give more bearing surface.



FIGS. 95 AND 96.—MAIN BEARING SHOWING OIL RESERVOIR AND FEED RINGS

The company recently adopted the use of the "Rites" shaft governor, in which a simple bar loaded at the ends is so connected to the eccentric and pivoted to wheel as to shift the latter across the shaft and the weights at the same time act both by centrifugal force and by their inertia to secure prompt action during part of a revolution in case of sudden changes of load, as has been several times described in relation to other engines, though the name of the governor has not heretofore been mentioned, there being a number of modifications of the general form which can better be set forth by the inventors than the author. The triple compound and simple engines of this firm have been made familiar to the readers of the journal by illustrative cuts in the advertising columns. There has been selected for illustration at this time a tandem compound engine manufactured by this company.

Fig. 99 is a perspective view of the tandem compound engine as furnished for ordinary commercial purposes. One of these engines with shaft extended to an outer bearing for direct connection to a railway generator was furnished the Rapid Transit Company, Detroit, and an end view of same is shown in Fig. 100. This engine is of the center crank type directly connected to a 400 k.w. generator. Cylinders 16 ins. and 30 ins. in diameter x 18 ins. stroke; speed of engine, 200 r.p.m.; i.h.p. condensing at 125 lbs. boiler pressure, 400, or the same with 140 lbs. steam pressure non-condensing. This h.p. rating is based upon 3-10 cut off condensing and 4-10 non-con-

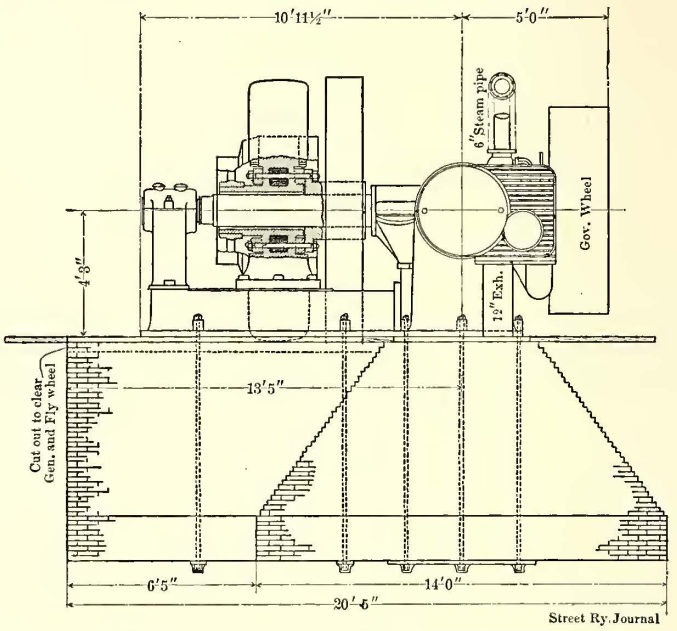
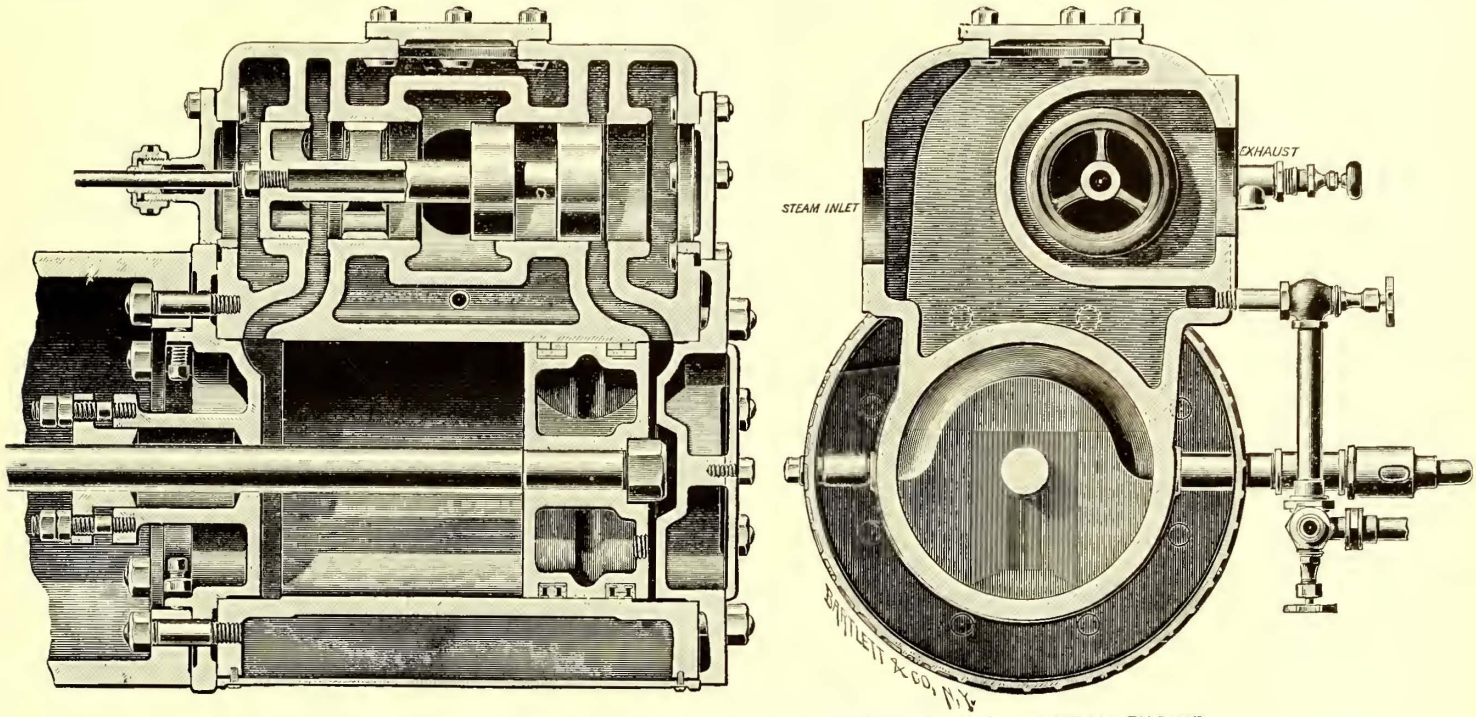


FIG. 100.—END VIEW OF DICK & CHURCH TANDEM COMPOUND ENGINE

densing. The range of cut-off of the governor is sufficient to give 600 i.h.p. Total weight of engine, 84,000 lbs.; weight of fly-wheel, 20,000 lbs.; of governor wheel, 5,000 lbs.; crank shaft, 9¼ ins. in diameter on governor wheel side; crank pin 9¼ ins. x 9¼ ins. Crank shaft on generator side, 12 ins. diameter in bearing, 13 ins. diameter through the generator. The 10-ton fly-wheel is placed on the shaft next to the generator and has a flange cast on the hub for the purpose of bolting the spider to the generator solidly to the fly-wheel. This relieves the strain on the prey of the key of the armature and all fluctuations of the load are immediately thrown on and cared for by the momentum of this 10-ton fly-wheel turning at 200 r.p.m. The engine regulates within 2 per cent on the widely varying loads handled. Both the valves of the high and low pressure cylinders are piston valves and both controlled automatically by the governor, which secures a substantially regular receiver pressure and a proper distribution of the load and temperature between the two cylinders. The low pressure cylinder is further from the crank than the high pressure and supported by an emplacement integral with the bed-plate, corresponding in shape to that supporting the high pressure cylinder. This construction allows each

cylinder to expand independently of the other, and always preserves the alignment. Moreover, either cylinder is easy of access without disturbing the other.

In four-valve triple expansion engines of this company the governor is made double and cross connected; that is, there is a governor on each side of the wheel and all valves are controlled automatically by the one governor, so that there is no danger of an excess of load being thrown on one side of the engine. The manufacturers guarantee that when the mean average load is only 50 per cent of the rated power of the engine, the water rate will not be increased over 20 per cent, and state that on a tandem compound condensing engine of 150 h.p., using a Conover belt driving air pump with a plunger feed pump on the end of the shaft, with a load of 106 h.p. the water rate was less than 18 lbs. per h.p. per hour, and the coal consumption 2.01 lbs., the coal being a mixture of bituminous nut and slack, costing $1.50 per ton.



FIGS. 97 AND 98.—TYPICAL CYLIN DER AND VALVE CHAMBER—DICK & CHURCH ENGINE

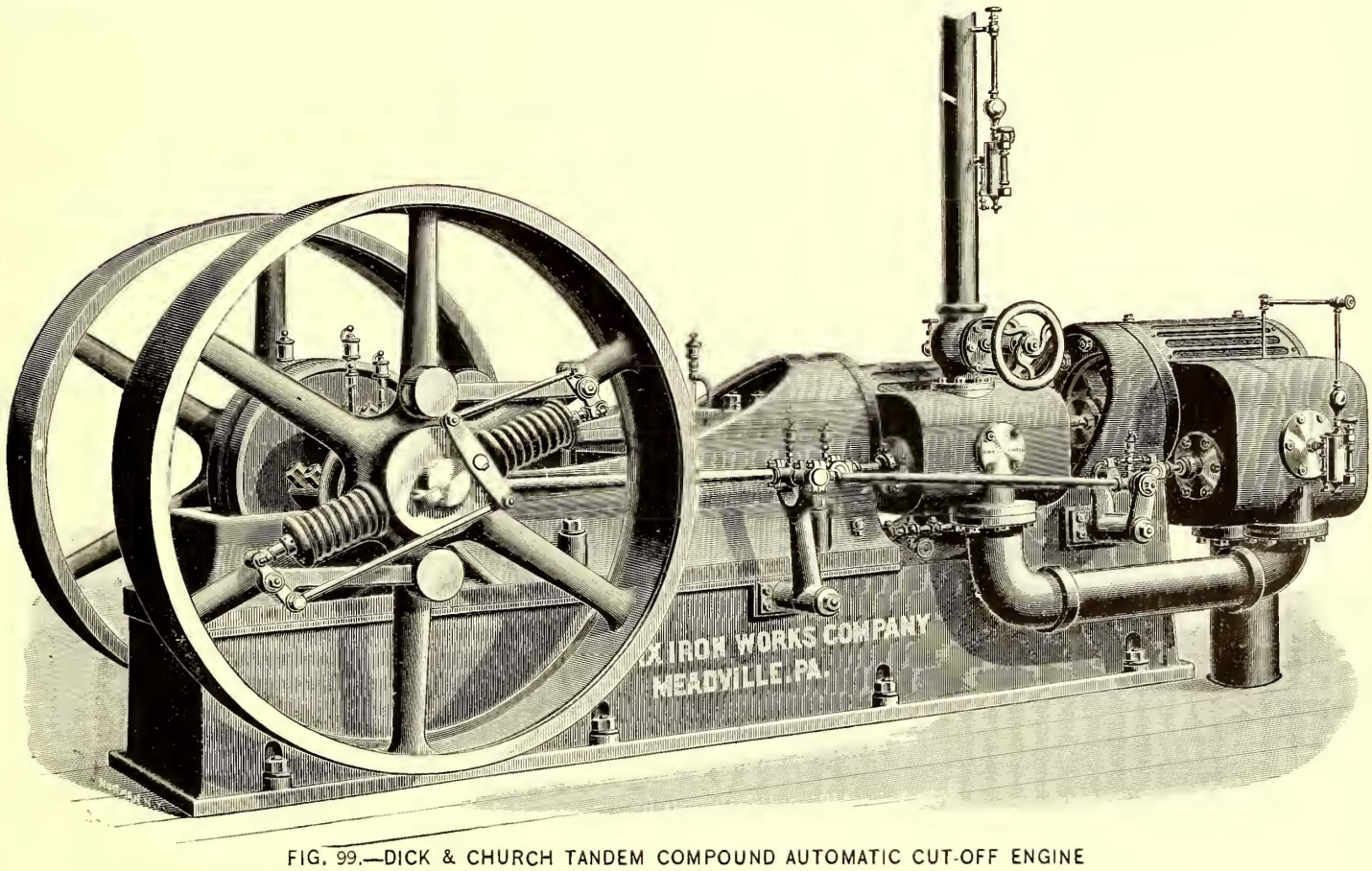


FIG. 99.—DICK & CHURCH TANDEM COMPOUND AUTOMATIC CUT-OFF ENGINE

THE "AMERICAN BALL" ENGINES OF THE AMERICAN ENGINE COMPANY.

These engines are the latest production of Mr. Frank

H. Ball, so well and favorably known in connection with the perfection and introduction of high speed engines adapted particularly for electrical work. The type of valve customarily employed is the double valve already described and illustrated in connection with the work of the Ball Engine Company of Erie, Pa.

The engraving Fig. 101 represents the typical double crank high-speed American Ball engine directly connected to an electric generator. As shown, the sub-frame of the engine carries an integral projection which supports the field of the dynamo and an exterior bearing beyond the same, the arrangement making a sightly, compact and rigid structure adapted for continuous hard work. The American Engine Company is also engaged in the manufacture of electric generators and other electro-dynamic apparatus.

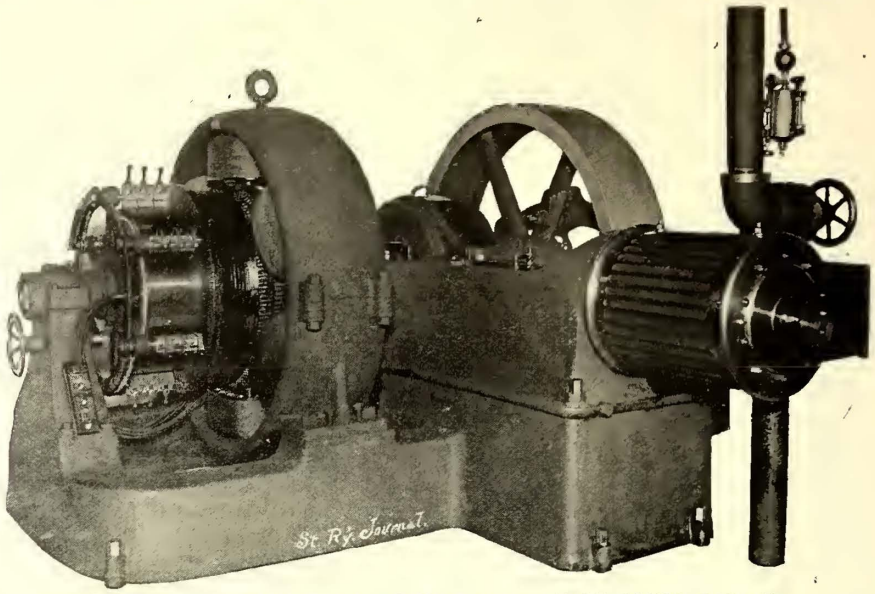


FIG. 101.—AMERICAN BALL DOUBLE CRANK HIGH SPEED ENGINE

The illustration below, Fig. 102, is a side view of a similar engine, not connected to a dynamo, which shows the improved Ball governor, which is of the combined Rites centrifugal and inertia type with improvement by Mr. Ball, whereby the operating pin or eccentric is swung with a short radius from a point on the opposite side of a shaft from that from which the lead is laid off, so that the lead reduces at first slowly as the cut-off increases and yet becomes zero at mid position so that the engine will not race when unloaded. This arrangement gives greater lead and greater opening at ordinary points of cut-off than is possible with the ordinary construction.

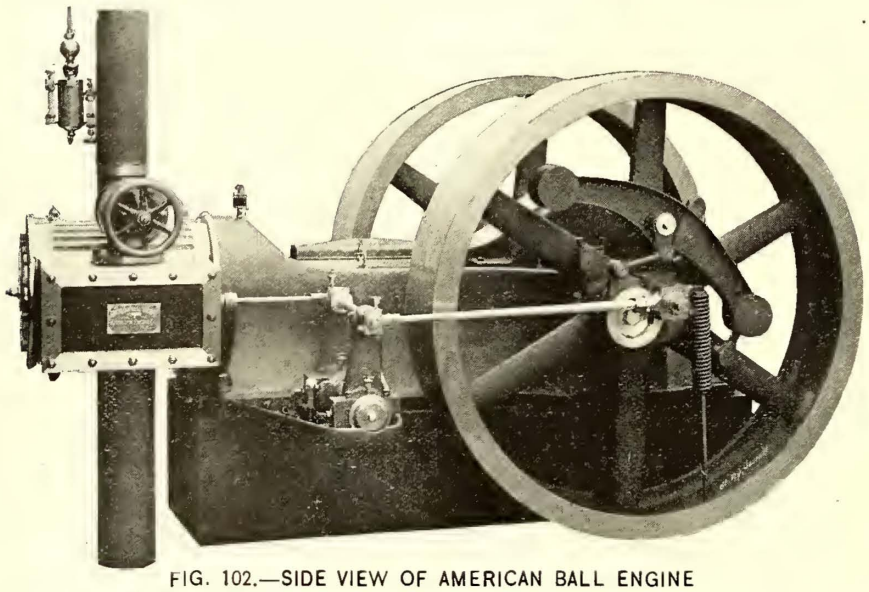


FIG. 102.—SIDE VIEW OF AMERICAN BALL ENGINE

Fig. 103 is an engraving showing a cross-compound American Ball engine with attached dynamo embodying the several features above explained. The steam for the large cylinder is, however, distributed by a circular slide valve in a pendent valve chamber, making the connection with independent operating eccentric very simple. Especial pains have been taken to secure automatic lubrication of these engines. The oil flows through pipes to each of the bearings except the crank pin. To lubricate the latter, grooves on the outer sides of the crank arms catch the oil exuding from the main bearings and through suitable holes conduct it to the pin. A surplus of oil is preferably employed so that the bearings are continuously covered with an oil film and the friction is greatly reduced. The crank is covered in such way as to retain oil thrown therefrom while giving free exit to slight leakages of steam from the stuffing box. The drips from the bearings are conducted by pipes through fine wire gauze to a chamber underneath the rock shaft and a simple pump operated from such shaft lifts the oil, or, if temporary derangement should accidentally occur, a temporary overhead tank is provided which connects to the same series of pipes.

Two of the American Ball engine dynamos are located in the engine room of George W. Munro, on Vandewater st., New York, and furnish the power and light for the whole printing establishment. The boiler pressure is 125 lbs., and the exhaust steam is used for heating when required. Electric current is delivered at 250 volts to operate motors directly connected to single machines or groups of the same, and the lights are adapted to this voltage. The system has displaced two Corliss engines formerly used for driving the machinery of the building through the old system of belts and shafting.

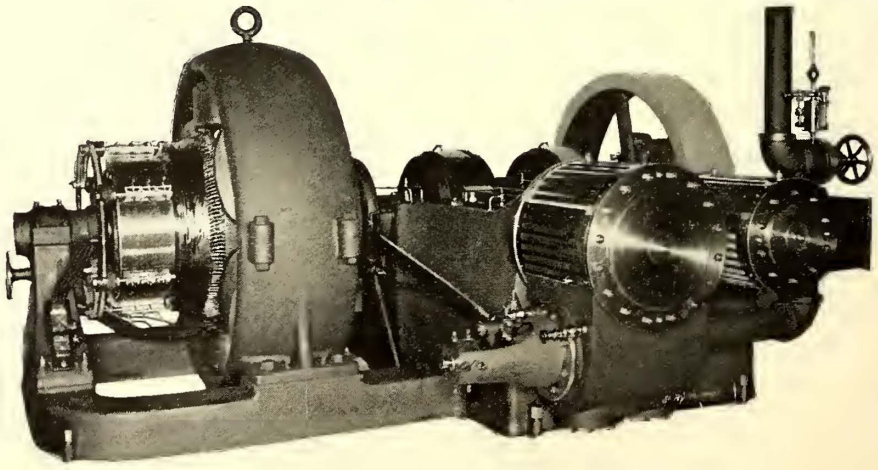


FIG. 103.—END VIEW OF CROSS-COMPOUND AMERICAN ENGINE

ENGINES OF THE ARMINGTON & SIMS COMPANY

As this article was about to go to press the Armington & Sims Company redeemed its promise to send details of its more recent engine designed for operating electric generators, pressure of business having prevented an earlier response. Time will not permit the illustration of the standard engines previously manufactured by this company. The observation of the writer agrees, however, with the statements in the catalogue, that the company builds a great variety of sizes and types of engines designed to meet the requirements of any service. In addition to its well-known high speed types it is also builder of slow and medium speed engines up to 2000 h.p. capacity. The company manufactures a special line of light, high speed vertical engines, designed expressly for electric lighting service on steamships or wherever economy of space is an important factor. The materials used are the best of their various kinds; the workmanship of the highest quality, and all parts made accurately to gage, so that duplicates can be furnished at short notice. The high speed engines are provided with automatic devices for oiling the several bearings. The valve is of the piston type, with long bearing, double ported on the steam side and operated by the Rites fly-wheel governor.

A front side view of the more recent types of engines designed by this company for directly operating electric dynamos is shown in Fig. 104. A rear side view of the same engine is shown in Fig. 105. Fig. 106 shows in three views the improved form of governor employed on these engines.

Attention has already been called in this article to the fact that the conservatism of purchasers and commercial considerations tend to bring about a certain degree of uniformity in machinery designed for the same purpose. In the new type of railway engine of the Armington & Sims Company this and other considerations have led to the adoption of Corliss valves. They are, however, of improved type, being double ported, as can be clearly seen in Fig. 105, so as to secure, on the principles already discussed, the advantages of short travel due to the multiple port system. The valves are, moreover, closed by steam pressure instead of weighted vacuum pistons, and are released by an improved form of fly-wheel governor of the Rites type, instead of the ordinary two-ball centrifugal governor.

The engine is of massive construction, the frame being

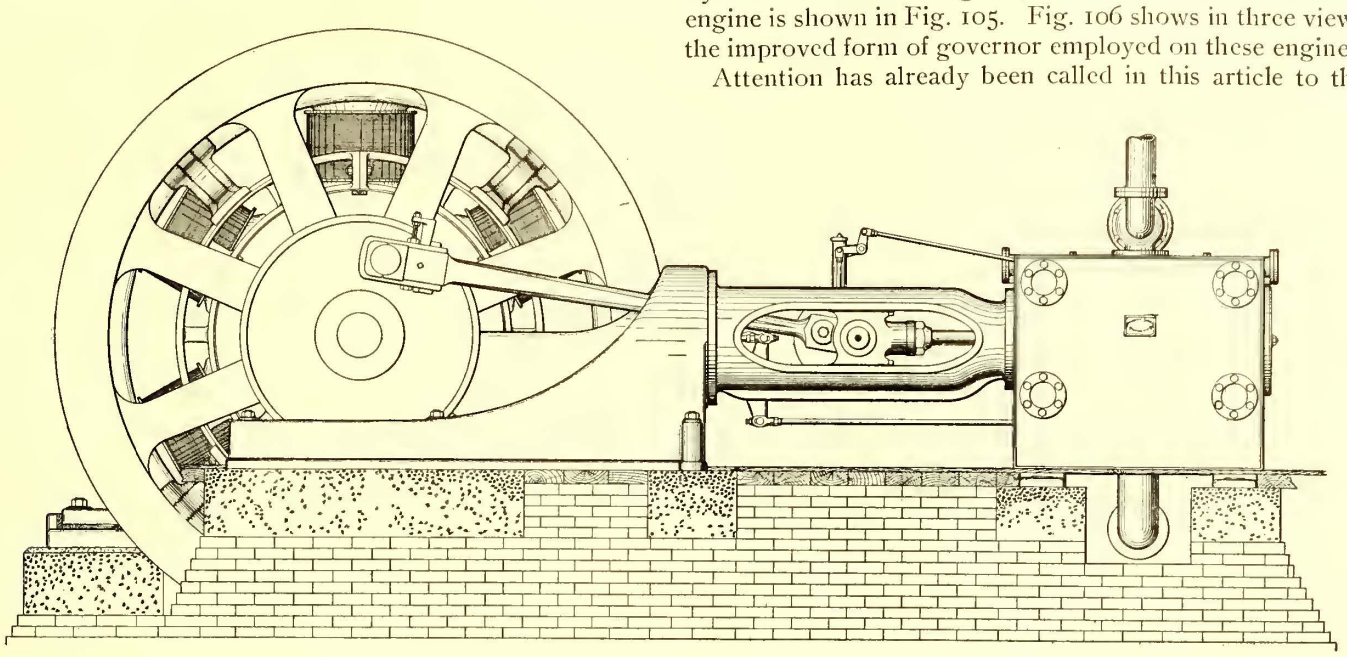


FIG. 104.—DIRECT CONNECTED ARMINGTON & SIMS CORLISS ENGINE

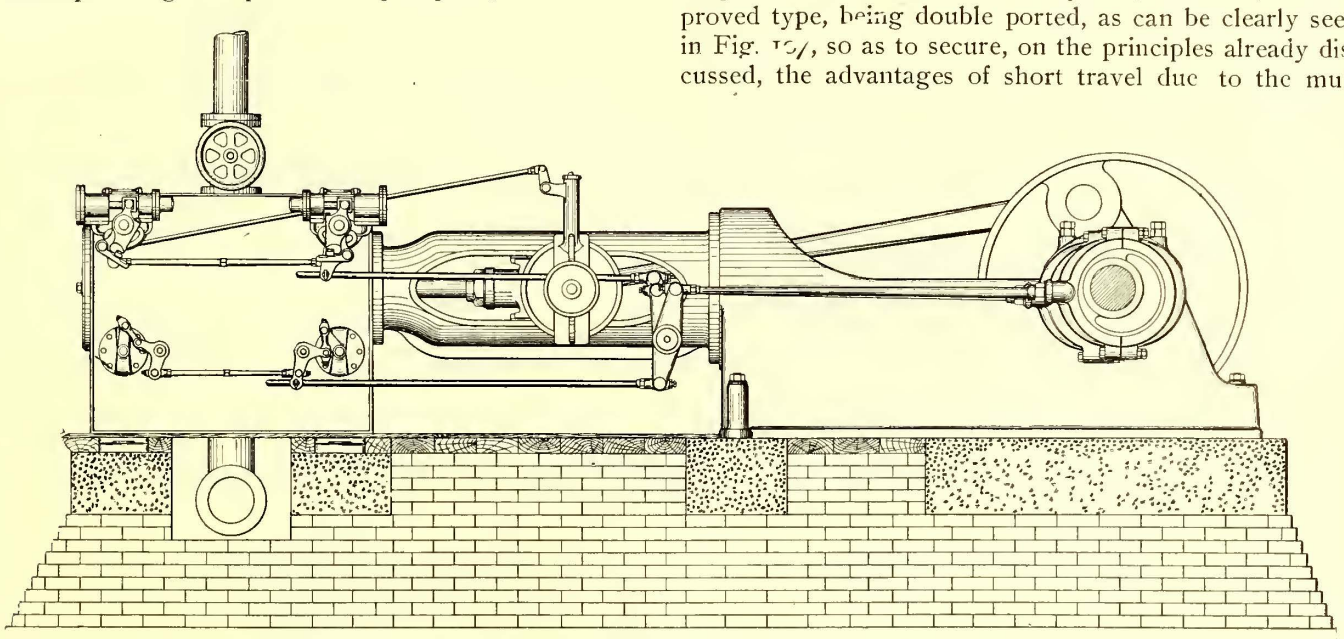


FIG. 105.—DIRECT CONNECTED ARMINGTON & SIMS CORLISS ENGINE

designated by the builders as of the "Tangye type" with bored guides. The steam and exhaust valves are operated by separate eccentrics, the latter being driven through "carrier arms," which give the desired "quick opening" and "dwell" at closing, without the use of the Corliss wrist-plate. The steam valve gear is of the liberating type, with the distinctive feature that a steam closing mechanism is employed instead of vacuum dash-pots. Each steam valve is operated by a rod, one end of which forms a plunger and enters a cylinder in which constant steam pressure is maintained from the steam pipe, and the other end is provided with a modern sized piston working in an air cushioning cylinder. It follows that the valve opens against the resistance of the steam pressure on the operating plunger, is retracted by such steam pressure when released and is brought to rest by an air cushion. By this arrangement very much less mass is put in motion in opening the valve than with the customary arrangement, and the valve is not only closed more promptly but more certainly, as the force is constant and not influenced by the variable opening, as is the case where a vacuum is employed. The short stroke of the valves and the steam-closing

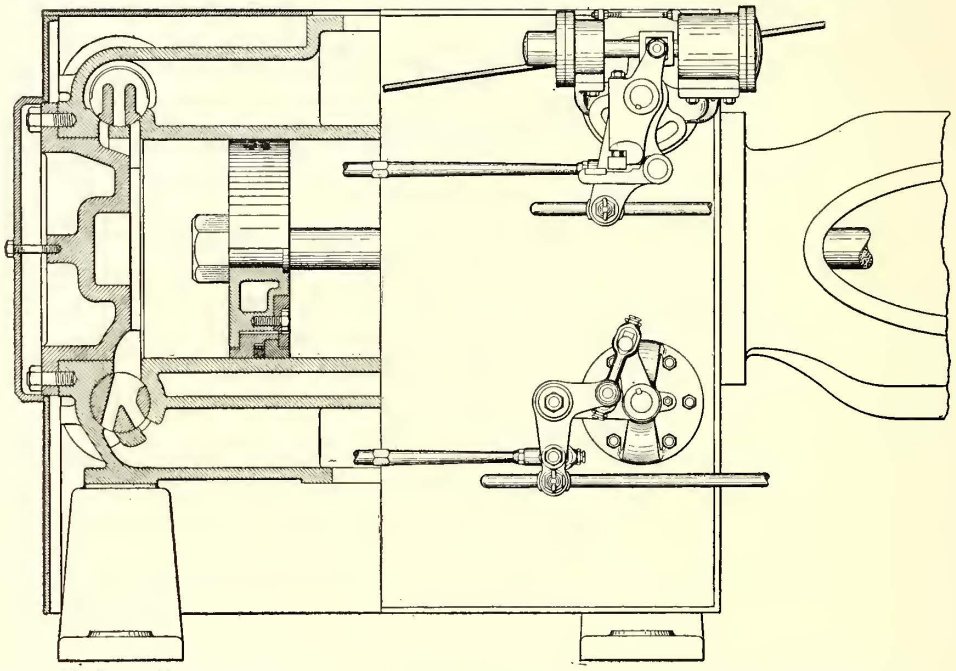


FIG. 107.—HALF SECTION OF CYLINDER AND SIDE ELEVATION OF VALVE GEAR

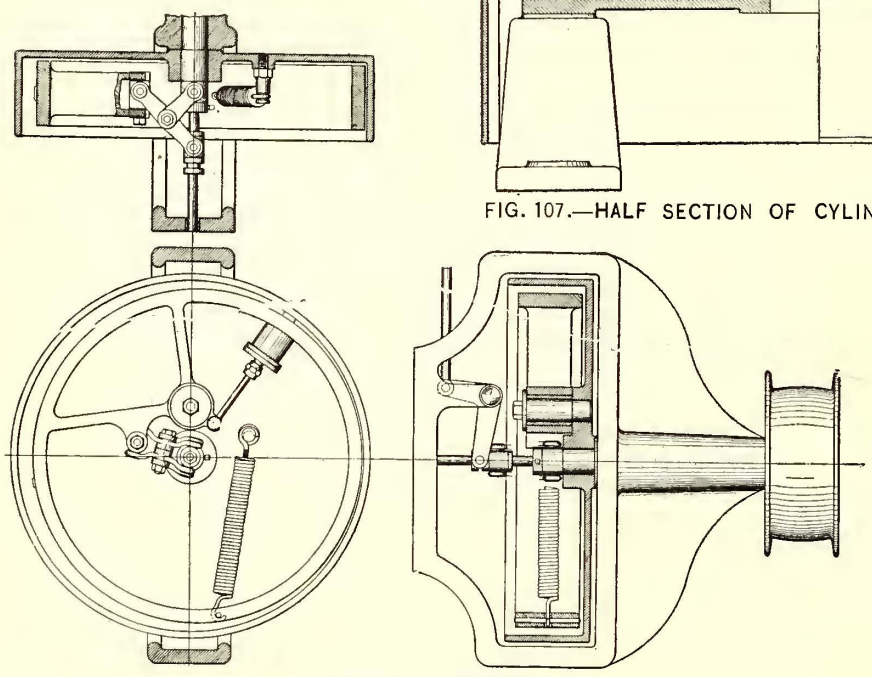


FIG. 106.—GOVERNOR

device permit the satisfactory operation of the engine at a higher speed than is possible with valve gear of the ordinary releasing type.

The governor shown in Fig. 106 is an improved form of the Rites governor. Instead of distributing the weight at the ends of a lever it is in the form of a perforated disc with a rim, as shown, such disc being pivoted eccentrically in the governor wheel. Rotation is resisted by a spring and governed by a dash-pot. The motion of the disc is, through the joints shown, transformed from a radial direction to an axial one, which, through a sliding collar, bell cranks and connections, is transferred to tripping cams concentric with the valve stems. The disc operates directly by its inertia to trip the valves quicker when the engine first moves faster than the speed designed and to trip them later in the stroke as the engine commences to fall behind. The disc is also subjected to centrifugal force which maintains a certain tension on the spring and a fixed point of cut-off when the speed reaches the pre-determined limit and acts with the inertia of the disc in varying the cut-off when the speed is changed. It has come to be universally acknowledged that the regulation of high speed engines with fly-wheel cut-offs is superior to that which can be obtained with any other form of governor, and the application of this form of governor for tripping the valves of a disengaging cut-off is a creditable advance in this branch of steam engineering.

In this particular engine the governor is located in the position customarily occupied by the ordinary centrifugal governor and operated by a belt. This new application has been thoroughly tested with very satisfactory results.

The motive for public ownership abroad is twofold. The first has reference to the conditions of the streets and street surface. They have, as a rule, finely constructed and maintained streets, and in their very proper regard for keeping them so, they desire to control all construction and maintenance of track. The second has reference to controlling and regulating the method of operation. That has proven a failure, and can be accomplished better when granting a franchise. In nearly every case in England where the municipality acquired the operation of the property, it did so involuntarily.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

Where conditions are favorable for the use of oil, it makes an ideal fuel, requiring no handling, making no smoke or ashes, and allowing the fire to be regulated with the utmost nicety.—From report of committee, St. Louis Convention, 1896.

A street railway mail service has just been inaugurated in Duluth, Minn.

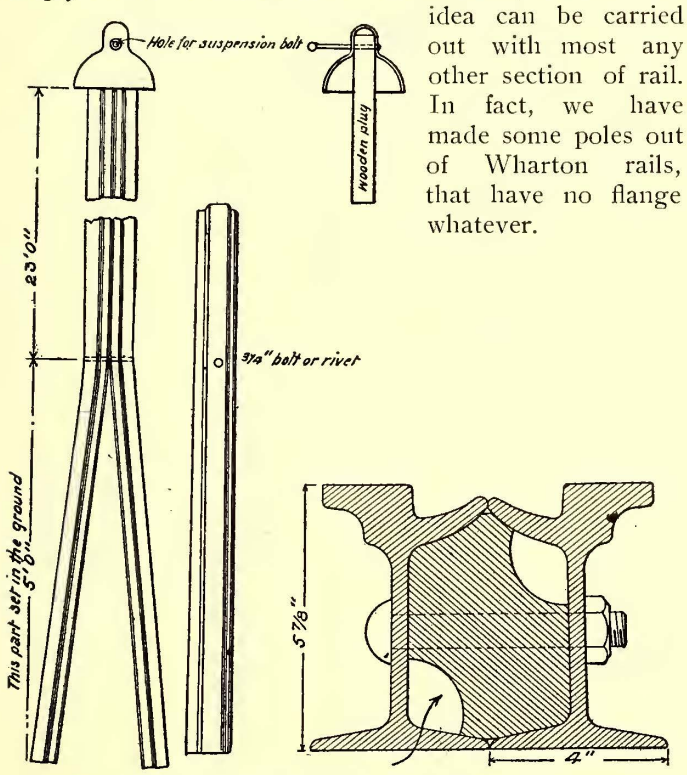
LETTERS AND HINTS FROM PRACTICAL MEN.

Poles and Cars in Rochester

ROCHESTER RAILWAY COMPANY,
ROCHESTER, N. Y., April 8, 1898.

EDITORS STREET RAILWAY JOURNAL:

The accompanying sketch shows a method employed by this company for utilizing old rails as poles. We take two section "Y" 62 lb. rails and place them side by side, inverting them if it is necessary in order to make them lie evenly against each other, but we very often find that the tram is so worn down with wagons traveling upon it that it is extended sufficiently to make the head of about the same width as the foot of the rail. We use this section simply because we have more of it on hand, but the same idea can be carried out with most any other section of rail. In fact, we have made some poles out of Wharton rails, that have no flange whatever.



SIDE ELEVATION AND SECTION OF POLE

We bolt two of these rails together through cast iron parting blocks every 4 ft. The parting blocks are provided with passages at opposite corners for wires. The cap, or top of pole, is a casting made either round or square, as may suit the fancy of the user, and into this top we fit a wooden plug, which is also made to fit between the rails when bolted together, and extends down into the same about 20 ins. This is for insulating purposes, and is practically the same as is used on all kinds of iron poles.

We have found the cost of these poles to be about as follows:

1150 lbs. old rail, at ½c. lb	$5.75
70 lbs. castings at 1½c. lb	1.05
Four ¾ in. x 5 in. bolts, at 3c. each	.12
Wooden plug	.25
Labor of putting together and binding foot of pole	1.75
Total	$8.92

An ordinary pipe pole costs all the way from $14 to $16. Supposing the former to be the price, there is a saving of $5.08 on each pole, with the additional advantage of using up old scrap rails, for which there is a very poor market at the present time.

The conditions existing in Rochester are so varying that it would be difficult for me to say as to what we consider the best type of car. The fact is we require three different kinds. For our suburban business I should be in favor of a long, double-truck, cross-seated car, with a capacity of about sixty. For city business on some of our lines we are compelled to use a car that sets very low, on account of passing under overhead bridges, and it would be hardly possible to use a car longer than 20 ft., in which case a single truck might be used. I am of the opinion that in this country we should use vestibule cars in winter, constructed so as to admit of rapid egress and ingress.

T. J. NICHOLL, VICE-PRES. AND GEN. MGR.

Notes from Denver, Colo.

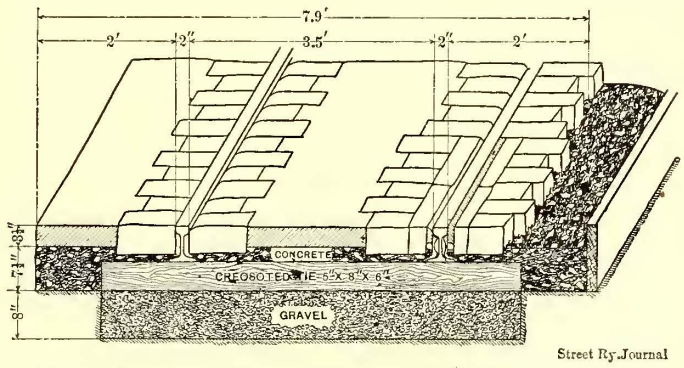
THE DENVER CONSOLIDATED TRAMWAY COMPANY.

DENVER, COLO., March 18, 1898.

EDITORS STREET RAILWAY JOURNAL:

We changed our lines from cable to electric just before the panic of 1893. The expenses of operating our lines are now much less than they were formerly, when operated by cable power. We find it much easier to run electric lines, they being more reliable, and less subject to "breakdowns" than the cable system. The public undoubtedly prefer the electric to the cable, chiefly for the reasons that the cars run faster and can make up time, are not blocked by stranded cables, and that they do not have the jerky motion peculiar to the cable.

During the past two years we have been replacing our cable tracks with new construction, as shown by illustration herewith. The rails were formerly 35 lbs. to the yard. We are now laying T-rails weighing 72 lbs. to the yard. During the coming summer we expect to relay about five and one-half miles of cable track, and have ordered 60-ft. rails from the Johnson Company, creosoted ties from



SECTION OF T RAIL TRACK CONSTRUCTION IN DENVER

Michigan, and the Brown plastic bonds. We expect to begin work within the next thirty days.

The Rasmussen switch was designed for cable construction only, and therefore we are not using it at present. Our overhead switches and trolley-wire splices are manufactured at our shops, after our own designs. We employ the same method of overhead construction and feeder system as formerly, and our power-houses are coupled by means of feeder-wires, as they were in 1893, when our line was fully described in the Street Railway Journal.

We are still using practically the same form of examination blank as described in March, 1893. Our hospital fund is still maintained, acceptable to the company and men alike. The uniforms are still of the Burlington Woolen Mills gray cloth, practically the same style as has always been used. We are satisfied that this is the correct cloth for motormen, especially in dusty climates.

The pay for our trainmen is 17½ cents an hour for the first year, and 20 cents per hour thereafter. Three years ago, when it became necessary to reduce the pay of our men from 22½ cents to 20 cents per hour, we made a voluntary agreement with them that we would divide a portion of the receipts over a certain average per day with them. For example: If the receipts for any one month averages $2,100 per day, the men receive an additional cent per hour for every hour worked by them during that month. An account is kept with each man, and a check handed him at the end of the month, for the additional amount. In case the receipts are $2,250 average per day for the month, each man would receive 2½ cents per hour, in the manner just described. This applies only to men who have been in the service for one year. During the past three years we have paid out in this way, $11,799.86. We believe that this sharing of the profits, as it were, with our employees, stimulates them to greater exertion on behalf of the company, and that we obtain better service from them. The increase naturally comes in the summer time, when their labors are most arduous, and we are satisfied that the men, for the most part, greatly appreciate the plan.

We no longer require the men to furnish a bond, but instead they put up a deposit of $10, to secure return of badges. Our motormen are trained in the shops before they start on the cars, as formerly. All resident's tickets have been done away with, and any one now living in any of the suburban districts can ride to any part of the city on payment of a single 5-cent fare. The greatest distance one can ride over the lines of this company for one fare is about twelve and one-half miles. About one out of four of our patrons uses a transfer.

Our telephone car dispatching system is still in effect, and we would be very unwilling to dispense with it. Since we inaugurated in 1889 the system of dispatching our cars by telephones, the plan has been adopted and put in by the City & Suburban Company of Portland, Oregon, and by the Los Angeles Company. Our latest advice from those cities is that they are entirely satisfied with the system.

The combination type of car, half closed and half open, the closed part running in front, is still our standard. It is certainly the most popular car for our climate. We are at the present time experimenting with a new brake devised by a Mr. Sauvage of Teluride, Colo. We are very much pleased with it so far, and will undoubtedly equip a number of cars during the coming summer. We still have a large number of old style cars equipped with rheostats on the platform. As business improves, we will probably replace all of the old style motors with those of latest type.

We grind our wheels to some extent, but we are glad to say that we do not have many flat wheels; so that our grinder does not pay interest on the investment.

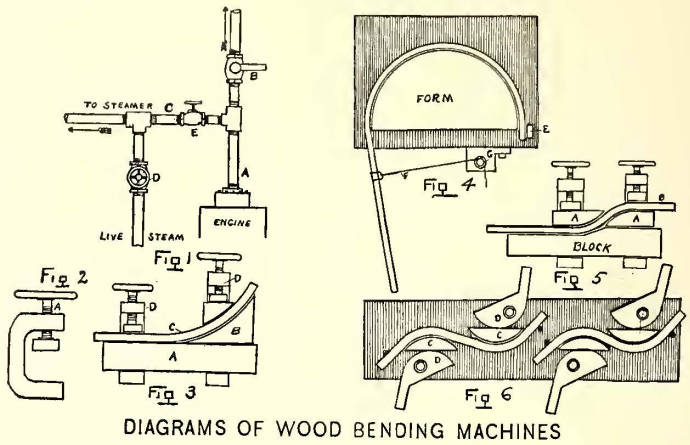
C. K. Durbin.

Wood Bending

Boston, Mass., April 12, 1898.

Editors Street Railway Journal:

Wood for railway work can be bent in any shop that has steam if the principle of bending is understood. I visited recently a station where an ingenious method was employed, the exhaust engine steam being used for the purpose. The method adopted is shown in Fig. 1. In this (A) represents the exhaust pipe of the engine, and (B) is a back pressure valve, placed in the exhaust pipe for the purpose of diverting a portion of the whole of the exhaust steam into pipe (C), which leads into the steam chest of the steamer. At (D) a 1-in. pipe from the boilers was tapped into pipe (C). Then, when the engine was not running, valve (E) was closed, and live steam was turned on to do the work.



DIAGRAMS OF WOOD BENDING MACHINES

In Fig. 2 a form of clamp for bending woods is shown. The C shaped piece was made of cast iron drilled at (A) for the threaded shaft. The shaft was provided with a pivoted stub and a turning wheel. One of the bending forms is shown in Fig. 3. It consists of the brass piece (A), form blocks (B) and clamps (D). The piece in process of bending is marked (C).

In Fig. 4 is another style of bending form which was used. The blocking pin is at (E), under which one end of the piece to be bent was put, while the other end was laid over the form and held by attaching the grip cord (F). The latter is held on the pin (G).

The device in Fig. 5 was for bending wood in the form shown, and can be made easily. A piece of hard wood 2-in. plank was used for a block. By placing one of the forms (AA) beneath and the other above bar (B) and clamping as shown, almost any angle could be bent. The affair in Fig. 6 is a suggestion of the shop superintendent for bending on scientific principles. The shape of the press cams (D) is such that a very positive force may be brought upon the forms (C), and any angle obtained.

Mechanic.

Economy in Car Acceleration

San Francisco, March 12, 1898.

Editors Street Railway Journal:

In the past six months there have appeared a number of discussions in your paper on the most economical method of running a car between two stations in a given time. Some of these have been practical and others theoretical.

While there may be a chance for a difference of opinion when discussed from a practical point of view, there should be none when discussed from a theoretical standpoint.

In order to make the conditions uniform it is usually assumed that the brakes are applied at the same distance from the second station, and when the cars have the same velocity. That is, the rate of retardation is the same in the two cases, and the energy absorbed by the brakes is also the same, being equal to $\frac{1}{2} m v^2 F s$, F being the force of friction on the rails and s the distance passed over from the time of applying brakes. Since the energy at this point (the point of application of brakes) is the same and the work done by the motors to transfer the cars from station 1 to this point is equal—being equal to the force of friction, times the distance between first station and the point of application of the brakes—it, theoretically, does

not make any difference in the economy as to the rate of acceleration and is altogether independent of the maximum velocity which the car may attain.

In fact, the efficiency of transfer of the car might be written $\frac{Fs}{Fs + \frac{1}{2} m v^2}$ where F, as before, is the force of friction, s the distance between stations, s the distance from station 1 to point at which brake is applied and v the velocity of the car at the last named point. G. B.

The Oscillation of Cars

KINGSTON, N. Y., April 14, 1898.

EDITORS STREET RAILWAY JOURNAL:

In the April issue of the Journal there appeared an article by J. A. Brill contradicting some statements about oscillation of car bodies made in an article in January number. In drawing his conclusions Mr. Brill has fallen into the common error of not following his premises far enough to arrive at the true result.

The demonstration of what movements constitute oscillation and of the forces governing them can readily be made with aid of the four figures following. In these figures the point A is the center of gravity of the car and load, assumed for simplicity to be half way between the two points of spring support, B and C.

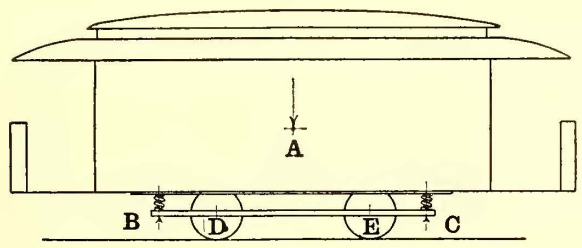


FIG. 1

Fig. 1 represents the car running on a level. The forces acting are gravity, *a*, acting through the point A and the reactions *b* and *c* acting through the springs B and C. As the car is in stable equilibrium *a* equals *b* plus *c* and *b* equals c.

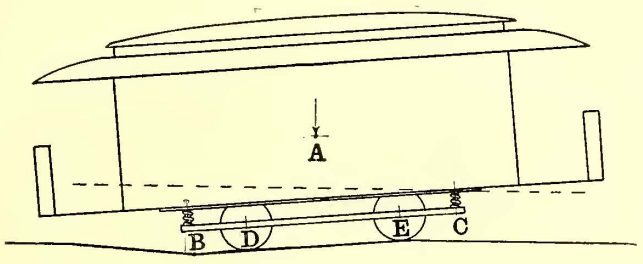


FIG. 2

Fig. 2 represents the front wheels D of the car dipping into an uneven place in the track, such as a low joint. Neglecting the slight up thrust at C, due to the movement of the truck frame taking place about the center of the wheel E, instead of about the point C, the forces acting are the same as in Fig. 1, as gravity acts equally on the car body and truck frame and they drop at the same speed. Mr. Brill's argument was correct up to this point, but he stopped here and did not consider what follows.

Fig. 3 represents the next step in succession. The wheel D has ceased to fall, in fact has begun to rise out of the dip. Of the forces now acting, *c* acting through the spring C remains unchanged, and equals one-half *a*. The spring B, however, in order to restore the body to its horizontal position, must exert a force of $\frac{\frac{1}{2} a}{g} \times (g \times f)$ where f is the speed in feet per sec. with which the point B is raised by the upward movement of the wheel D. The reaction opposed to the joint upward pressure of the springs B and C is gravity plus inertia, acting through the center

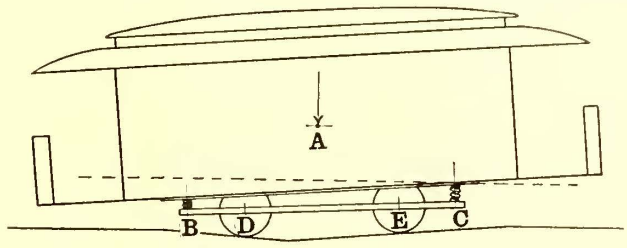


FIG. 3

of gravity A. There is consequently an unbalanced force equal to the difference between the forces acting through B and C, acting to turn the car body about the center of gravity A.

Fig. 4 represents the next and final step in the cycle. The difference $\left(\frac{\frac{1}{2} a}{g} \times f\right)$ between the forces acting through B and C has raised the center of gravity A and

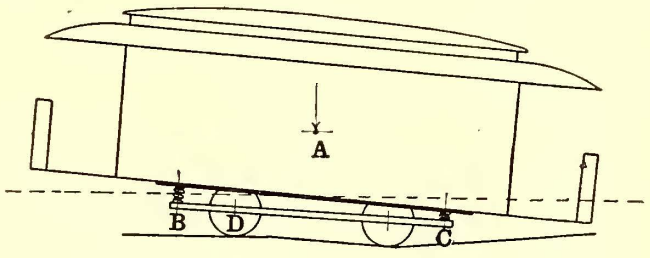


FIG. 4

revolved the car body about it until the point was reached, at which the forces acting through B and C were equal and the spring C is now required to resist the angular inertia thus imparted to the car body, in addition to supporting its share of the weight. The unbalanced force thus exerted by C revolves the car body back on to B again. This balance wheel action will continue until damped by the friction of the parts connecting the truck frame and car body. The car will thus oscillate about a point, not necessarily at exactly the center of gravity, but near it, as I notice the article in the January issue criticised by Mr. Brill distinctly stated.

So much for the demonstration of what ought to take place. The practical proof that it does take place is the well known fact that during the oscillation the rear platform of the car rises and falls in the same manner as the front one.

It follows from the existence of this balance wheel action that any arrangement of the springs which tends to increase their resistance to this oscillation, such as placing them nearer the ends of the car or the addition of counter springs below B and C, arranged to resist the upward movement of the car body will tend to make this oscillation shorter and quicker, just as increasing the stiffness of the hair spring of a watch shortens and quickens the movement of the balance wheel. This shortened and quickened movement is more quickly dampened.

Referring now to Mr. Brill's remark about hanging a car body on trunnions at the center of gravity, were it possible to conceive of any satisfactory mechanical arrangement to accomplish this, it would prevent any oscillation, as all forces affecting the car body would then act through one point, and consequently could produce no motion about that point.

C. F. UEBELACKER.

The First Electric Road.

Denver, Col., April 19, 1898.

Editors Street Railway Journal:

In view of the fact that there has been considerable history manufactured in regard to the first electric roads, and to combat an official statement made by the acting Commissioner of Patents in his last annual report that the first commercial electric road was built but ten years ago (presumably the Sprague roads at Richmond), I send some heretofore unpublished views of historical interest, showing my personal efforts in that direction.

Views 1 and 2 were taken from the East Fifth Street road in Kansas City in the Fall of 1886. No. 3 represents one of the trains on the San Diego and Old Town road, in California, taken in the Summer of 1887. No. 4 represents a view on the Fourth Street road in San Diego, which was constructed in 1887. On the latter road, which was about five miles long, we carried as high as 150 passengers up a 9 per cent grade with a single motor. On the Kansas City road we used the double overhead structure. On the Old Town road in San Diego we used underground feeders with single overhead wires. All of those roads were supplied from compound wound dynamos. The motor fields were wound with a multiplicity of parallel wires. The motor's resistance was varied with a switch which connected more or less of them together in parallel. The armatures ran constantly and were connected to or from the car by a combined differential gear and clutch running in oil. The diminutive trolley engaged the sides and bottom of the trolley wire, and the wheels, which ran in a horizontal position, were held to the wire by strong springs. These wheels were 3 in. in diameter, were made of steel and were tempered "file hard;" by using this form of trolley we were enabled to keep up a traveling contact with the trolley wire, which in some cases was 15 ft. to the side of the track.

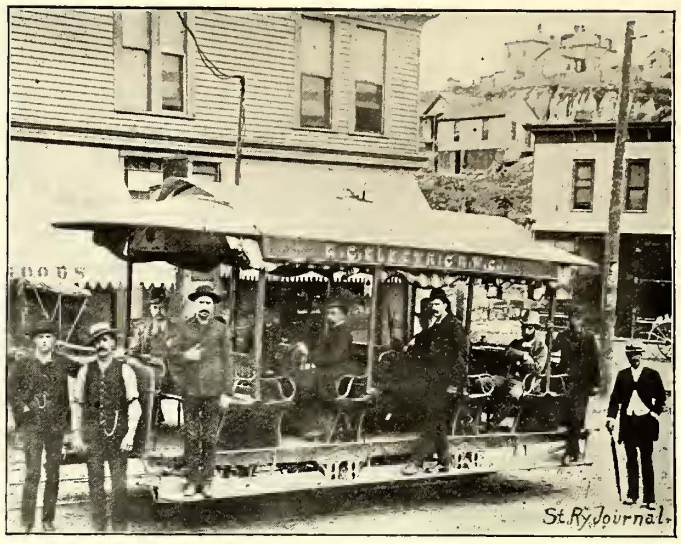


FIG. 2.—EARLY ROAD IN KANSAS CITY

The details of the line construction and motors were worked out and tested by the writer during the years 1884 and 1885 on the Westport road, and also on the Fort Scott & Gulf road in the suburbs of Kansas City.

John C. Henry.

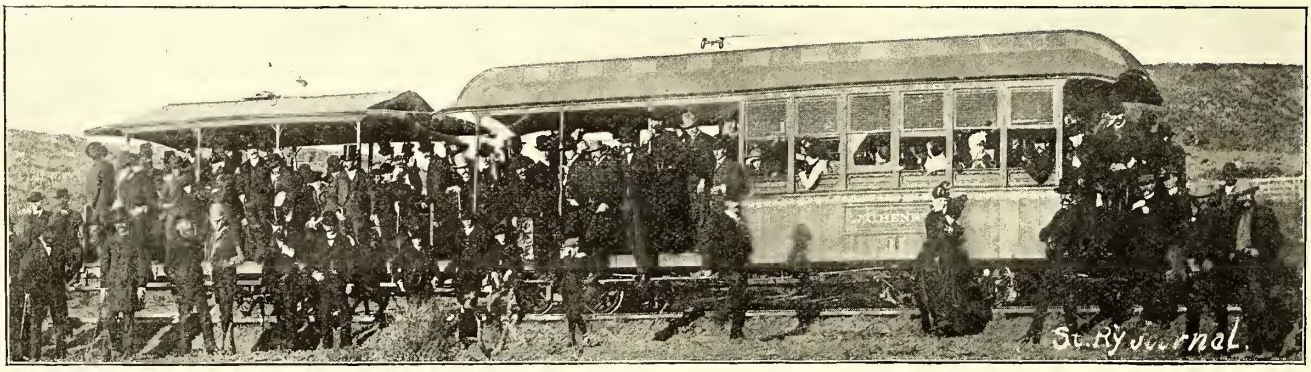


FIG. 3.—EARLY ROAD IN SAN DIEGO

FIG 1.—ROAD IN KANSAS CITY

FIG. 4.—EARLY ROAD IN SAN DIEGO

The high efficiencies obtained in boiler tests are seldom reached in actual practice, as they usually result not so much from excellence of design in the boiler itself as from careful and intelligent firing during the test.—From report of committee, St. Louis Convention, 1896.

Power Station Records

TRENTON PASSENGER RAILWAY COMPANY,
TRENTON, N. J., April 8, 1898.

EDITORS STREET RAILWAY JOURNAL:

I inclose the report of our power station for the year ending Dec. 31, 1897. The low cost in the fuel consumption for October was due to our taking account of stock of coal on hand during that month. The cost for power includes the expense of lighting our park and heating and lighting our cars.

In our station we have one 800 h.p. and two 400 h.p. Watts-Campbell tandem compound condensing engines, six 100 h.p. return tubular boilers, four Short 100 k.w. generators and one G. E. 750 k.w. generator. The generators are belted to the engines. Our boiler pressure is 100 lbs.

HENRY C. MOORE, President.

STATEMENT OF THE COST OF OPERATION OF THE POWER STATIONS OF THE BROOKLYN HEIGHTS RAILROAD COMPANY, PER K.W. HOUR, YEAR OF 1897.

Operation—	Eastern Station.	Southern Station.	Ridgewood Station.	Grand Average.
Fuel and supplies.	$.002822	$.003361	$.005612	$.003362
Labor	.001737	.002654	.002890	.002168
Repairs—				
Supplies	.000377	.000447	.000282	.000385
Labor	.000245	.000422	.000374	.000315
Total	$.005181	$.006884	$.009158	$.006231

STATEMENT OF THE COST OF OPERATION OF THE POWER STATION OF THE TRENTON PASSENGER RAILWAY COMPANY FOR THE YEAR 1897.

	Supt.	Engineer.	Oiler.	Fireman.	Helper.	Repairs, Engines.	Repairs, Boilers.	Repairs, Dynamos.	Repairs, Piping.	Repairs, Pumps.	Fuel.	Oil, Waste and Pack'g.	Light.	Extra Labor.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$
January	50.87	122.67	86.84	91.91	38.75	. .	78.42	. .	4.49	. .	964.97	73.62	3.82	18.75
February	46.92	110.80	78.44	83.04	35.00	2 35	95.46	. .	. .	. .	909.33	101.63	4.67	16.37
March	50.88	122.67	86.85	91.93	38.75	3.75	9.01	. .	8.90	4 24	911.90	78.53	. .	33.25
April	49.56	119.72	84.04	88.98	36.87	. .	7.91	22.57	. .	. .	635.89	81.04	4 51	11.50
May	50.87	122.67	86.95	91.93	38.75	4.75	6.00	. .	. .	1.48	667.69	6.69	4.29	9.00
June	49.56	118.71	82.72	88.97	37.50	21.25	1.40	. .	. .	. .	682.28	91 58	. .	9.75
July	50.88	122.67	86.84	91.94	38.75	25.99	4.66	. .	. .	. .	640.79	77.42	. .	22.50
August	50.87	122 68	86.85	91.94	38.75	. .	58.97	. .	. .	. .	718.82	116.18	4.34	13.75
September	49.56	118.71	84.04	88.97	37.50	19.38	36.07	. .	. .	. .	847.37	89.81	4.34	17.87
October	50.88	122.67	86.84	91.94	38.75	. .	4.20	. .	. .	. .	427 07	60.44	. .	9.00
November	49.55	118.72	84.05	88.97	37.50	2.81	67.50	10.00	. .	. .	677.28	63.25	4.42	12.75
December	50.88	122.68	86.84	91 94	38.75	4.58	5.20	. .	. .	64.15	897.54	83.26	4.25	7.75
Total	601.28	1,444.36	1,021.20	1,082.49	455.62	84.86	374.90	32.57	13.39	69.87	8,980.93	123 45	34 64	182.24

Total cost, 1896 . . . $17,026.35
" " 1897 . . . . 15,301.60
Saving $1,724.74

Car miles, 1896 1,499,082
" " 1897 1,484,885

Cost per mile $0.011
" " " 01

Cost of Station Operation in Brooklyn

The accompanying table gives the cost of operation of each of the power stations of the Brooklyn Heights Railroad Company per k.w. hour for the year 1897. The figures given include all payments made for station account, the repair charges including all repairs to buildings as well as to machinery. The statement is particularly interesting, as it affords an opportunity of judging the relative economy of direct connected and belted units, and of condensing and non-condensing engines in the same city, and therefore under practically the same conditions as to cost of fuel, labor, etc. The "grand average" was determined by dividing the total costs by the total k.w. hours of the three stations. The steam equipment of the stations is as follows:

Eastern Station.—Sixteen batteries of boilers 500 h.p. each, Babcock & Wilcox; six cross compound condensing engines 2000 h.p. each, E. P. Allis; six 1600 k.w. generators, direct connected, General Electric and Walker.

Southern Station.—Eight batteries of boilers 500 h.p. each, Babcock & Wilcox; six cross compound condensing engines 1200 h.p. each, E. P. Allis; twelve 500 k.w. generators, belted over belt tightener, General Electric.

Ridgewood Station.—Four batteries of boilers 500 h.p. each, Babcock & Wilcox; three tandem compound non-condensing engines 700 h.p. each, McIntosh & Seymour; six 300 k.w. generators, belted, General Electric.

Electric Railways in Europe

"L'Industrie Electrique," in a recent issue, published a summary of the electric railways in Europe at the commencement of 1898. It is given below. Of the 204 lines in operation 13 use accumulators, only (6 in Germany, 4 in France, 1 each in England, Belgium and Holland), 3 use the mixed system of trolley and accumulators (2 in France and 1 in Germany), 8 employ the underground conduit (2 in Germany, 2 in Austria and 1 each in Belgium, France and Russia), and 8 the third rail (6 in England, 1 in France and 1 in Ireland). All others use the trolley.

	Total length in k.m.	Total power in k.w.	Number of motor cars.	Total number of lines.
Austria-Hungary	106.5	3,404	243	13
Belgium	69	2,415	107	8
Bosnia	5.6	75	6	1
England	134.4	6,197	220	22
France	396.8	15,158	664	44
Germany	1,138.2	25,868	2,493	65
Holland	3.2	320	14	1
Ireland	22.8	646	32	2
Italy	132.7	6,570	311	11
Portugal	2.8	110	3	1
Roumania	5.4	140	15	1
Russia	30.7	1,270	65	4
Servia	10	200	11	1
Spain	61	930	50	4
Sweden and Norway	24	875	43	3
Switzerland	146.2	3,828	237	23
	2,289.3	68,000	4,514	204

STREET RAILWAY JOURNAL

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Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our Directory, our Financial Supplement, or our news columns.

All matters intended for publication in the current issues must be received at our office not later than the twenty-second of each month.

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There is war between Spain and the United States. Questions of justification and of the righteousness or wrongfulness of this war are not now in order, but only the ways and means necessary to accomplish the purposes determined upon, after due deliberation, by the President and our representatives in Congress. *No duty is so important as that of presenting a united front to the enemy and of maintaining our national honor and prestige among the nations of the world.*

* * * * * * * * * * * *

That there will be great sacrifices by both sides, of men, of property and of business profits, is a certainty. No war during the last century has been undertaken by both parties with a less regard for money interests or aggrandizement, and on more idealistic grounds. Distinctly and most emphatically disclaiming an intention of enlarging its territorial possessions, or of obtaining any other direct benefit from its action, the United States sets forth as its sole purpose the prevention of further uncivilized methods of warfare in Cuba—of extermination by starvation and other "insufferable conditions;" while Spain, upon a fine point of national honor, has refused an enormous money indemnity for granting independence to Cuba, and undertakes still more enormous expenditures for maintaining war, although her best informed statesmen undoubtedly well understand that all will be lost in the end. Surely no reasons for war could be less sordid than these, whatever may be said of their "common sense."

* * * * * * * * * * * *

The nations of the world are divided in their sympathies. The British people and colonists appear to be heartily and almost unanimously in sympathy with the American position, and their government is doing all it can in legitimate lines to help us. If this policy is consistently pursued it cannot fail to bring about in America a much warmer and more cordial feeling for Great Britain than has ever before obtained. Nothing could be better diplomatic policy for both countries than to promote the closest possible sympathetic union of the Anglo-Saxon race. Jealousy of America is becoming a more and more marked feature in governmental policy on the Continent of Europe. This jealousy is due in part to the greatly increasing competition of American agricultural and manufactured products in international markets, and in part to a restless craving for colonization in South American countries, against which our Monroe Doctrine is at present a bulwark. It is probable that all Europe will be neutral in the coming conflict, but there is little doubt that France sympathizes with Spain, partly from racial and religious instincts, and partly from financial, the holdings of Spanish bonds in France being, it is said, very large. Austria and Germany are fighting America commercially with all the weapons in their power, refusing to admit many American agricultural products at all, and—not unnaturally, in view of our own high tariffs—putting our manufactured products at as much disadvantage as possible. The press of both countries, probably representing the feeling of the military classes, is decidedly anti-American, though not exactly pro-Spanish, but it is not probable that either country will be other than officially neutral, Germany in especial, because of the great number of its former citizens now resident in America. We shall probably have the sympathy of Russia, the traditional friend of America, and to some extent, perhaps, its moral support. In Mexico and South America a large proportion of the population are of Spanish descent, and it is quite probable that there will be much privately expressed sympathy for Spain, but nothing more than this is possible, as the friendship of the United States is, of course, of enormous value to all countries in the Western Hemisphere.

* * * * * * * * * * * *

Electricity and electricians will doubtless play an important part in the campaign. Modern warfare now involves, and will increasingly call for the use of electricity in many ways. Movable electric generating plants will be used with searchlights for both offensive and defensive night work, for lighting permanent camps, for the operation of pumps, hoists, drills, etc., in siege operations, and for many other purposes. Movable search light outfits to find the wounded on the battlefield, and apparatus for use with Roentgen ray outfits in field and permanent hos-

pitals, will come into service, and many novel applications of electricity in warfare will undoubtedly be brought into use for the first time. Photography will be largely used in reconnoissance work, and no field topographical map will now be regarded as complete without supplementary photographs showing the appearance of the ground occupied or to be occupied by our troops or the enemy's, or over which projected movements are to be conducted. The use of electric motors on shipboard for carrying on machine work, repairs, etc., is already considerable, and investigations have already been made by Government agents upon the utilization of the current from electric railway lines in some of the Southern cities for repair and machine work of a similar character at the various army and navy bases of supply.

* * * * * * * * * * * *

In every war the value of topographical engineers capable of making rapid sketch maps quickly, and civil engineers capable of building and destroying bridges, tunnels, railroad tracks, etc., mechanical engineers able to construct, operate, repair or destroy machines and mechanical appliances, and military engineers who understand laying out and constructing hasty entrenchments and field fortifications, has been more clearly recognized as the necessities for their services have arisen. Some of the brightest engineers in the electrical industry are graduates of our naval and military academies, and formerly held commissions in the service, and, although engaged for several years in private pursuits, they now, almost without exception, feel it a duty to proffer their services to the government which has educated them. They will re-enter the service of their country, "men of affairs"—stronger and more valuable to the Government by far than would have been the case had they not received outside the army or navy a training in fertility of resource and invention which comes from competition with the brightest and sharpest minds of a great industry. If they are not hampered too much by official red tape they will devise means of making electricity a most important element in military and naval success. It is probable that a brigade of civil, mechanical and electrical engineers, and practical electricians, mechanics, artisans, draughtsmen and men familiar with all kinds of engineering work, all capable of being rapidly converted with proper training into military engineers, will be recruited by the vice-president of an important manufacturing company, himself an ex-army officer of engineers, who has offered his services to the Government for the purpose. It is believed that in the contemplated occupation of Cuba, the character of the country, and the probability of siege operations against Havana will call for an unusually large proportion of engineer troops. The Army of the Potomac, under Generals Grant and Lee, had in January, 1865, 107,923 men, of whom four per cent formed a volunteer engineer brigade apart from the battalion of engineers in the regular army. The Army of the Cumberland numbered 76,986, of whom five per cent were engineer troops present for duty. General Sherman's Army in the march to the sea numbered 60,000, of whom seven and one-half per cent were engineer troops. It would seem that of the 125,000 volunteers to be raised by the call of the President, at least five per cent should be in the form of a volunteer engineer brigade, and it would be, of course, best that these should be picked men from all sections of the country, though special permissive legislation may be required for accomplishing this.

Profit-sharing in industrial enterprises between the owner of a business and his employees is a favorite proposition of many social and political economists, and the system has been introduced to a greater or less extent in industrial enterprises. It is not often, however, that it is applied in railroad operation. It is interesting to note, therefore, that the plan is being employed in Denver by the largest railway company there—the Denver Consolidated Tramway Company. In a letter elsewhere in this issue the superintendent describes the system employed, which was put in force at a time when the exigencies of the company required a reduction in wages paid, and his comments upon its success are worthy of consideration.

All electric railways which reach shore resorts will be interested in the outcome of an experiment which is being carried on by the Staten Island Midland Railroad Company, and which looks toward the extermination of mosquitoes. This railway company owns and operates an extensive seaside resort—Midland Beach—on the south side of Staten Island, which, like many localities similarly situated, has its quota of mosquitoes. Some preliminary experiments were made by the company last year; the method employed was to select a time during the spring in which to cover the surface of the neighboring ponds with kerosene, the object being to destroy the larvae. The results last year, it is said, were sufficiently encouraging to induce the company to join with the neighboring property owners in carrying out the experiment this year on a much more extensive scale. If successful, the remedy for this summer pest would be a great boon to many electric railway companies.

Many of the interurban electric railways, built originally with single track and turn-outs, have found, to their sorrow, that this type of construction has serious inconveniences when an increase in traffic makes more frequent trips necessary. As a usual result, double tracking has to be done before long, with a considerable increase in expense over that which would have been required if the double track had been laid in the first place. A single track with turn-outs on a road of any length is to be thought of only when the traffic will absolutely not warrant the expense of a double track, and when the owners of the road are very confident that a double track will not be needed within the next four or five years. When electric cars stop at any point for passengers, as is usually the case, delays are almost unavoidable, and if they occur to any one car the result is an interference with many others, and a disarrangement of the entire system, or a large part of it. Again, there is not the same opportunity of making up lost time on a single track line as on one laid with double tracks, and when the headway is made less complications multiply. We venture the assertion that the number of railway companies which have regretted the installation of a single track instead of a double track is two or three times the number of those which have made a wrong decision the other way.

Among the bills which our wise legislators have had an opportunity to consider during the present sessions in the different State capitols, are one by Assemblyman Griggs, of the New York Legislature, who wants a law passed which will permit passengers in street cars who have to stand to ride for 3 cents, and one by a Mr. Bracken, of the Ohio Legislature, who proposes a penalty of from $10 to $25 a day on every car in Ohio which is "provided with hanging straps or other devices for a support or inducement of passengers to stand while riding in street cars." The nominal object of both of these bills is of course to force railway companies to supply seats for every passenger, and they are only cited as instances of the belief of some people that legislation of this kind would secure the object sought. Many people seem to think that railway managers take a peculiar delight in forcing passengers to stand. As a matter of fact the railway companies would much prefer to have the load distributed than to have it all at one time, as it is almost impossible for the conductors to avoid missing some fares on an excessively crowded car. Intending passengers, therefore, have the remedy in their own hands of waiting until an empty car comes along in preference to getting on one already crowded, and, as well, will have double the satisfaction of making the work of the railway company easier and of satisfying our legislators who believe in the "no seat, no fare" plan.

The Situation in Boston

The rapid transit experiment about to be tried in Boston is in many respects unique, and the results will be watched with great interest by the people of other large cities. Hitherto, when an elevated railroad has been built it has been in direct competition with the existing surface roads, has worked against them instead of in harmony with them, and has been able to secure traffic only by offering the public superior advantages. In this case, however, the conditions are very different. The elevated roads are to be built in a city crowded with surface traffic already, seeking refuge from inevitable congestion by going underground, and the owners of these non-existent lines are in absolute control of the existent ones. The only competition comes from the steam suburban lines converging in the city and this is limited in direction, and hence, by no means uniformly severe. The public, consequently, is waiting with great interest to discover what bearing this amicable arrangement is to have upon the general rapid transit situation.

It is certainly true that freedom from competition and the consequent necessity for building lines in such wise as to meet it, gives the new company a magnificent opportunity so to build as to supplement the existing rapid transit facilities in the most beautiful manner. The main difficulty in the Boston situation has been not so much the traditional narrowness of the streets or the great mass of traffic to be handled as in the attempt that has steadily been made to deal with that traffic from a single distributing and receiving point. It is as if all the New York surface roads centered in Madison Square. This condition has been due largely to the circumstances of gradual growth. Up to the present time the use of the subway has merely accentuated it, although matters will be improved when the subway is done. But how about these elevated roads? Are they to give real rapid transit between suburbs and city and between railway station and railway station without decreasing materially the surface facilities, or are they to acquire traffic by picking up a part at the expense of the steam railway lines and having the rest deflected into their trains by reducing the service on parts of the present system? The enterprise is backed by men of high character, but eleemosynary enterprises do not eagerly guarantee 8 per cent on a capital stock like that of the West End road, and those that dwell in the Hub cannot be blamed for a trifle of good natured suspicion. The profits must come in somewhere, and it is certain that the West End régime, with its policy of rapid expansion into suburban districts involves running certain lines at very small returns and giving excellent service as the virtual price of immunity from competition. In the present state of the art of electric traction it is a comparatively easy matter for the present suburban railway lines to change their motive power and give as good service as may reasonably be expected on an elevated road, at less cost, and this being so, how great investment would an electric road be justified in making to withdraw part of their traffic?

In two particular locations contemplated for elevated lines, they could be of very great service, to wit, in connecting the two Union stations and Boston with Cambridge. At present, so far as convenience is concerned, one might as well live in Salem as in the suburb just mentioned. If the managers of the elevated system build, as they probably will, along these lines, they will be forgiven much. With these exceptions the function of an elevated road in promoting rapid transit is not altogether obvious. Unless stops are frequent more time is lost to the average passenger in getting to the elevated station than is saved by the superior speed of the train, and if they are frequent the schedule time is seriously decreased. Where long distances are to be covered, and something like an express service is to be attempted, an elevated road can save much time, but its usefulness depends on the extent to which it supplements suburban railroads. Its true field is therefore rather limited, and in no sense can it replace ordinary street railway facilities. Let us hope that it will not attempt the feat in Boston or anywhere else.

From a financial standpoint there is no reason to forecast disaster in any elevated road economically built and operated for profit in its own proper sphere. Such roads can be built more cheaply now than ever before, and the Boston enterprise ought to pay on its merits if administered properly. It has assumed heavy obligations in leasing the West End system, but with a fairly long term of years before it, there is every reason to suppose that the burden can be easily and profitably carried, always assuming that the water supply is kept low. All railroads may be divided into two classes, those built on rocks and those built on sand (see Holy Writ for particulars), which last are unfavorably affected by the kind of flood to which such enterprises have of late years been peculiarly subject. We hope to place the Boston elevated project in the former category. At all events, it is under obligations to go ahead. It has, as we stated at the beginning, a unique opportunity. For once the lion and the lamb have lain down together, and the question that seems to be perturbing our respected brethren of Boston is the point of doubt as to which of these amiable creatures is inside.

St. Anthony's Falls Water-Power Plant

The construction of the recently inaugurated water-power electrical generating plant at St. Anthony's Falls was undertaken by the St. Anthony's Falls Water-Power Company, the plant when completed being leased to the Twin City Rapid Transit Company for the purpose of furnishing power to all the street railway systems of both Minneapolis and St. Paul, which are operated by the Twin City Company. The engineers of both the above-named companies worked in unison, and the result is most creditable, whether viewed from the standpoint of hydraulic, mechanical or electrical engineering. It is interesting to note that the plant has supplanted more steam-driven belted electrical machinery with its direct connected generators and rotary converters than any other plant in the world.

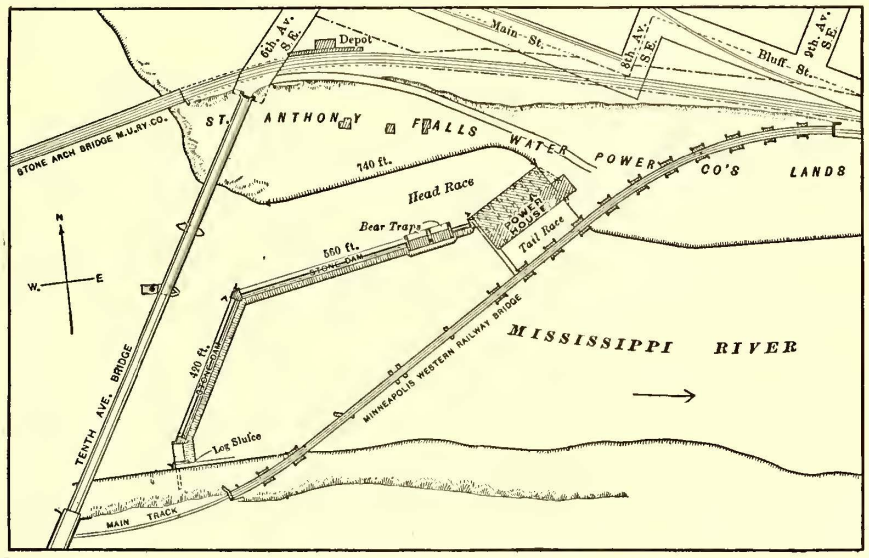


FIG. 1.—MAP SHOWING LOCATION OF PLANT

Three of the old power stations have practically been closed, and are now used as sub-stations for the accommodation of the rotary converters. These, of course, take up much less floor space compared with the former plant; in fact, room enough was obtained to install the converters without removing any of the old plant, the floor space required being very small. A preliminary description of this plant was published in the Street Railway Journal for June, 1897, while the work was in course of construction. Since that time the plant has been put in operation, so that the information given below will be of interest. The map showing the location of the dam and station given in that article is reproduced here for the convenience of reference.

WATER RIGHTS

The site of the present plant is located in Minneapolis, just below the great St. Anthony's Falls of the Mississippi, where there is a long stretch of rapids. The power company has the right for the entire width of the river at this place, but great care has to be taken not to interfere with the water rights of companies located above this plant, for if too much water were held back by the dams of the St. Anthony Company the head above would be considerably diminished. This is amply taken care of in a manner which will be explained later. Fig. 1 is a map of the site of the plant.

MAIN POWER STATION

The power house of the company is located at the end of the main dam, on the north side of the river, as shown in Fig. 3, and in reality forms a portion of the dam. The foundations are all built of cut granite, and the walls are of hollow tiling with sandstone trimmings. A steel frame, as shown in the interior view of the power house (Fig. 4), supplements the wall and supports the roof, which is covered with slate. This cut gives a general interior view of the station, showing the generators which are already installed.

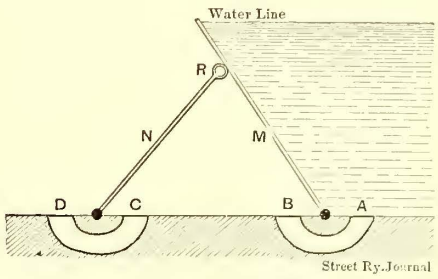


FIG. 2.—BEAR TRAP

The station is 250 ft. long and 80 ft. wide, outside measurement, and there is accommodation for ten 700 k.w. units, directly coupled to horizontal water-wheels. The height of the building from floor to ridge of roof is 45 ft. Ample room is provided, as will be seen in the illustrations, for the installation of engines if it is found necessary to use them at times of low water or when the plant is increased.

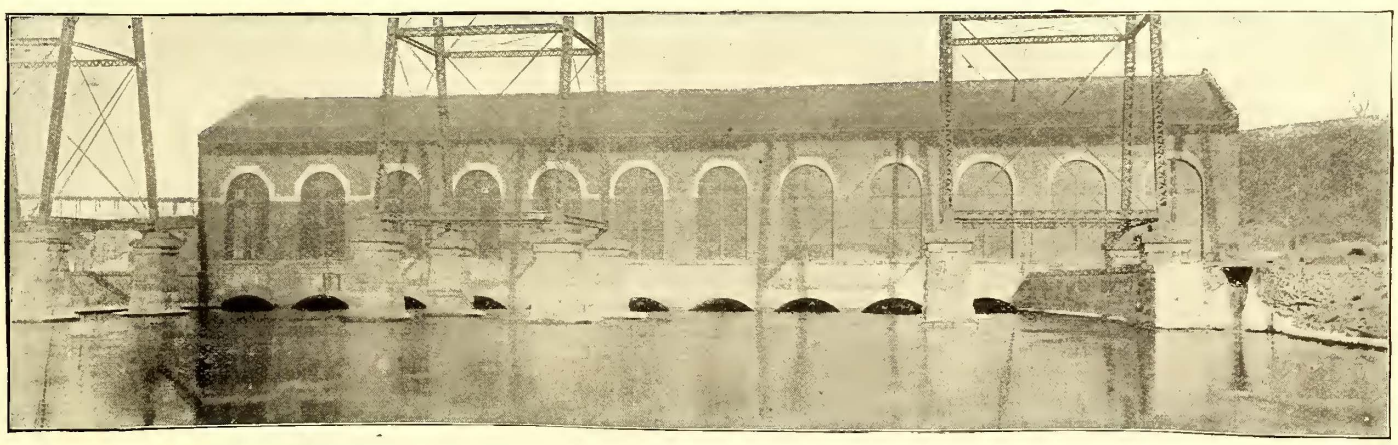


FIG. 3.—POWER STATION AND TAIL RACE

The station is also provided with an electric traveling crane capable of handling any of the machinery in the station. The cross-sectional view Fig. 5 represents the station as originally designed. As built, the roof structure

is different, and the switchboard gallery is in a recess in the side wall of the electrical generator room, as shown in Fig. 4; the arrangement of the machinery, however, is properly given. Fig. 6 is a plan view of the station, showing the arrangement of the turbines and generators; as actually installed, each unit is not provided with an exciter, as shown, there being two separately driven exciters, as elsewhere described.

HYDRAULIC WORK

The appearance of the dam is partly shown in Fig. 7. The retaining wall which can be seen in this cut extends along the north shore 740 ft. from the power station to a point a short distance beyond, where the wing and head dam form an angle. This wall had to be built for the protection of the bank, and is constructed entirely of cut granite. It forms one side of the fore bay, which is also well shown in Fig. 7.

As may be seen from Fig. 1, the main cross wall starts from the west bank of the river and runs directly across for a distance of 500 ft. This is the length of the wall proper, and does not include gates or waste ways. It then branches off at an angle and runs down stream nearly parallel to the east bank for 370 ft., to the upper end of the large waste way, shown in Fig. 3, close to the power station. Between the waste way and the power house the wall is continued, but at an increased height. All of the construction is of the best cut granite laid in cement.

As before stated, the power house forms a portion of the dam. There is a rack placed at the fore bay side of the power house, extending its full length, and the water, after passing through this, enters the wheel chamber and flows from the draft tubes into an arched tail race underneath the power house.

In addition to the main wheel chamber, there is another small wheel chamber at the north end of the building, used for the purpose of driving two exciters.

The head is a maximum of 22 ft. and a minimum of 16, with an average of 20. The wheel chamber can be seen from an inspection of Fig. 4, which also shows the switchboard, placed on top of it. In the interior of the power house the wheel chamber is faced for its entire length with glazed brick. Fig. 8 shows the side of this wall, and one of the direct-current generators.

The set of waste gates near the power station, shown in Fig. 7, are known as "Bear Traps." They are made in two sections. The apron, M (Fig 2), forming the gate proper, is hinged at its lowest point, and the support against which it rests, or, more properly speaking, which supports it, is another apron, N, somewhat smaller in size, placed some distance in front of it, and having rollers, R, along the entire top edge. These rollers rest against the outer surface of the main apron.

When the gate is fully open, the supporting apron closes down with the main apron on top of it. The gates are raised by simply opening a valve in a large pipe, AB, under the apron, which allows the water to pass from the fore bay, underneath the gate and underneath the front apron having the rollers along the edge. The pressure of the water is sufficient to raise this gate and maintain it at any desired height. By means of an outlet, CD, from the

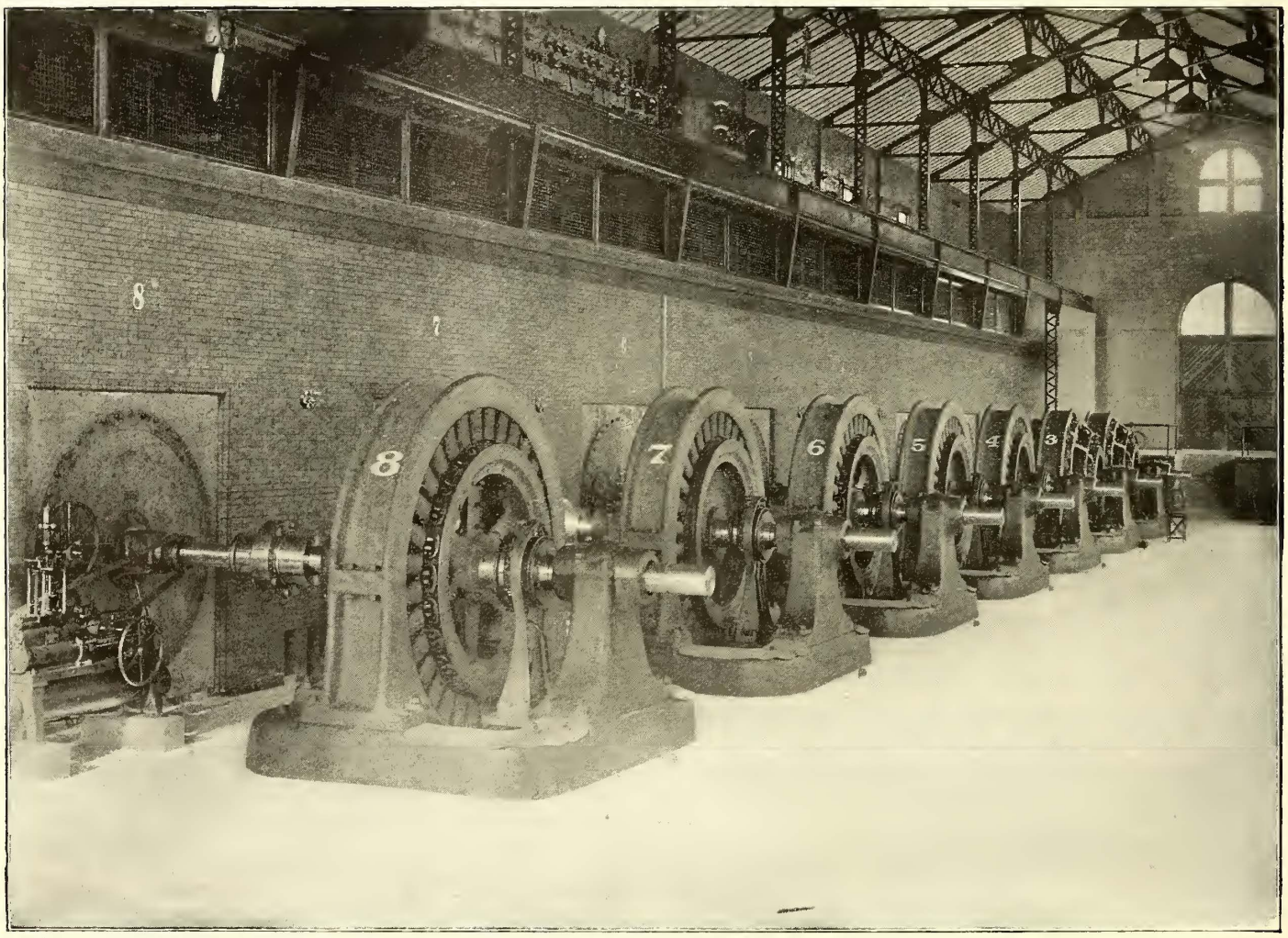


FIG. 4.—INTERIOR OF POWER STATION

chamber between the gates, they can be instantly closed by shutting off the water at the intake and opening a valve which allows the water below the gates to escape, when the gates will collapse upon themselves.

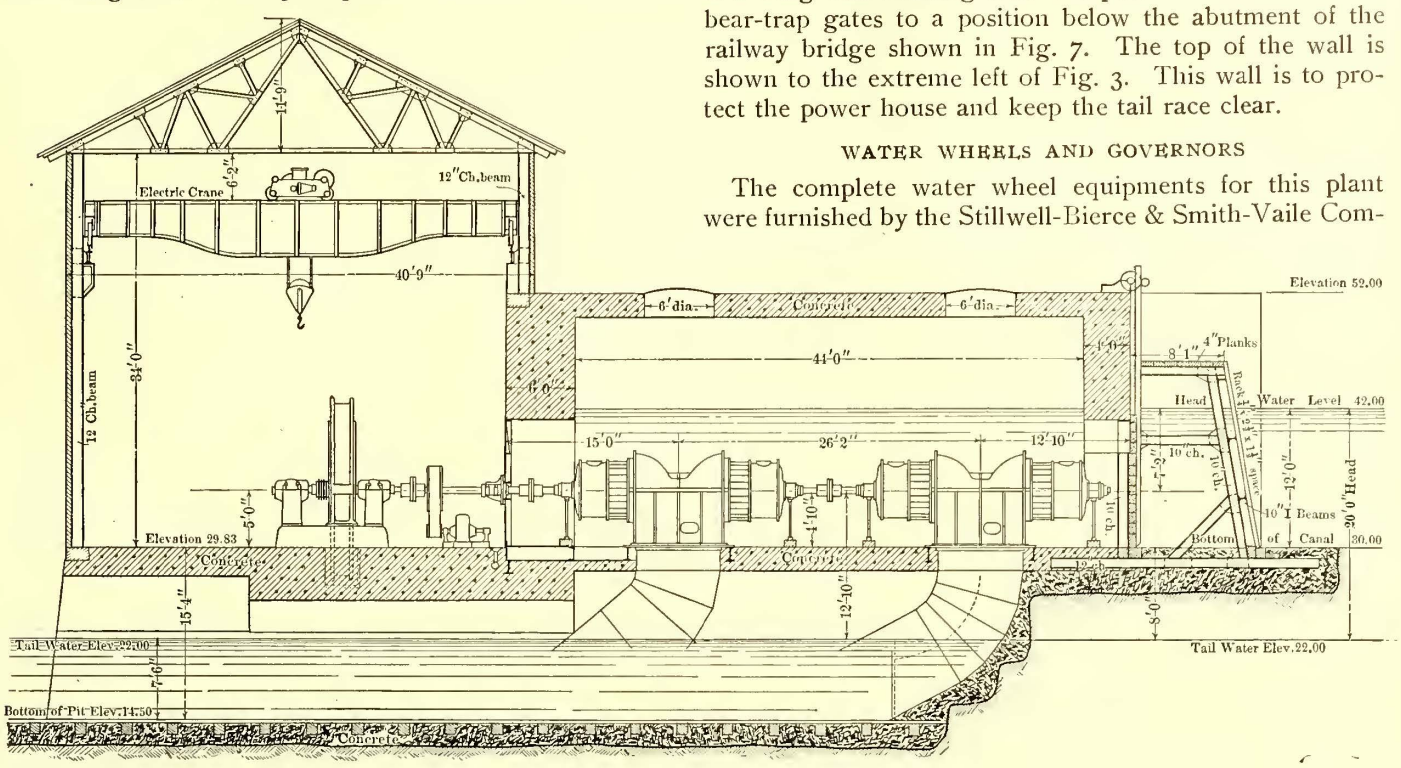


FIG. 5.—CROSS SECTION OF POWER HOUSE

One of the strongest advantages of this gate is that the water in flowing over carries off all debris which comes into the fore bay, and which would otherwise catch in the racks.

The gates in the south side of the river are of the ordinary slide type, and three in number. They are operated by large screws furnished with ball-bearing nuts and operated by a small water-wheel placed in one of the piers.

In addition to the granite walls forming the dam, there is a wing wall running from the power-house side of the bear-trap gates to a position below the abutment of the railway bridge shown in Fig. 7. The top of the wall is shown to the extreme left of Fig. 3. This wall is to protect the power house and keep the tail race clear.

WATER WHEELS AND GOVERNORS

The complete water wheel equipments for this plant were furnished by the Stillwell-Bierce & Smith-Vaile Company, and are of the well-known Victor type. As shown in Fig. 6, to each 700 k.w. unit there are two pairs of 42-in. horizontal wheels, giving a total of four 42-in. wheels directly connected with each generator shaft. These wheels are designed and guaranteed to develop 1,000 h.p. per set, or 250 h.p. each.

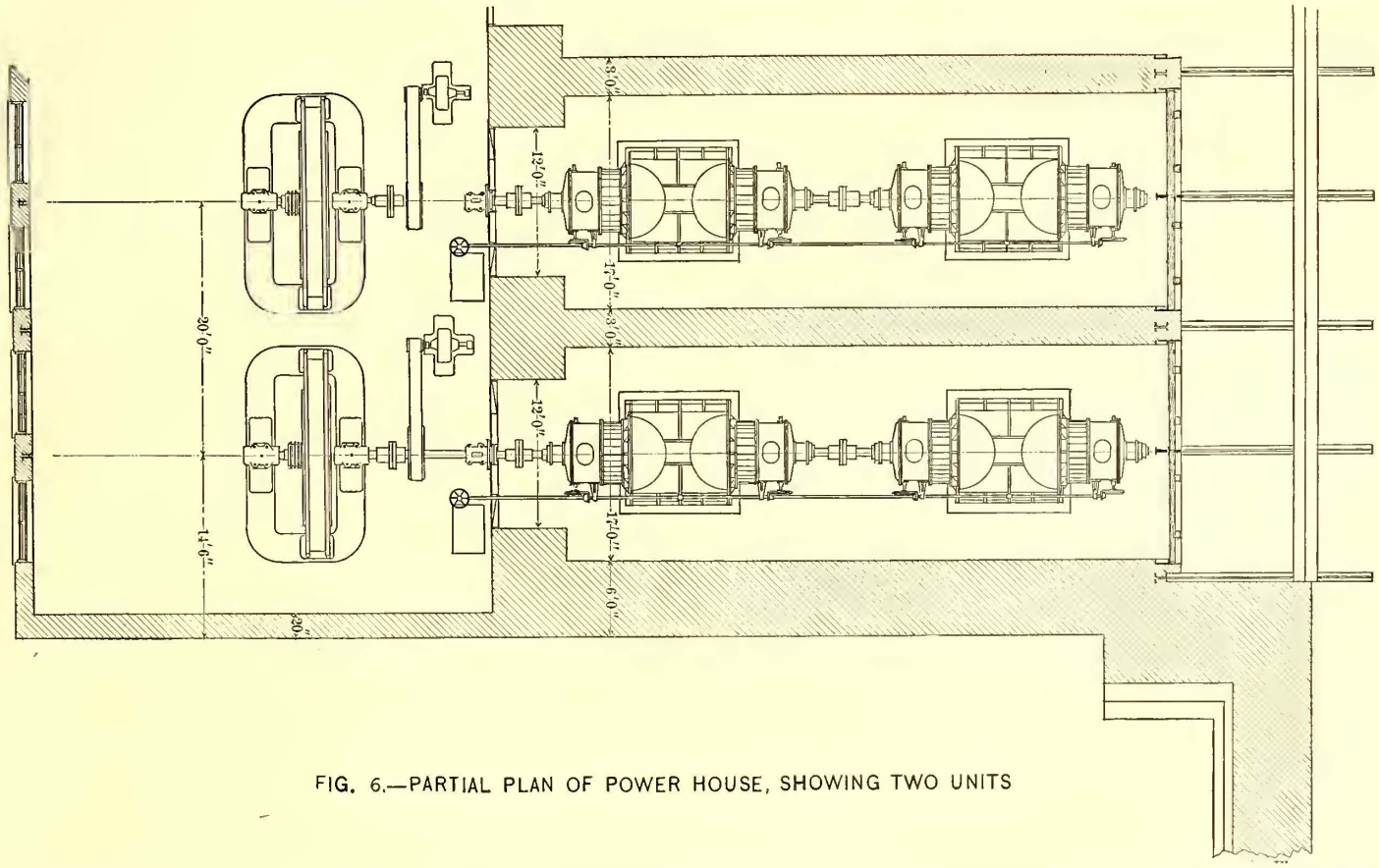


FIG. 6.—PARTIAL PLAN OF POWER HOUSE, SHOWING TWO UNITS

This method of installing wheels is an innovation in low head work, and forms an exceedingly compact and efficient unit. The shafts, with couplings attached, can be seen in Fig. 4 projecting through the wheel chamber wall.

In addition to the wheels just described there are two sets in the wheel chamber at the east end of the house, which were manufactured and installed by the D. S. Morgan Water Wheel Company. These wheels are for the purpose of operating generators for furnishing exciting current to all the three-phase generators in the station.

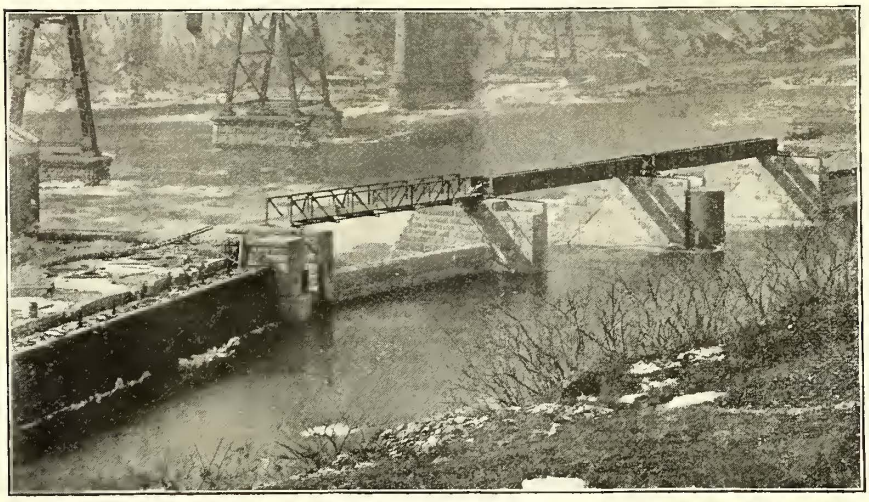


FIG. 7.—VIEW OF BEAR TRAPS

The governors were furnished by the Lombard Water Wheel Governor Company. The governor is very well shown in Fig. 8, and is driven by a belt connected to a small pulley on the generator shaft. The excellent result given by these governors in other installations leaves no question as to their satisfactory operation in this plant. Each governor operates the gates for each full set of four wheels.

ELECTRICAL APPARATUS

The electrical apparatus installed was manufactured by the General Electric Company. In the main station there are at present installed five 700 k.w. three-phase generators, having 32 poles, and operating at a speed of 130 revolutions, giving a frequency of about 35. One of these is shown in Fig. 9.

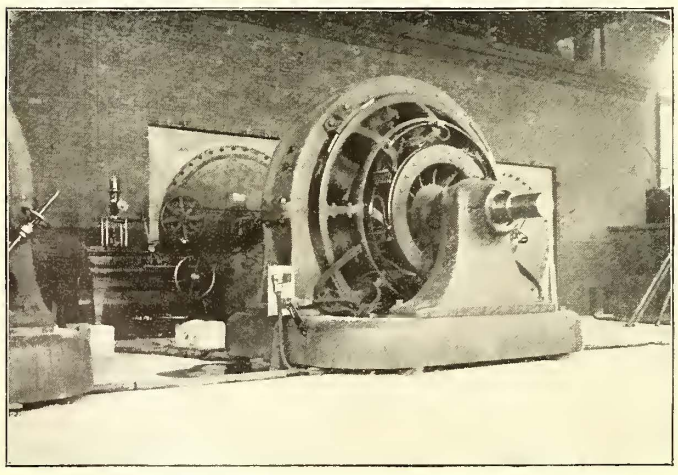


FIG 8.—ONE OF THE DIRECT CURRENT GENERATORS, AND GOVERNOR

The base frame is so constructed that the field frame can be moved parallel with the shaft for the purpose of cleaning the armature or for repairs. The approximate weight of the armature is 25,000 lbs., and the complete weight of each machine about 84,000 lbs.

In addition to these machines, there are two direct-current 700 k.w. generators, having eight poles, and running at a speed of 130 revolutions per minute. These machines are wound for a pressure of 575 volts at no load, and over-compounded to a voltage of 600 volts at full load. They feed the 500-volt circuit direct from the power station, through five 500,000 C. M. cables.

The armature is of the well-known ironclad type, and is ventilated by means of ducts in the armature .4 in. in width. The armature winding on these machines consists of copper bars laid in the slots, the winding being of the type known as the "barrel."

The commutator is designed so that the current density at the point of contact with the brushes does not exceed 35 amperes per square inch at the full rating of the machine, and the difference of potential between commutator bars is very low.

There are two 100 k.w. six-pole exciters, running at a speed of 280 revolutions per minute, and wound for a voltage of 575 volts at no load, and over compounded to 600 volts at full load. These machines have armatures of the ironclad type, ventlated in practically the same manner as the machines previously described.

The switchboard installed in the station was especially designed with a view to having two separate sets of busbars, so that the attendant in charge may run any particular machine on either of the two busbars. A view of all connections of the main station and switchboard is shown in Fig. 11. This sketch shows the connection of the main station to all generators, and also the three rotary converter sub-stations. There have been some minor modifications made in the wiring since this wiring diagram was made, but none that are worthy of note, with the exception of the circuit to the St. Paul sub-station, which has only one circuit from the power-station. The switchboard consists of twenty-three panels as follows:

One station panel, equipped with one 750-volt, illuminated dial Weston voltmeter, one 2500-ampere, 600-volt, Thomson recording wattmeter, the panel being surmounted with a 12-in. dial, eight-day clock, and head piece.

Five alternating-current generator panels, each equipped with one 200-ampere, dead-beat, inclined coil ammeter; one 5250-volt, inclined coil voltmeter and station transformer; one generator rheostat; one high-voltage main switch (porcelain chamber); two single-pole field switches; one two-point phase lamp switch; two pilot lamps; one phase lamp; one potential plug; one 700 k.w. single-phase indicating wattmeter and three fuse blocks.

Two continuous-current railway generator panels, each equipped with one 1200-2000 ampere circuit breaker; one 2500 ampere illuminated dial Weston ammeter; one generator rheostat; one lightning arrester; two single-pole, double-throw main switches; one lightning switch; one two-way field switch; one potential plug; one pilot lamp; one resistance lamp; two bus wires on the back. (Equalizer switches are furnished, but are located at the generator.)

Five alternating-current feeder panels, each equipped with one 200-ampere, dead-beat, inclined coil ammeter; one 200-ampere, 3500-volt, alternating, three-phase Thom-

son recording wattmeter, and two station transformers; three porcelain chamber, high-voltage triple-pole switches; one pilot lamp; six busbars at the back; one indicating wattmeter, 700 k.w. capacity (single-phase type), and three fuse blocks.

Eight special railway feeder panels, each equipped with two 300-500-ampere, circuit breakers; two 200-ampere, round pattern, Weston ammeters; one pilot lamp; two single-pole main switches; two busbars at the back.

Two exciter panels, each equipped with one illuminated dial Weston voltmeter; one round pattern Weston am-

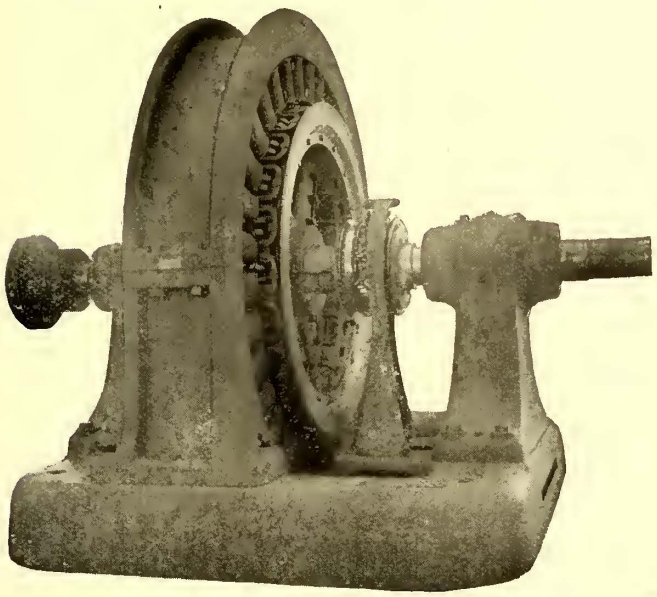


FIG. 9.—700 K.W THREE-PHASE GENERATOR

meter; one rheostat; two single-pole, double-throw, main switches; two single-pole field switches; two busbars at the back; one automatic circuit breaker.

TRANSFORMERS

The static transformers employed in this plant are of the standard air-blast type, and are twenty-one in number, of 233 k.w. capacity each. Six of these are placed in the main station for the purpose of raising the generator voltage from 3450 to 6900 volts, and the remaining 15 are placed in the three sub-stations, two containing six, and the third three.

This type of transformer is too well known to need an extended description, although it might be interesting to refer to some of the most important features of its construction.

The first and greatest aim in the manufacture of any transformer is to thoroughly insulate the high potential from the low potential windings. This is accomplished in this transformer by the method of cooling, which admits of a heavy insulation being placed on the coils without unduly restricting the radiation of heat. In addition to this, solid diaphragms of heavy insulation are placed between the high and low potential coils. Air ducts separate this diaphragm on either side from the adjacent coils.

How effectively this insulation fulfills its duty may be judged from the fact that the transformers for this plant were tested with a 20,000-volt potential between primary and secondary windings, and it could have safely been tested for considerably higher voltages. Transformers of this type have been built for higher voltages with similar insulation, and have successfully withstood a test of 80,000 volts.

Another one of the problems connected with the building of large electrical apparatus is to properly dispose of the heat generated within the windings. This problem has been very successfully met in electrical apparatus which has revolving parts by so designing these parts that they act as blowers, thereby forcing currents of air through the revolving parts. It is not surprising then that this method, which has proved so thoroughly satisfactory in revolving apparatus, should prove equally satisfactory in static transformers.

In order to present the proper amount of surface to the circulating air, the coils of the transformers are separated from each other by narrow air ducts, and the sheet iron of which the transformer core is composed is separated into small groups by similar ducts.

The air is forced through the main duct which runs underneath all of the transformers. This forced draft is obtained from an electrically driven blower set, and the air, after passing through the coils in the core, escapes into the surrounding atmosphere having absorbed the heat in its passage through the transformers.

So carefully and thoroughly has this system been carried out that each transformer has some 350 sq. ft. cooling surface. As a result, no portion of the windings has a temperature rise of more than 35 degrees C. above the surrounding air after having carried their full rated load for an indefinite time.

It is a fact worthy of note that this very effective cooling is accomplished with an expenditure of power of only one-tenth of one per cent of the capacity of the transformer.

The efficiency of these transformers is a fraction under 98 per cent. While this is not as high an efficiency as can be obtained in the design of transformers, it represents practically the most economical design where power is as cheap to produce as it is in this plant. Good regulation rather than extremely high efficiency is, of course, to be desired in water-power plant, and consequently the trans-

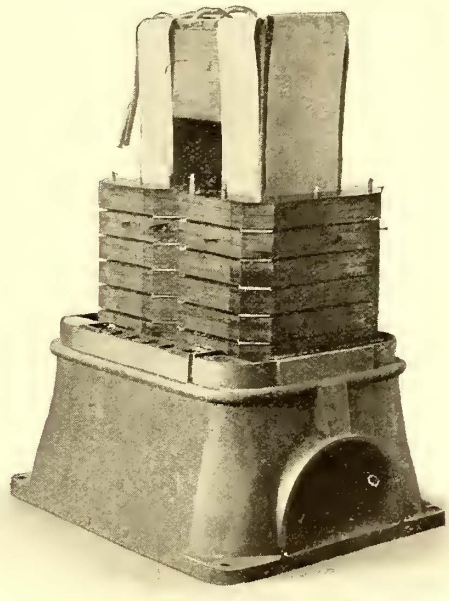


FIG. 10.—CONSTRUCTION OF AIR-BLAST TRANSFORMER

formers were designed for the very close regulation of 1 per cent from no load to full load.

As is seen from Fig. 10, the transformers are compact and of neat appearance. They are thoroughly protected by an enclosure case, no portion of the windings being exposed. The high potential coils have their terminals brought out through the casing in porcelain bushings, and rubber-covered cables connect these terminals to the lines. Fig. 10 shows the transformer with the casing removed. The dimensions of the transformer are—height, 58 ins.; floor space, 38 ins. x 32¾ ins.; weight, approximately, 4500 lbs.

INDUCTANCE COILS

A three-phase open magnetic circuit inductance coil is placed between the transformer and each rotary in order to give greater range of adjustment of the direct current voltage of the rotary.

On most power transmissions there is sufficient inductance in the system, due principally to the inductance of the line, to allow a considerable range of adjustment in the voltage of the rotary by changing the field excitation, without any considerable idle current being produced.

In this transmission, due to the comparatively short distances between generator and rotary and to the extensive use of cable rather than overhead line, the inductance of the system is so low that the introduction of this artificial inductance is necessary in order to get the desired flexibility in the voltage.

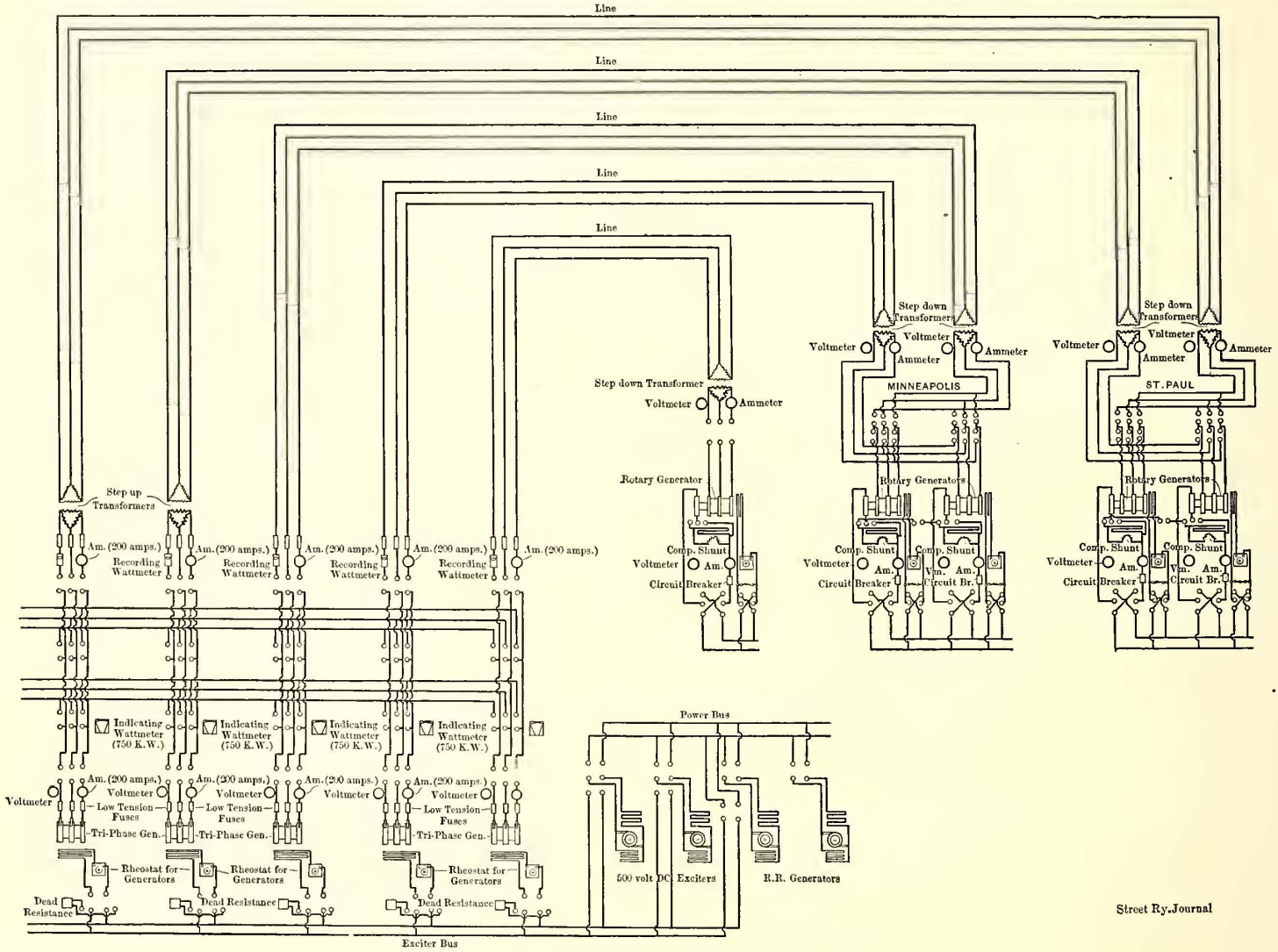


FIG. 11—GENERATING AND SUB-STATION CONNECTIONS

ROTARY RECONVERTERS

There have been installed in the three sub-stations five rotary converters. Two of these converters are in what is known as Sub-station No. 1, located in the heart of the city of Minneapolis, and are 9,000 ft. from the power station, current being transmitted at a pressure of 3500 volts over two triple-conductor, paper-insulated, lead-covered cables, each conductor equal to 3-0 B. & S. furnished by the National Underground Conduit & Cable Company; one is in Sub-station No. 2, located in Minneapolis and 23,700 ft. distant from the power station, and operated at the same potential as No. 1 Station, by one triple-conductor cable, each conductor equivalent to 4-0 gage; two are in Sub-station No. 3, located in St. Paul, distant ten miles from the power station. The current is transmitted at a potential of 12,000 volts through one triple-conductor cable, made up of three 1-0 B. & S. wires.

These converters are of the 8-pole type, of 600 k.w. capacity each, and operated at a speed of 530 revolutions, giving 580 volts on the direct-current sides at all loads up to normal.

The armature is of the iron-clad type and is thoroughly ventilated by means of 5-16 in. ducts. The armature spider is calculated for a safety factor of 6, and so constructed that all shrinkage strains are obviated; the laminae are dovetailed into the armature spider, dispensing with the use of bolts in the core.

The commutator is assembled on a separate spider mounted upon the armature spider. The voltage delivered to the A. C. side of the rotaries is approximately 350 volts.

SUB-STATION SWITCHBOARD

The switchboards for the three sub-stations will consist of ten blue Vermont marble panels, divided into three units, two having two alternating and two direct-current panels, and the other one alternating and one direct-current panel.

Each continuous current panel will be equipped with the following apparatus: One 650-volt, inclined coil, dead-beat voltmeter; one 1500-ampere, inclined coil, dead-beat ammeter; one pilot lamp; one potential plug; six single-pole, quick-break switches.

The hydraulic work of the plant was constructed by local contractors, supervised by William de la Barre, engineer of the company. The electrical work was in charge of Edward P. Burch.

Street Railway Parks

The problem of beautifying and improving a piece of land to be used as a street railway park, without spending more money than it can be expected the park will earn, is receiving considerable attention from street railway managers, particularly at this season of the year. It has now undoubtedly been proven that a street railway park under average conditions is a paying investment, but the question as to the best way of fixing up the grounds and the proper attractions to offer is still open to discussion.

One line of improvement that particularly lends itself to beautifying and enhancing the natural attractions of a park is the judicious use of rustic work. This feature of rustic work can of course be carried to any extent desirable, and it may range from a half dozen simple rustic benches scattered throughout the park to an elaborate system of rustic bridges, shelters, pavilions, theaters, etc. The idea of rustic construction has developed wonderfully within the past year, and experience has shown that these rustic structures, when planned and located by a skillful architect, can be made a valuable adjunct to the attractions and beauties provided by nature. In addition to this, rustic construction can be brought into use, where it is necessary to have a large pavilion or shelter, and where an ordinary structure of painted boards would greatly mar the scenic beauties of the place. Again, in wooded localities, it is quite cheap.

RUSTIC THEATRE AND STAGE—RIVERTON PARK

The rustic open-air theater particularly recommends itself to the attention of designers of street railway parks, as it is undoubtedly true that a popular entertainment held in the open air, amid rustic and natural surroundings, are an attraction to people that would not visit the park if the entertainment was held in an ordinary covered inclosure. This question of the advantages of the rustic theatre and that of the character of entertainment most desirable for such a place are quite thoroughly discussed in another column of this issue.

RIVERTON PARK, PORTLAND, ME.

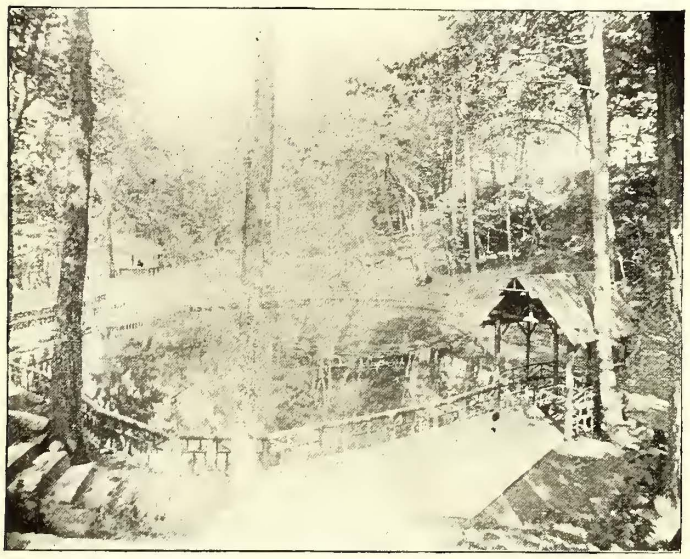
Riverton Park is a beautiful tract of land owned by the Portland Railroad Company of Portland, Me. A great deal of time and money has been spent in beautifying and improving this park, and it is now one of the best equipped street railway pleasure resorts in the country. The park is situated on the banks of the Presumpscot, and this fact lends greatly to the attractiveness of the place. The company has built a very fine entrance to the park, the fence and gateway being constructed of rough blocks of stone arranged in apparent confusion, yet with an artistic effect. All along the top of this stone wall there is a rich and varied assortment of potted plants, their colors blending gracefully with the background. At the right of the entrance is a bicycle house, where wheels are cared for. This bicycle building is large and roomy and is built with a pleasing architectural effect. To the left is a natural basin, which has been sodded with a fine quality of grass and is made the receptacle of plants and flowers in effective combination. Still further to the left and on the bank of the Presumpscot is a canoe house, where a great variety of craft is kept for the use of visitors.

Just in front of the entrance and to the left of the main roadway is a fine casino. This costly built structure is always a center of attraction, and from its broad piazza an excellent view is obtained over the entire park. The casino is handsomely finished and furnished, not the least among its attractions being a pretty dining hall, where an efficient corps of attendants serve an excellent menu. Soda water and an excellent assortment of confectionery are also kept on hand at the casino. Above the dining hall is situated a very pretty dancing hall. Just opposite the casino across the roadway is a broad lawn dotted here and there with carefully attended flower gardens. A handsome band stand, from which open air concerts are frequently given, is also provided. At the edge of the lawn and in the shade of the trees are a large number of swings for the accommodation of patrons. A very attractive deer park, fenced

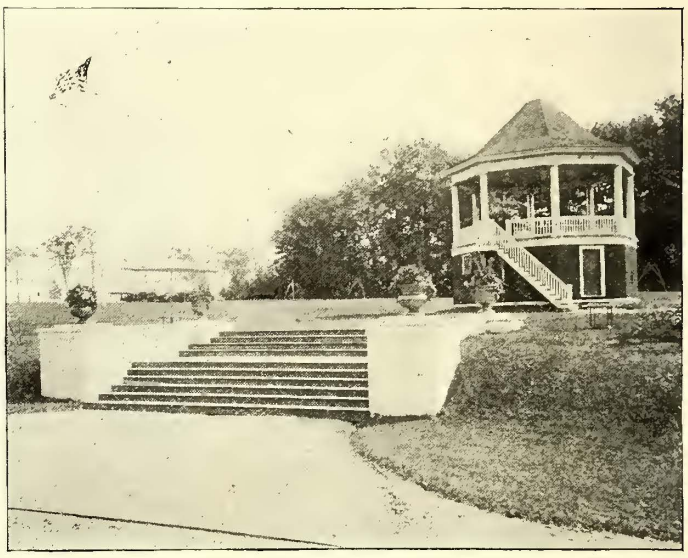
off from the rest of the grounds, is provided and contains several pretty deer.

The company has also built an open air theatre at Riverton Park. In the construction of this theatre the idea of rustic work has been carried out very fully. The theatre is shown in the accompanying illustrations, together with the stage, showing a group of Gorman's Alabama Troubadors. The large stage is upon the river's bank, and in front, upon the naturally steep incline, are the seats. This theatre seats about 4500 people, and is exceedingly popular with the public. One feature of the seating arrangement is that there are no particularly choice seats, the view of the stage being excellent from all. The stage has been arranged with the idea of combining beauty and convenience. The dressing rooms are underneath, and are commodious and well appointed. The lighting is all done by electricity and lends added enchantment to the scene. Upon each side of the stage are cozy reception rooms, used between the different portions of the entertainment. These are fitted up in the same excellent style as prevails in all other parts of the park.

Here and there through the park are bridges, arches, arbors, seats, and, in short, the whole inclosure is thoroughly calculated to offer entrancing inducements to the visitor. Throughout the whole the rustic architecture prevails, and its many beautiful designs offer pleasing relief to the eye, and rest and recreation to the mind and body.



POND—RIVERTON PARK



BAND STAND—RIVERTON PARK

FLOWER BEDS—RIVERTON PARK

RUSTIC THEATRE—WHALOM PARK

WHALOM PARK, FITCHBURG, MASS.

This park is owned and operated by the Fitchburg & Leominster Street Railway Company of Fitchburg, Mass., and is situated on the shores of a lake by the same name, $3\frac{1}{2}$ miles from the center of the city. The park contains water surface to the extent of ninety-six acres, this area consisting principally of a lake fed by natural springs. The water is very clear and pure, and the lake is surrounded by green hills and woodland. A small steamboat, having a seating capacity of fifty people, is in operation on the lake, together with fifty cedar boats, finished in natural wood, very light and handsome, canoes of all descriptions and several small sailboats. A bath house and diving tower are also provided at the lake. This park also contains a very attractive open-air rustic theater, which is shown herewith. The seating capacity of this theater is about 300. The dimensions of the stage are 45 ft. wide by 35 ft. deep, with dressing rooms on two sides. No admission to the theater is charged, but reserved seats can be secured at five cents each, and this feature has proven very satisfactory. On a fair day the

receipts of the road on account of the theater are very large. The entertainments provided are mostly of a light vaudeville character, with gymnastics and performances of trained animals. Entertainments are often given at night, when the theater is lighted by means of Manhattan arc lamps on the railway circuit, as well as the lamps on the city circuit, and the dressing rooms by incandescent lamps.

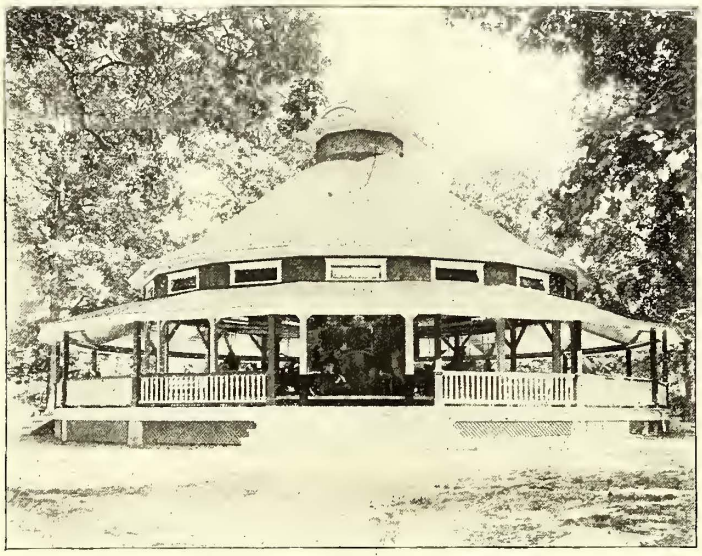
VIEWS IN CASCADE PARK

Other attractions at the park consist of a deer, elk and moose reservation, rustic bridges, rustic shelters, free lawn swings, steam merry-go-round, a dance hall 44 ft. x 100 ft., a two-story café with private dining rooms, broad veranda, phonograph, bowling alley, pool and billiards, photograph gallery, etc. No intoxicating liquors of any kind are sold, but soft drinks, ice cream, fruit, peanuts, cigars and the other usual restaurant fare are sold on the grounds at all times. Convenient seats placed in various parts of the sixty acres of fine groves and lawn, convenient hitching places for horses, and a broad boulevard between the park and the lake, add to the natural attractions. No loud talking fakirs are permitted in the park. The bridge, theater and shelters are finished with selected

trees and limbs of trees with the bark left on, making a bright rustic effect. These buildings have proven very popular with the public. Exhibitions of water fireworks on the lake are often given, and these always draw large crowds. This park is considered one of the most beautiful pleasure resorts in the vicinity of Boston, and many people go from Boston and the surrounding towns to spend a day or more at this place. The officers of the street railway company state that the park is a benefit to the railway and is greatly enjoyed and appreciated by the people.

CASCADE PARK, NEW CASTLE, PA.

Cascade Park is located three miles from New Castle, Pa., and is the property of the New Castle Traction Company. A part of the grounds was formerly used for many years as a picnic ground, but previous to its acquisition by the present owners no pains were taken to develop it in any way. The buildings were very crude and not adapted to the wants of a growing community. Since the park was bought by the New Castle Traction Company, however, a great deal of time and attention has been given it, and it is now one of the most attractive and well equipped street railway pleasure resorts in the country. The views will give a good idea of some of the particularly pleasing spots in this park. When the work of improvement was taken in hand the old buildings were all torn down and a pavilion about 140 ft. x 75 ft. was erected. There have also been built a dancing hall and a merry-go-round, a band stand, a rustic stable for the animals, a terminal station, four rustic bridges and nine rustic houses and shelters. The terminal station for the cars of the company is particularly worthy of note, and is shown in the accompanying group of views. Care was taken to make the outlines and proportions of this building very pleasing, and the fine trees in the background bring out very well these features. The grounds in front of the station are now being improved and a sunken garden will be laid out, which will be an interesting feature, as it will be one of the first things to attract the attention of visitors approaching the station from the city. After leaving the car and passing through the station into the park, the visitor's attention is immediately drawn to a large, clear spring, which is built up with natural stone, the water running over all the time. Directly in front of the spring a large flower-bed has been arranged with choice native ferns and flowers.



MERRY-GO-ROUND—CASCADE PARK

RUSTIC PAVILION—HIGHLAND PARK

RUSTIC BENCH—HIGHLAND PARK

As stated above, a number of rustic shelters are scattered over the grounds, and in this connection it may be said that every rustic building has been placed for a purpose, either for a fine view, a proper resting place or a quiet nook for reading; they are not put up at random, for the sake of having a certain number.

A picnic grove is reserved where visitors may eat their lunches, and a number of tables and benches are provided. A large rustic shelter is located in this grove. The park also contains a small zoo, in which are now deer, elk and a pair of black bears. This collection will probably be added to from time to time. Near the picnic grove there is a dam and a pretty cascade, which gives the park its name. A very pleasing rustic foot-bridge 60 ft. long and 12 ft. wide has been built over the dam near this cascade. An electric light illuminates the cascade at night and makes the spot as interesting as by daylight. This bridge leads to the amusement grounds, where various kinds of pastimes are provided.

All the buildings in this and in the two other properties previously described were designed by Frank M. Blais-

dell, civil engineer and landscape architect, who has devoted special attention to rustic work.

HIGHLAND PARK, STAUNTON, VA.

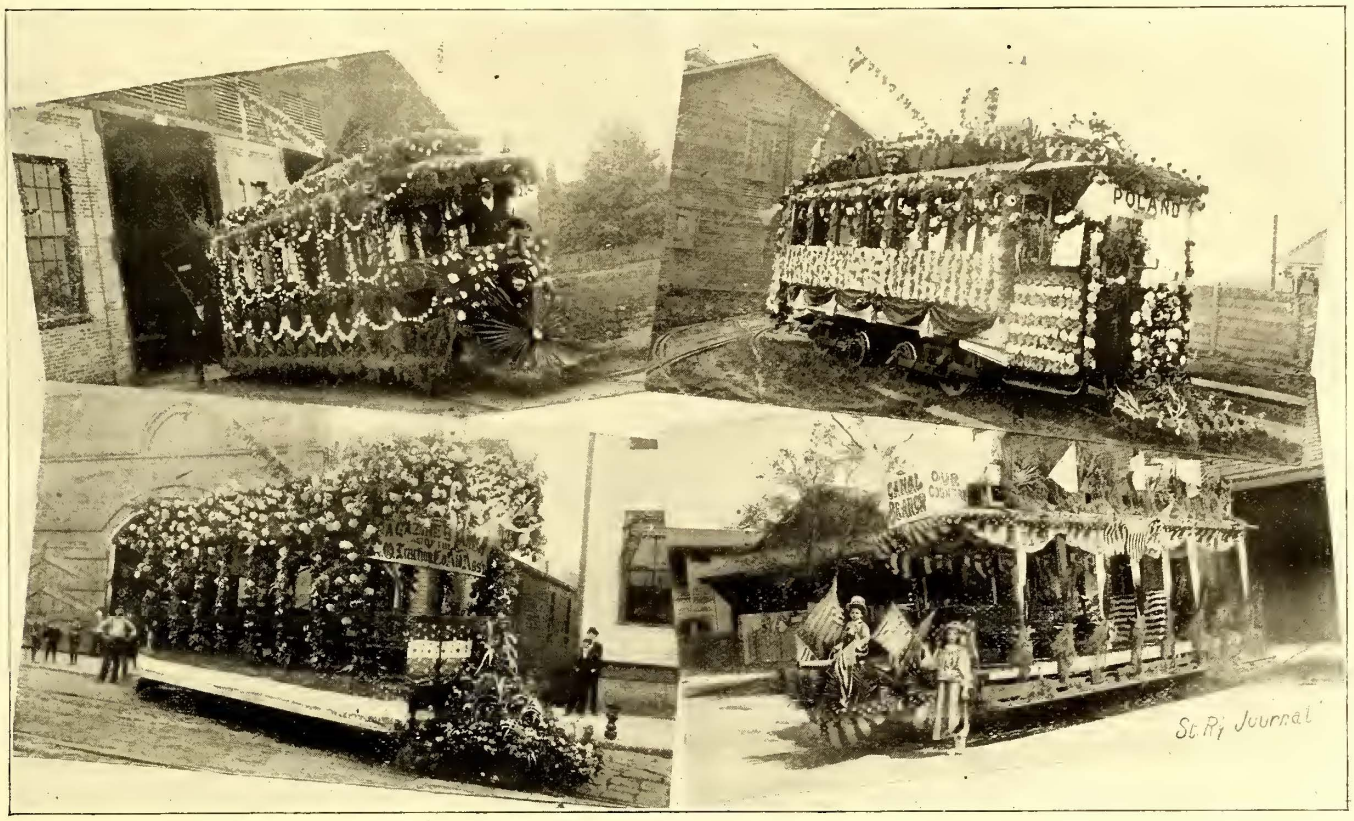
This park is owned by the City Street Car Company of Staunton, Va., and has been left almost entirely in its natural condition. A rustic pavilion of about 30 ft. by 70 ft. is provided, and this is used for dancing, etc. It is shown in the accompanying illustration. This pavilion cost, completed, about $275, and the rustic benches, which are also shown herewith, averaged about 16 cents each when finished.

It has been the experience in Staunton that it is not necessary for a small street railway company to have extensive plans and specifications, if the volume of traffic does not warrant such expenditures. The general manager of the City Street Car Company, B. D. Apperson, made his own designs and drew his own plans for all the improvements in this park, doing the work with the help of four of his motormen, who were handy with saw and hatchet. One of the motormen, who is a carpenter, acted as foreman. The improvement of the park was started on May 27 and the park was opened to the public June 29. In this short time about twenty-five acres of woodland were cleared, the pavilion was erected and the benches, refreshment stands, etc., placed in position.

The officers of the City Street Car Company state that fully 75 per cent of the company's traffic last summer was carried to the park, and on several evenings during the season the company was unable to handle all the people who wanted to go to the park. The park line is now being greatly improved, so as to have it in perfect order for the summer business. It will be rebonded with Brown's plastic bonds and Weber rail joints will be installed.

Parade of Decorated Cars

The accompanying group of engravings shows a number of decorated cars, which were used in a parade recently of the employees connected with the New Orleans Traction Employees' Aid Association of New Orleans, La. The parade was held in the evening, and the decorated cars, which were brilliantly lighted, produced a very beautiful effect. Each car was decorated by a different branch of the Employees' Aid Association, and there was great rivalry among the different branches to see which one would produce the prettiest car. The car shown in the upper left hand corner was gotten up by the Arabella Street branch, and was decorated with moss and cotton, representing "Louisiana." There were fifty extra lights on this car. The car shown in the lower right hand corner represented "Our Country," and was decorated by the Canal Street branch. There were twenty-five extra lamps on this car. The car shown in the lower left hand corner was designed by the Magazine Street branch and represented "Spring." This car carried 175 extra lights and was decorated with numerous cut flowers and ribbon grass. The car shown in the upper right hand corner was decorated by the Poland Street branch and represented "Flowers." Three hundred and sixty incandescent lamps were employed in the decoration of this car.



DECORATED CARS—NEW ORLEANS

The Aid Association of the New Orleans Traction Company is based upon principles of sick benefits and a species of life insurance, as well as social enjoyment. The New Orleans Traction Company contributes annually to the association quite a large sum, and the treasurer of the Traction Company is also treasurer of the Aid Association.

The monthly dues amount to very little to each member and the benefits derived from membership are such as to be highly attractive to the men, and a very large proportion of the Traction Company's employees are members of the Aid Association. Membership is not compulsory, however, every one being free to join or not, as he pleases. At the installation of officers of each different branch a social time is arranged and every branch is invited to join, usually going to the station where the festivities are to be held in decorated cars.

LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., and Robt. H. Ernest, of the New York Bar.

Statutes of Limitations in Tort Cases

At common law there was no limitation upon the time within which one might enforce his legal remedy against another. Limitations of that time derive their authority, wholly, from statutes. At the common law, however, there was a well established doctrine of presumption of payment after a period of years which was fixed at twenty. This doctrine is quite independent of the statutory law; but it applies only to actions arising not out of contract, and not to actions arising out of the misconduct or tort of the defendant.

Every State has a different statute of limitations, and these are being constantly changed. In each of them a different period is set for different classes of torts. Actions for libel and slander, assault and battery and false imprisonment are generally short, two or three years, while actions arising out of negligence and fraud are in many states longer—from three to six years.

Ambiguity is sometimes caused by use in the statute of the expression, "actions for personal injuries," since some actions arising out of negligence resulting in personal injuries are not brought for them, but for the loss of services occasioned by them, as, for example, the loss of service sustained by a husband due to injuries to his wife caused by the negligence of the defendant.

The object of this article is to suggest some reasons why the statute of limitations for personal injuries caused by negligence should be shortened, and why it is fair, both to the plaintiff and the defendant, that it should be.

Manifestly, it is proper that, when a cause of action arises against an individual or a corporation, that he or it should know at once of its existence, in order that he may ascertain the extent of his liability, if any, and the witnesses by which he can prove such facts as may be a partial or a complete defense.

It is also clear enough that, where a defendant commits assault and battery, or is guilty of false imprisonment, or utters a libel or slander, the act in most cases is voluntary and is known to the defendant, while in cases of negligence the act may be a careless one, committed involuntarily, unknowingly or by a servant, and the defendant is totally unaware of any claim being possible. As a matter of fact, in a large number of cases, as the heads of the loss departments of all railroad companies know, accidents occur, and suits are brought for actions, long after their happening, and great difficulty is experienced in ascertaining anything about the occurrence, since the careless act, if it is committed at all, is committed by employees and not reported to the corporation.

There would seem to be, therefore, good cause for requiring the party who has been injured, and who therefore must know at once of the existence of the wrong, to bring his action within, at least, a year, against the party, who may not be at all aware that any tort has been committed. Especially where the law provides that a plaintiff is only given two years within which to bring an action for libel, and yet he may not know of the libel for a long time after its publication, and may not learn of the injury that has been done him by it for a still longer period; while the defendant who has committed the published statement has done so voluntarily, and knows all about it.

The only reason that can be urged for a longer period of limitation than that which has been suggested is, that the plaintiff may desire to give his injuries time to develop, but the answer to that is that one year is an adequate period; that he is allowed to show at the trial his condition at that time as well as his condition at the time of the beginning of the action, and is also allowed to show by medical experts whatever he can, with reasonable certainty, as to the future result of his injuries.

If it is suggested that impecuniosity on the plaintiff's part may prevent him from bringing an action within so short a period as one year, and therefore the rule would be a harsh one, the practical reply is that there are plenty of lawyers in every city of the land who will take the preliminary steps in the bringing of an action, which are not costly, for a sum which would not bankrupt anybody, however poor, and especially if they have a case in which there is any merit.

One suggestion might be made in this connection, which, so far as we are now aware, is not embodied in any statute and which would seem to have many practical advantages. A statute might be framed providing that the time within which an action must be brought for negligence should be six months, unless within sixty days after the accident a notice is served upon the defendant or filed in a public office stating that a claim is made and an action may be brought for injuries received at a given time and place, and in case such a notice is served or filed then the injured party may be allowed to bring his action at any time within a longer period, as, for example, two or three years. Such a statutory provision would always lodge with the defendant, at least within six months of the alleged carelessness, a notice which would put him to inquiry.

When the statutes now in force were originally passed the court calendars were not so crowded, and the delay between the service of a complaint and the trial was nothing like as prodigious as it is now.

To-day in New York a case is frequently not reached for trial before a jury for two or three years, and it is not infrequent that actions are tried for street car accidents which occurred six or seven years before the trial.

These reasons make it the more important that the actions should be begun promptly, for witnesses die, remove their residence and are lost, while the lapse of time gives easier opportunity for unconscionable claims to be brought.

The legislation suggested, it is believed, would not only benefit corporations who are common carriers and subject to litigation of this character, but would be a benefit to justice as between the plaintiff and the defendant; for it would not only exclude stale and unconscionable claims, but it would occasion claims that are properly brought before the courts to be brought at a time and under circumstances when all the facts can be more completely placed before a jury.

It may be interesting to note generally the present period within which such actions must be brought, as provided in the statutes of limitations of the several states. In New York and a few other states it is three years, while in some of the New England states it is six years; in several of the Southern and Western states it is four and five years; in New Jersey, Minnesota, Illinois, California. Georgia and a few others it is two years; while in Connecticut and Kentucky it is one year. H.

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CHARTERS, FRANCHISES, ORDINANCES, ETC.

MICHIGAN.—1. Where, under its contract with the company, a city has the right to prescribe the frequency with which street cars shall be run, it may fix a penalty for a failure to comply therewith, it having by its charter, the express right to punish violations of its ordinances.

2. A city ordinance granting a street-railway franchise for 30 years provided that the city would not require cars to be run more than six miles an hour or oftener than once in 20 minutes. Over 15 years later, when the population had doubled, another ordinance, extending the franchise 30 years, was passed and accepted, providing that the cars should be operated as public convenience might require and the council order. Held, that the last one should control, giving the city the right to prescribe the frequency with which cars should be run.

3. Courts cannot presume that public officers are actuated by improper motives in performing their duties.

4. A city council, in passing an ordinance prescribing the frequency with which a street railway shall run its cars, will be presumed to have exercised a judgment on the facts, which judgment must control, unless it clearly appears arbitrary, or not required by public convenience.

5. An ordinance required a street-railway company to provide a six-minute service between certain points during the day. It appeared that stub trains could be used. The company proved that the average travel between such points during the 12-minute service was 7 persons to each car, and during the 6-minute service, which it provided for a few hours, was 13. Held, that the ordinance, not having been given a trial, could not be held unreasonable, under the circumstances shown.—(People v. Detroit Citizens' St. Ry. Co. et al., 74 N. W. Rep., 520.)

NEW JERSEY.—1. When the governing body of a municipality receives a petition under the act of April 21, 1896 (P. L. 329), for permission to construct, operate, and maintain a street railroad, and at a regular meeting designates a time and place to consider the application, and notice is given and consents of landowners are filed, as required by said act, the ordinance granting such permission, after a hearing of the matter, may be passed at the time so designated or at any subsequent time to which the hearing may be adjourned. The hearing may be adjourned from time to time until final action.

2. A restriction on a municipality that an ordinance shall be submitted in writing at a regular meeting, and passed at a subsequent meeting, does not apply to an ordinance passed under said act.

3. An ordinance passed under said act will support a location of tracks and poles without the procedure prescribed by earlier statutes.

4. A location of tracks and poles may be included in such an ordinance or may be made by a subsequent resolution.

5. A requirement that the railroad company shall pay the incidental expense of such an ordinance, and a reasonable counsel fee, is not unreasonable or improper.

6. If permission is asked to construct a street railroad upon a route partly outside the jurisdiction of a municipality, it will be sufficient to support a grant for the part of the route within such jurisdiction that consents of the owners of the requisite proportion of frontage upon that part of the route be obtained and filed.

7. A revocation of the consent given under said act is not operative if notice is not given before the passage of the ordinance, either to the petitioning company or to the governing body of the municipality. Quaere, is such a consent revocable?

8. The Mayor and Council of a borough chosen under one of the borough acts repealed by the borough act of 1896 (P. L. 339), and exercising local government at the time of the approval of that act, were thereby authorized to continue such government under the borough act of 1878 (Gen. St. 179) until the annual election under said act of 1878, and could in the meantime lawfully proceed under said street-railroad act of 1896. A majority of the Council constituted a quorum, and a majority of a quorum could lawfully pass ordinances and resolutions.—(State—Hutchinson et al., Prosecutors—v. Mayor, etc., of Borough of Belmar et al., 39 Atl. Rep., 643.)

NEW YORK.—1. Corporation—Mortgage—Creation of Debt.—Where a corporation executes and delivers a trust mortgage to secure a proposed issue of bonds, the mortgage itself does not constitute any debt or obligation of the company, but only creates a lien for the security of such bonds as may thereafter be issued under it.

2. Same—Railroad Corporations.—Section 2 of the "Stock Corporation Law," restricting the amount of corporate obligations secured by mortgage, is applicable to railroad corporations.

3. Same—Limiting Mortgage Indebtedness.—Section 2 operates to limit corporate mortgages either by the amount of the stock or by two-thirds of the value of the property, as such value or property exists when the mortgage is executed, and does not warrant the execution of a mortgage to secure an issue of bonds in excess thereof, even though the excess is not to be actually issued until some future date, and upon further consent of two-thirds of the stockholders.—(Flynn v. Coney Island & B. R. Co. et al., 50 N. Y. Supp., 74.)

NEW YORK.—1. Consent of Abutting Property Owners—Curative Statute.—Under Laws 1896, c. 649, validating proceedings to obtain authority to maintain street surface railroads which are defective for failure to comply with General Railroad Law, Section 59, and providing that such surface railroads may be constructed and operated on obtaining the consent of the abutting property owners, the consent of such property owners need not be obtained, where the commissioners appointed by the court, on application for leave to construct such road determine the necessity thereof, and such determination is confirmed by the court.

2. Statutes—Re-Enacting Existing Laws.—Laws 1896, c. 649, validating proceedings to obtain authority to maintain street surface railroads which do not conform to General Railroad Law, c. 59, is not in conflict with Const., Article III., Section 17, providing that no act shall be passed making an existing law a part thereof without inserting same.

3. Same—Local or Private Lands.—Laws 1896, c. 649, validating defective proceedings to obtain authority to maintain street surface railroads, is not a local or private statute, within the prohibition of Const., Article III., Section 18, though it may affect but one railroad company in the State.

4. Consent of Local Authorities.—The Board of Aldermen fixed the day of hearing of an application for leave to construct a street railroad as required to be obtained by General Railroad Laws, Section 91, as amended by Laws 1896, c. 855, and notice of such day of hearing was given. On the day fixed that board passed a resolution granting such leave, which was afterward approved by the Board of Councilmen and the Mayor. Held, that such leave was obtained in substantial compliance with the law.—(In re. Buffalo Traction Co., 49 N. Y. Supp., 1,052.)

USE OF STREETS AND HIGHWAYS.

MAINE.—1. Equity will not enjoin a public nuisance on the application of an individual, either in his own behalf, or in behalf of himself and others of like interest who either do or do not join in the application, unless some special damage to the individual, not suffered in common with the public generally, has been sustained.

2. The public may regulate by law the use of its public ways in such manner as the Legislature may think will best serve the public interest. The kind of use that may be permitted is of no consequence to the abutting landowner. He has been paid his damages for the creation of the way, so that the public controls its use, and he must take his chance with the rest of the community in which he lives of any inconvenience suffered by reason of the use that the public may see fit to permit.

3. Where the plaintiffs, as abutting proprietors and owners of the fee in a public way, sought to enjoin the location of a street railway withtin the limits of a public way, held, that the railway company is allowed to share with the public its right of transit over the same, and its location does not create any additional servitude.

4. Also, that the plaintiffs have suffered no damage from the defendant's occupation in common with the public of some share in the easement acquired by it upon the creation of the way; so that they have no cause for complaint on account of the construction of defendant's railroad, not common to the public in general, and therefore have suffered no special damage, and can have neither an action at law nor relief in equity.

5. In considering such use of public ways for surface transit, the court holds that it matters not what the motive power used may be, nor whether the transit be the carriage of passengers, of freight, or the transmission of intelligence, by telegraph or telephone, or of water, gas, or sewage. All these are public uses that the public may permit, regardless of the individual, so long as they do not infringe the statute which defines what the public use may be.—(Taylor et al. v. Portsmouth, K. & Y. St. Ry., 39 Atl. Rep., 560.)

NEW JERSEY.—It is not necessary to the regulating of the use of streets in a borough, by a street railroad company already having, by ordinance passed conformably to the acts of 1893 and 1894 (3 Gen. St., pp. 3,235, 3,247), a location of tracks, and the right to construct, maintain and operate its railroad, that there should be a new or continued consent of any abutting landowners,

or a public hearing on notice. The general powers of boroughs (P. L. 1897, p. 296, Section 28) suffice for that purpose, even though the railroad has not been fully constructed.—(State —Moore et al., Prosecutors—v. Commissioner of Streets of Borough of Haddonfield et al., 39 Atl. Rep., 681.)

NEW YORK.—Street railroad companies have a paramount, though not an exclusive, right to that portion of the highways which is taken up by their tracks, and which is between intersecting highways.—(Rosenblatt v. B'klyn Heights R. Co., 50 N. Y. Supp., 333.)

TEXAS.—1. A street railroad is not liable to special assessments for street improvements, under a city charter authorizing assessments upon abutting property.

2. Plaintiff paved a street for a city, and was paid by certificates against abutting property owners, among whom was included a street railroad company, which was liable, under its contract with the city, for paving between its rails, and for six inches outside thereof, but not as an abutting owner. Held, that the claim against the railroad company was equitably assigned.

3. A street railroad company is bound, under its contract with the city, to pay for such paving as might be done between the rails, though the whole street was paved under an invalid law providing for assessments against abutting property owners.

4. A street railroad company, agreeing with the city to pay for such paving as might be done between the rails, cannot be made to pay more than the legal rate of interest.

5. A statute authorizing cities to impose charges upon persons and property to pay for street improvements is not unconstitutional.

6. The lien of a city upon a street railroad, obtained under contract for paving six inches outside the rails, is subject to a mortgage upon the road executed before the contract was made, where the city, under its charter, had no power to impose such a lien when the mortgage was executed.

7. Where plaintiff obtained a judgment in a State court, foreclosing a tax lien, it is proper to issue an order of sale, though in the meantime the property had been sold under a decree foreclosing a mortgage in an action in the Federal court, to which plaintiff was not a party; the subject matter of the receivership in that court having been disposed of.

8. A street was paved, including the space between the rails of a street railroad. The company had agreed that the city might have a lien on the road for paving between the rails. It owned numerous lots abutting on the street that were assessed for paving the street. Held, that it could not object to the enforcement of said lien on the ground that it was subjected to double assessment.—(Houston City St. Ry. Co. et al. v. Storrie, 44 S. W. Rep., 693.

WISCONSIN.—An electric passenger railway, running on the highways through country towns, when the company propose to grade down the highways to such an extent as to impair the right of access of abutting owners, imposes an additional burden on such highways, so as to require the consent of the abutting owners and compensation.—(Zehren v. Milwaukee Elec. Ry. & Lt. Co., 74 N. W. Rep., 538.)

Van Depoele Trolley Litigation

It will be remembered that on July 22, 1897, the United States Circuit Court of Appeals for the Second District decided, on appeal from the United States Circuit Court of the District of Connecticut, that claims Nos. 6, 7, 8, 12 and 16 of the patent of April 11, 1893, granted to Charles J. Van Depoele were invalid on account of anticipation by Van Depoele himself in a patent issued in 1890. It was then believed that this decision threw open the Van Depoele trolley invention to the public, except for the remote chance that an appeal to the Supreme Court could be successfully made.

In February, 1898, however, suit was again brought by the General Electric interests against a customer of the Walker Company, this time on claims 2 and 4 of the Van Depoele patent of 1893. These claims read as follows:

2. "The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm carried by the car and carrying the contact device, and pivoted so as to swing freely around a vertical axis."

4. "The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm on the car movable on both a vertical and a transverse axis and carrying the contact device."

The lower court decided in favor of the plaintiffs, but on April 7 the United States Circuit Court of Appeals for the Second District reversed its decision, and pronounced these two claims invalid on substantially the same grounds as those on which its previous decision was made. It was claimed by the appellants (the customers of the Walker Company) that the two claims in controversy were for the same combination specified in some of the claims previously held to be void. The appellee contended that they were not, because claims 2 and 4 omitted to specify any means for holding the contact device in underneath contact with the conductor, and consequently they could be construed as covering a sub-combination in which such means are not employed, or if such means must be read into the claims by implication, the claims were not limited to the means described in the specification; upon either construction they were not the claims of the anticipatory patent of 1890.

The Court of Appeals decided that means for maintaining the contact device and the conductor in their normal working relations must certainly be incorporated into claims 2 and 4 by implication, and that when so incorporated the claims were substantially for the same invention as that described in the other claims previously declared void by anticipation.

The Walker Company is thus for a second time victorious in Van Depoele trolley litigation.

Mr. Frederick P. Fish, who is in charge of the Legal Department of the General Electric Company, has made the following statement concerning this last decision on the Van Depoele patent:

"On the 22d day of July last, the United States Circuit Court of Appeals for the Second Circuit, on an appeal from a motion granting a preliminary injunction, decided on technical grounds that the Circuit Court had erred in granting a preliminary injunction on Van Depoele Patent No. 495,443, which up to that time had been held by many of the Circuit Courts and by the Circuit Court of Appeals for the Sixth Circuit to control the overhead trolley system of electric traction in general use.

"Subsequently the Circuit Court for the Southern District of New York reinstated the patent, holding that other claims than those which had been passed upon by the Circuit Court of Appeals were valid and not open to criticism upon the grounds upon which the Circuit Court of Appeals had reached its decision.

"On appeal from this last-named decision of the Circuit Court, the Court of Appeals for the Southern District of New York has decided that, for the purposes of a motion for preliminary injunction, the claims more recently sustained by the Circuit Court were open to the same criticism as the claims formerly passed upon by the Court of Appeals, and it therefore reversed the decision of the Circuit Court, ordering that the injunction of the Circuit Court should be dissolved.

"While there is a substantial difference of opinion among the judges who have passed upon this patent, and the question at issue is by no means finally decided by the courts, it is none the less the fact that until the matter has been brought up for final decision the particular patent is no longer of controlling importance.

"Every effort will be made to secure as soon as possible from the court of ultimate resort a final decision as to the validity and scope of this patent, and inasmuch as there seems to be no question as to the merit of the invention, nor as to the fact that Mr. Van Depoele was entitled to all the credit for this important contribution to the art of electric railroading, there is reason to believe that the objections to the claims of the patent, which are, as already stated, purely technical, will be found upon a full investigation of the case at final hearings not to be sufficient to defeat the patent.

"While this patent, if sustained, would be in and of itself of controlling importance, it is by no means the only patent upon which the General Electric Company relies for protection in its manufacture of apparatus for the overhead trolley system. The litigation on other patents of the company relating to this subject is well advanced, and adjudication as to their validity and scope are to be expected at a comparatively early date."

NEWS OF THE MONTH

The Third Avenue Railroad Company of New York requires its conductors to give a bond of $1,000, signed by some property owner, and also a cash deposit of $25, before entering its employ. This is for the faithful performance of their duties while engaged with the company.

It is stated that the Long Island Railroad and the Brooklyn Elevated Railroad have united on a traffic agreement, whereby an inclined connection will be built so as to enable the cars of the

former road to run over the tracks of the latter, and also across the Brooklyn Bridge.

During the recent heavy floods in Ohio the property of the Columbus Street Railway Company was damaged to a large extent. The power house was partly flooded so that operation on several of the lines had to be suspended. The company's park, known as Olentangy Park, was also considerably damaged by the high water.

Mayor Van Wyck, of New York City, at a hearing recently on the Tiffany bill to prevent street railroads being laid through East Eighteenth and Nineteenth Streets, expressed himself as favoring rapid transit. He said: "The great population of New York needs railroads. It needs all the kinds of rapid transit it can get. The interests of some of us must give way to those of the largest number. A law existed for the exemption of Broadway from railroads and it was years before a franchise could be obtained. Nothing has done so much for the city or for property along Broadway as the Broadway cable."

The employees of the Salt Lake City Railroad Company of Salt Lake City, Utah, have an unusually complete and well organized mutual aid association, which has been in existence since 1890. This association was formed for the purpose of securing to the employees of the road a certain weekly amount if they are disabled by sickness. Each member of the association pays $1.00 per month, and receives in case of sickness or accident $6.00 per week for the first four months and $3.00 per week for the second four months. If he dies within the eight months his heirs are paid $250. The association has a sick committee and also a physician, who is not paid by the association, but depends entirely upon his patients for his fees. After a member is reported sick by the sick committee the physician calls upon him and decides whether he is entitled to the weekly allowance from the association or not. The members of the association are assessed $1.00 at each death. On March 8th last the board of directors of the aid association declared a dividend of $812.70, and on April 1st each member of one year's standing received $7.25, thus making his insurance for the year only $4.75.

The Treasury Department of the United States Government has recently completed the compilation of statistics of the exports and imports during the last fiscal year. The figures referring to exports of electrical apparatus show that their aggregate value was $3,054,453. The countries taking the largest amounts of this machinery were as follows: England, $437,086; Dominion of Canada, $310,589; France, $298,133; Mexico, $284,714; Germany, $240,577.

A bill has been passed by the New York Legislature providing that on or before Jan. 1 every street surface railroad company whose cars are operated by electricity or cable, in every city of over 60,000 inhabitants, shall equip its cars with a fender to be approved by the State Railroad Commission.

The experiment of utilizing the electric railway system as an adjunct to the fire department is being tried in Indianapolis, Ind. The scheme consists of two low trucks, upon which fire engines or hose carts can be driven, together with the teams attached thereto, by means of an inclined plane. The flat cars are then attached to a trolley car and drawn to the nearest point to the fire on the line. The team and fire apparatus are then disembarked and proceed the remaining distance. This system will be of particular advantage when going to a fire in the suburbs.

President Rossiter, of the Brooklyn Heights Railroad Company, of Brooklyn, N. Y., has announced that it is the purpose of the company to shortly increase the salaries of the faithful motormen and conductors who have been in its service for three years or upward. The men are at present getting 20 cents an hour.

The Milwaukee, Racine & Kenosha Electric Railway Company had an interesting experience fighting snow during a recent heavy storm. This line runs through a slightly rolling country and there are a number of cuts where snow drifts badly. In some instances drifts were 15 ft. or 16 ft. deep, and on the whole length of the road the snow averaged 3 ft. The company was not fully prepared for fighting snow, having only one small Taunton snow plow to cover twenty-five miles of track. This plow, however, did excellent work cleaning the track where the snow was not more than 2 ft. deep with very little difficulty. By bucking the snow the plow went through long drifts 5 ft. and 6 ft. deep. The company worked two gangs of men, one night and one day shift. A car followed the plow so that the men could have a warm place to rest and eat their meals. It was found that snow that was 10 hours old could be handled twice as rapidly as snow that was 24 hours old. The general manager of the Milwaukee, Racine & Kenosha Electric Railway Company states that he considers board fences a curse to any interurban electric railway that runs along a public highway. He states that board fences have cost his company enough this winter to pay for the wire for a fence the whole length of the road, and his advice to all roads subjected to snow storms is to get rid of the board fences. This company has offered to furnish the wire free to all farmers who have board fences along its road if they will tear them down and put up wire. A great many of the farmers have accepted this offer.

Foreign Notes

The annual report of the Odessa (Russia) Tramway Company is just at hand. It shows gross earnings from operation of Fr. 2,274,543, against Fr. 2,062,686 for 1896; operating expenses, Fr. 1,173,181. The car kilometers run were: Horses, 2,875643; steam, 153,567; passengers caried were, by horses, 14,283,411; by steam, 1,510,438.

There are three electric railways projected in Japan. One is to be fifteen miles in length, extending from Kobe to Amagasaki. The company has a capital of $249,000, and the work is to be completed within two years. A line is also to be built between Amagasaki and Osaka, a distance of five miles. This company is to have a capital of $149,900. The promoters of these two roads are Shinyemon Konishi, of Itamicho, Kawabe-gun, Japan, Ki-ichiro Kosone, of Minato-cho, Kobe-shi, Japan, and others. Another road is propected to run from Kobe to Armina, fifteen miles. The capital is $149,900. The promoters are Ki-ichiro Naka, of Orinamura, Arima-gun, Japan; Shigezo Yamamoto, of Fukiamura, Kobe-shi, Japan, and others.

The construction of the electric system at Boulogne-sur-Mer, France, has been completed, and it will be put in operation as soon as the cars are received.

The work of constructing the Tee-side Electric Tramway, of Middlesborough, England, is progressing rapidly. The track construction is nearly finished, while the overhead construction is well advanced. Work at the power-house is being pushed, and the machinery and plant are being installed rapidly. This road will be one of the best constructed tramways, from an engineering point of view, that has ever been built in Europe. The credit of the successful planning of the line is due to Clifton Robinson, the able and resourceful engineer of the company, and his worthy assistant, Mr. Holliday.

The American Consul at Montevideo, Uruguay, S. A., under date of March 5, writes as follows: "All the street railways in Montevideo are operated by horse power, and a good service is maintained. The cars are very clean, and connections are good. The cars were made by John Stephenson Company, Ltd., but the rails were supplied by English manufacturers. Electricity should undoubtedly be used in Montevideo, but, as all coal comes from Wales and costs about $8.00 per ton or more, the expense would be very great, especially in view of the fact that horses are valued at about $15.00 each and are of a very hardy nature, averaging five years' work."

An electric tramway is to be built in Cognac, France. Communications should be addressed to M. Jules Brisson, Maire de la Ville de Cognac, Charente, France.

Interesting tests have recently been made in Rome, Italy, in connection with the application of the Pescetto type of accumu-

lators to electric traction. One of the ordinary trolley cars, belonging to the Rome Tramway & Omnibus Company, and equipped with two G. E. motors, was equipped with accumulators. These were divided into four sets, two in each smoking compartment, at each end of the car; in regular use, however, the batteries will be carried under the seats. The total weight of the batteries was 2,000 kg. The operation of the car was said to be satisfactory, and the accumulator manufacturers are about to equip a number of the cars of this company to give further tests of the system.

It is proposed to change the motive power of the tramways of Mainz, Germany, from horse to electricity. Two systems are to be used, on one line the storage and on the other the overhead electric, which road is to be extended to the suburbs of the city. The Suddeutsche Eisenbahngesellschaft (South German Railroad Company) is now conferring with the municipal and State authorities regarding this project. This company also proposes to establish an electric railway connecting Mainz, Kastel, Amoneburg, Biebrich, Schierstein and Eltville. To supply the power for these lines, as well as for local lines, the company intends erecting a large electric-power station in Mainz. The estimated cost of effecting the change is placed at $400,000. It is also estimated that the cost of maintaining those cars which are to be equipped with the storage system will amount to about $250 each per annum.

It is understood that a French syndicate has been formed to acquire a number of tramways in the North of Spain, with a view to replacing the horse traction by electric traction. The line from Valencia to Catarroja is amongst them.

Some interesting figures on tramway statistics in France were presented on Feb. 16 by M. Schelle before the French Statistical Society. The French law makes a distinction between interurban railways (chemin de fer sur routes) and tramways. The former term is applied to those lines connnecting two or more towns, while the latter applies more particularly to systems operating over the streets of the same town or of communities very close together. Of tramways proper in the six largest cities, Prof. Schelle gave the following statistics in regard to passengers, number of rides per capita, etc.:

Tramways.	Population.	Passengers per Year.	Rides per Year per Capita.
Paris	2,400,000	160,000,000	66
Lyon	440,000	24,000,000	54
Marseille	400,000	27,000,000	67
Bordeaux	250,000	15,000,000	60
Lille	200,000	10,000,000	50
Toulouse	155,000	7,500,000	48

The Council of Bradford, Eng., has accepted Messrs. Cole, Marchent & Morley's tender, at £1,079, for supplying another set of condensing plants at the electric supply works. A deputation of three, accompanied by Mr. Gibbings, set out for a Continental traction tour. The main object of the trip is to collect information on the supply of energy for both lighting and traction from one power-house.

The Council of Shanghai, China, has been authorized to consider the expediency of establishing a system of electric tramways in the streets of the settlement and in its discretion to formulate a plan for ratification by the ratepayers by which the system may be carried into effect.

Official reports state that Siemens & Halske have made a proposal to the town council of Moscow, Russia, to construct six lines of electric tramways in the city. The concession is to be for a period of forty-five years, and the firm is to be paid at certain intervals out of the net profits of the tramways.

The Principality of Monaco has recently built an electric central station of 1,200 h.p. for supplying the electric tramway system in Monte Carlo with power. It contains two 550 h.p. engines, each connected to two 200 kw. French Thomson-Houston generators. The station is also equipped with storage batteries.

An electric tramway is proposed for Angouleme, Charente, France. Communications should be addressed to MM. P. & M. Durand & Co., Lyons, France.

Attractions for Pleasure Resorts

J. W. Gorman, manager of Gorman's amusement attractions for street railway parks, has made a specialty of supplying out-of-door amusements for twelve years, and has been in the theatrical business for a still longer time; and has given more attention to this subject probably than any other person in the country. In a recent interview, Mr. Gorman said:

"The outside park amusement business has developed rapidly during the past five years, with the increase of street railway parks. Railway managers are realizing to a greater and greater extent the advantages which street railway parks bring in the way of increased traffic, and that the expenditure of a small amount of money in entertaining people, after they reach the parks, is money well invested in the returns from passengers carried.

"The common trouble with entertainments of this class is that one kind of amusement is often supplied, to the exclusion of others. There are three elements in entertainments of this character, and each should be represented in every bill of this class. They are music, gymnastics and comedy. A performance made up largely of any one of these elements to the exclusion of the others will prove monotonous to the majority of the public. The next most important consideration to be borne in mind is to supply in the afternoon an entertainment which will appeal to ladies and children, for they make up a large majority of the at tendants at that time, and in the evening one for the general public.

"All entertainments at summer resorts should be given as much as possible in the open air. The ordinary appurtenances of the theatre, such as an inclosed hall, and even scenery, are not only unnecessary, but inadvisable. People who visit these resorts wish the open air, and do not wish to attend a theatre, which they can do at home, and in the winter. The ideal place for an open air theatre is on the side of a hill, where the declivity forms a natural amphitheatre, preferably where a grove or clump of trees shades the seats, and where there is an attractive background for the stage. The latter should be an elevated platform measuring about 25 ft. by 35 ft., and should be very strongly built, so that there will be no spring to it and so that it will not give under heavy gymnastic exhibitions. A good stage of this character, with chairs or benches for seating 2500 people, can be built for about $500.

"Another common mistake in entertainments of this character is to charge an admission fee. It is here that the theatrical idea again comes into conflict with, and will destroy, the benefits of the out-door entertainment. The thought of a free entertainment is a most popular one to most people, and the increased traffic receipts should be depended upon to defray the expenses of the entertainment. If deemed advisable, a small charge can be made for reserved seats, but there should be no charge for general admission. It is easy to see that a large attendance will result from attractions of this character. As an instance I might cite the case of Portland, Me. Entertainments were supplied last year by the Portland (Me.) Railroad Company, in its park, and drew to the park in one week 49,000 people, although the population of Portland, according to the census of 1890, was only 36,400, and the city is well supplied with pleasure resorts. The attendance on other weeks was nearly as large.

"The cost of entertainments varies, of course, entirely with the wishes of the railway company, but ranges approximately from $250 to $500 per week. This covers from twelve to fourteen shows per week, lasting about an hour and a quarter to an hour and a half. This time, I might mention, has been found by practice, to be the most desirable length for entertainments of this character."

Mr. Gorman numbers among his performers each year about 200 people, divided into companies of from ten to fifteen people each, and is prepared to take contracts for supplying amusements to street railway parks for any length of time. With each company is a musical director and manager, who takes charge of all the business details. For the coming season he has already closed contracts to supply attractions to the owners of street railway parks in the following places: Portland, Me.; Salisbury Beach, near Amesbury, Mass.; Lynnfield, Mass.; Newport, R. I.; Bridgewater, Mass.; Southbridge, Mass.; Worcester, Mass.; Lawrence, Mass.; Haverhill, Mass.; Auburndale, Mass., and Concord, N. H.

Fireworks as Attractions at Parks

An exhibition of fireworks for attracting the public to street railway parks possesses a number of very excellent features. An entertainment of this kind can be given entirely in the open air, it is nearly always in season and, what is still more important, an excellent exhibition can be given with a very moderate expenditure. The Pain's Fireworks Company, which has made a specialty of the manufacture of fireworks for many years past, has now taken up the work of providing exhibitions particularly well adapted to the use of street railway managers at pleasure parks.

Many varieties of entertainments along this line have now been designed by this company, ranging from an exhibition consisting of a few roman candles and flower pots, to a colossal fire picture, each a handsome return for the amount of money expended. The exhibitions made by Pain's Fireworks Company at Manhattan Beach have secured for this company a world-wide reputation. "The Last Days of Pompeii," "The Siege of Sebastopol," "The Capture of Vera Cruz," "The Carnival of Venice," and "Japan and China" are among the productions that are especially well known.

If the pleasure resort be near the water, or has a lake of any size, a night of water fireworks is a novelty which will prove very attractive. This display can be given with the fireworks alone or with the introduction of a water pantomime, which is very funny and amuses the young people immensely. Such a show with daylight fireworks is interesting for an afternoon programme.

Now that we are having such stirring times, an evening of set pieces is particularly in season. Almost any subject of the day can be given. Patriotic mottoes and scenes of battles or sea fights can be displayed with a wonderful degree of accuracy. For instance, the ships of the American navy or portraits of the leading men can be given with absolute faithfulness as to detail. The American flag floating in the air is one of Pain's patents, and never fails to arouse great enthusiasm.

It is interesting to note in this connection that over a million people witnessed the water parade during a recent political campaign in New York, and that the railway companies carried 90 per cent of the people; that over one hundred thousand people went to Niagara to see the fireworks at the opening of the new bridge at Niagara; that the company owning Willow Grove Park, Philadelphia had an enormous increase in its transportation during the fireworks there, and that at every great celebration at which Pain has exhibited the railways are the beneficiaries.

The accompanying illustration gives an idea of a recent exhibition of Pain's fireworks, given at the Girard Avenue Bridge, in Philadelphia, July 4, 1897.

Pain's Fireworks Company, after considerable experimenting, recommends for street railway parks an exhibition lasting about fifty minutes. It should have its proper proportion of batteries of colored stars, spreaders, showers, floating stars, rockets of various kinds, bombs, packet fires, shells, etc., and set pieces. The latter are made according to the wishes of the purchaser, but a very good display can be had for a very reasonable cost. All during this Summer the Pain's Fireworks Company gave displays at Pleasure Bay for the Atlantic Coast Electric Railway Company, and in appreciation of these exhibitions the treasurer of the latter company wrote as follows: "The displays of Pain's Fireworks Company at Pleasure Bay, N. J., during the past season were eminently satisfactory both to our company and to the thousands who enjoyed them." Speaking of the value of the fireworks to Manhattan Beach in a recent letter to Mr. Pain, Austin Corbin, one of the owners, said: "In closing with you your contract for the coming season, I take pleasure in assuring you of the satisfaction we all feel in the continuance of your connection with Manhattan Beach. During the past twenty years you have constantly raised the standard of your pyrotechnic displays to meet the advancing requirements of the public; and in making our arrangements with you from year to year, we have never troubled ourselves as to what you had decided to produce, or how you intended to produce it, so certain did we feel that your efforts would be directed to attain the highest degree of artistic merit. The best evidence that the popularity of 'fireworks' has not diminished, and that you command as hearty a welcome as ever from the American public, appears in the result of last summer, when, although the country had not yet recovered from its recent financial depression, your receipts exceeded those of any previous year."

FIREWORKS AT GIRARD AVENUE BRIDGE, PHILADELPHIA

A Furnace Adapted for Cheap Fuels and Prevention of Smoke

The inducements for using low grade coals, such as "dust," culm, coal washings, slack, locomotive cinders, etc., are frequently very great, particularly in the mining States, where the refuse of mines can often be obtained at almost the bare cost of cartage. Nevertheless, difficulty is sometimes found in burning these cheap fuels to advantage, and special furnaces have to be devised for the purpose. These furnaces are frequently subject to rapid depreciation of the grate bars and overheating, due to the formation of clinkers, and the matter of properly designing a furnace is one of considerable difficulty.

A furnace for this purpose, which has met with much success in Great Britain and the continent of Europe, is manufactured by Meldrum Brothers, of England, and is illustrated herewith. Over 6000 Meldrum furnaces of this general type have been installed,

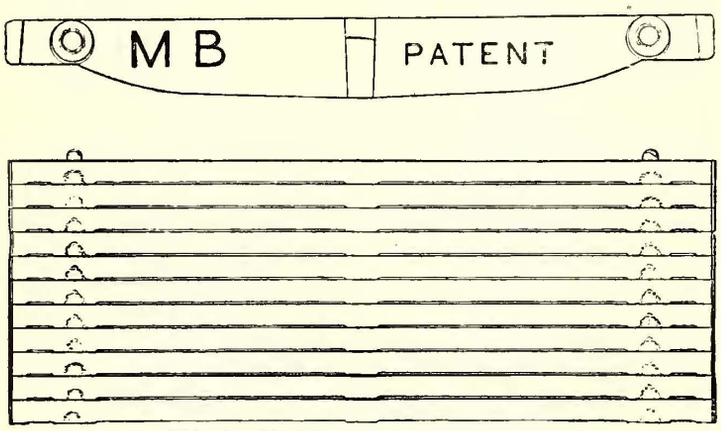


FIG. 1.—FIRE BARS FOR CHEAP FUEL

and it is claimed that the objects sought for have been accomplished in practically every instance. It is designed on the principle that cheap fuels can only be burned with good results when the bars are close together and the air is supplied under considerable pressure—a pressure much beyond the power of any chimney draught, and the whole air supply is so controlled by means of a steam jet that the fire may be forced or slackened at will entirely independent of atmospheric conditions.

The special form of fire bar is shown in Fig. 1. These bars are made interlocking to prevent displacement, and are spaced about one-sixteenth of an inch apart, so that nothing but the finest dust will fall through. The steam used for injecting the air preserves the fire bars and prevents the clinkers from adhering to them, while a looseness and porosity of clinker is brought about so that the air passes through the whole body of fuel, and not in the small eruptions common in fires worked with fan draught. It is

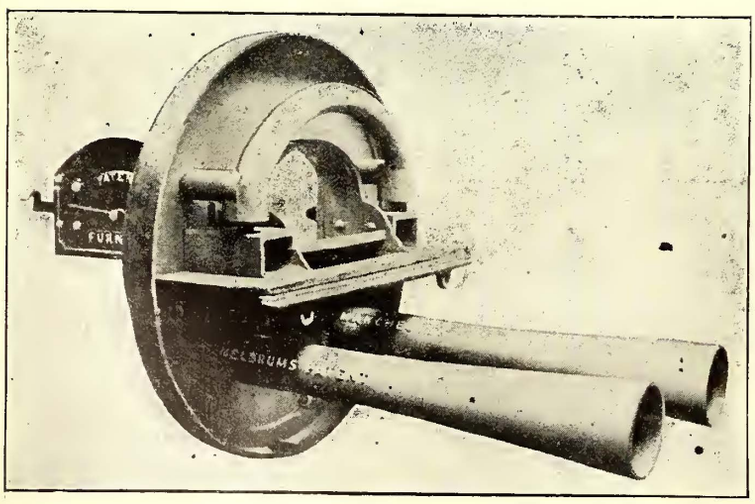


FIG. 2.—STEAM JET BLOWER

claimed that so perfectly is this done that the bars last three or four times as long as the bars of an ordinary furnace using natural draught.

Forced draught effects great economy in steam production. The sharper the draught the more thoroughly are the gases mixed, less excess of air being used over the theoretical quantity required, than with natural draught; the temperature of the products of combustion is higher; their volume and velocity through the flues is less; and there is consequently a better transmission of heat through the boiler surfaces. In burning one pound of coal it is theoretically necessary to furnish about 12 lbs. of air to bring about combustion, and practically, with natural draught, 24 lbs, while with forced draught only 18 lbs. is required. Now, if we could obtain a temperature of 4000 deg. with the theoretical air requirements, 12 lbs. per pound of coal, we could obtain but 2000 deg. F. with natural draught using double this quantity, while with forced draught, using but 50 per cent more we should obtain

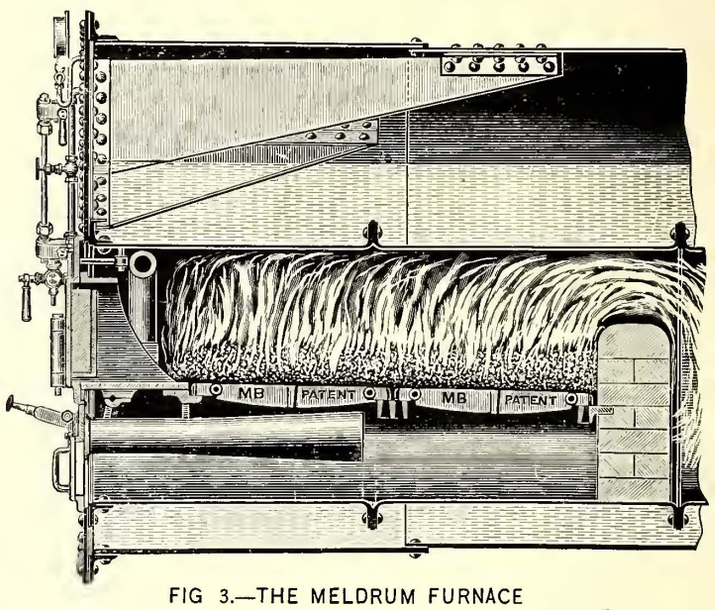


FIG 3.—THE MELDRUM FURNACE

3000 deg. This shows clearly the advantages of forced over natural draught;—to reduce the loss sustained by the admittance of the excess air.

The steam jet blower, which is the special feature of the Meldrum furnace, is the result of long and patient experiment, over 1000 tests having been made before the present shape was arrived at, and it is believed by the manufacturers that any deviation from this shape would at once reduce the efficiency of the plant. The ash pit is closed by an iron plate, in which is a small door for removing the ashes. The blowers are secured to this plate and project under the grate, as shown in Fig. 2. The steam connections to the blowers are made through the boiler front in the steam space, as shown in Fig. 3 and the steam is regulated by a valve and cock. The whole arrangement is self contained, and has no projecting parts in the way of the fireman. The ash pit is airtight and the only exit for the combined steam and air is through the bars, so that the pressure and amount can be regulated by the stoker to suit the thickness of the fire and the class of fuel to be consumed. Moreover, if there are periods during the day when a specially heavy duty from the boilers is required, as is usual in street railway work, their evaporative power may be rapidly increased and maintained, sometimes to the extent of 25 per cent or more, by increasing the rate of combustion, and in consequence the necessity of firing up additional boilers is obviated. The steam for actuating the blower is superheated and perfectly dried before using, and by this means the efficiency of the blower is materially increased and danger from moisture in the boiler flues overcome. The method of drying the steam is shown in Fig. 3. The pressure arising from the combined air and steam jet does not extend further than the ash pit and through the fuel, which is just the place where perfect combustion and a higher temperature of flames can be obtained. After passing over the bridge, the gases travel through the boiler flues at the ordinary rate of chimney draught. The Meldrum steam jet blowers are very quiet in action, but when desired, it can be arranged to make them practically noiseless by drawing in air from below the foot plates, as shown in Fig. 4.

Smoke prevention is a special feature of the Meldrum furnace. This is accomplished by the introduction of air into the furnace gases over the fire in such a way and in such quantities as to bring about nearly perfect combustion. The air supply is taken from the ash pit, passes through a valve in the dead plate over the fire, and is thoroughly mixed with the gases carrying the half consumed carbon. A number of very notorious chimneys have been practi-

cally freed from smoke by the use of the Meldrum furnace. In some cases where six large furnaces discharged into a chimney only 2 ft. 6 in. square, and where 120 to 150 tons of coal were burned per week, continuous observations taken every two weeks showed that the total dense smoke readings averaged only thirty seconds per day. In this matter of smoke prevention the manufacturers make special provision to suit each case after a careful study of the conditions, and are always willing to guarantee results.

Remarkable economies appear to have been accomplished by the use of the Meldrum furnace in Great Britain. The following table shows four examples of the reduction in cost of fuel for evaporating 1000 gallons of water, brought about by its use with cheap fuels. In addition to these, examples can be cited of increased steaming power with the same fuel, coming from the introduction of the Meldrum furnaces, such as 35 per cent in Marple, 55 per cent in Hartlepool and 63 per cent in Glaenavon.

Place.	Type of Furnace.	Kind of Fuel.	Cost of Fuel per ton d/d	Water evaporated per lb. Fuel	Cost of Fuel for evaporating 1,000 galls.
Manchester	Ordinary	Steam Coal	$2.50	8	$1.37
do.	Meldrum	Coke Dus	.25	6½	.68
do.	do.	Pan Breeze	Nil	3	Nil.
Blaydon-on-Tyne	Ordinary	Steam Coa	2.50	8.9	1.25
do.	Meldrum	Coke Dust	.41	5.5	.33
Birmingham	Ordinary	Steam Coal	1.37	7.5	.81
do.	Meldrum	Coke Dust	.08	4	10
Leicester	Ordinary	Steam Coal	2.25	6.8	1.47
do.	Meldrum	Slack	1.25	7	.79

With the belief that there is a large field in the United States for the Meldrum furnace, particularly in connection with electric light and street railway power plants, Meldrum Brothers have appointed as their American representative Alfred Hendricks, with headquarters in New York City, and full information, estimates and guarantees will be furnished by him.

Catalogue of Insulating Materials

The new price list of insulating materials just published by the H. W. Johns Manufacturing Company is larger than that of any previous edition issued by that concern. In trolley line accessories several additions have been made to the former long list of insulators and supplies. Among these are the cap and cone styles complete, third rail insulators, splicing sleeves and clips for "Figure 8" wire, the Hartford section insulator, trolley wheels, the "All-Steel" trolley bracket arms and sundry supplies. The Johns Company has long been known for the superior quality of its trolley construction and insulating materials, and the additions noted add still further to the completeness of its line of specialties. This company's new "H. W. J." arc lamp hanger, constructed after the principle embodied in the Giant strain insulator, is illustrated and described at length in the new catalogue.

The catalogue especially calls the attention of the railroad companies to the fact that this company makes a specialty of furnishing Vulcabeston repair parts, such as new commutator rings, bushings for brush holders and controller pieces, after its exclusive design; also molded mica and "Monarch" insulating pieces. Full details of prices for the Westinghouse No. 28 H and No. 38 controllers are also given. Prices and particulars of the "H. W. J." electric car heaters and the Electrotherm are given at the end of this compact and attractive booklet, which is just the right size for keeping handy for use or carrying in the pocket.

Street Car Curtains

Since the use of railway curtains has superseded the use of the old-time slat blinds so generally, the curtain manufacturers as well as the curtain users have constantly endeavored to procure some serviceable and attractive material of which these curtains could be made.

Such a large demand has been created that the attention of experts in the textile line has been called to the matter, with the result that waterproof materials of several different kinds have been placed upon the market. About five years ago the E. T. Burrowes Company placed before the trade its waterproof curtain material, Oakette. The sale of this material has gradually increased, until, at the present time, it is being used in immense quantities by steam and street railways; also for yachts, steamboats and war vessels. The United States Navy has equipped several of its best warships with Oakette.

Oakette is made of a single thickness of heavy material, with the waterproof substance applied directly to it; this waterproof material permeates the whole texture of the goods. Oakette cannot be scratched or marred with the finger nail; the surface is hard; it is non-absorbent, waterproof, dustproof, greaseproof, stainproof and may be washed with water and sponge, is not affected by heat or cold, will not fade and is particularly durable.

The E. T. Burrowes Company can furnish this material with any pattern of face. The line that it carries has been gotten out carefully and with particular reference to the needs of the trade. The patterns are mostly symmetrical; the colorings are those which are best adapted for service to which they would be put; no attempt has been made at dainty colorings or fancy patterns, but these, of course, can be supplied if anybody requires them.

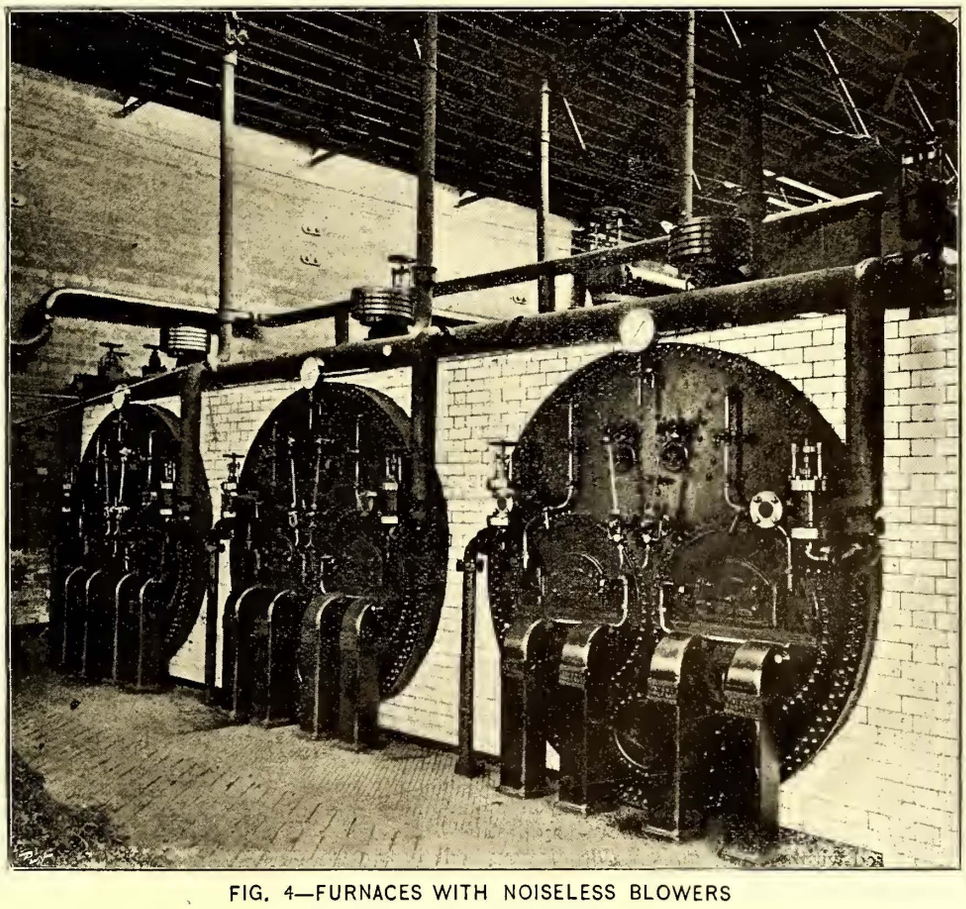
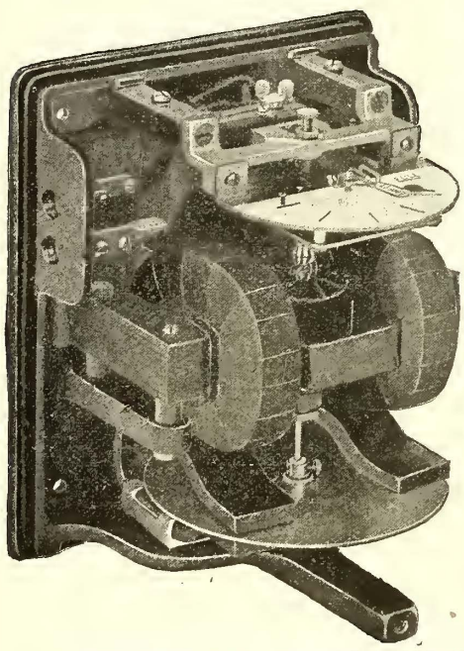


FIG. 4—FURNACES WITH NOISELESS BLOWERS

Watt-Meters for Storage Batteries

The increasing application of storage batteries, consequent on their perfection, to electric light and railway station use, as well as to street cars, motor carriages, electric launches, etc., where a portable source of power is requisite, has led the General Electric Company to develop a special type of meter, which will show at a glance the amount of energy available in the battery. The Thomson recording storage battery meter resembles in general appearance the standard Thomson recording wattmeter, and is, in fact, a development from it, the mechanism being almost exactly similar. The accuracy and durability characteristic of the standard type have both been maintained, while additional precaution is provided against injury from shock or vibration. The



WATTMETER FOR STORAGE BATTERIES

meter is provided with a single indicating needle moving over a horizontal semi-circular dial.

The essential requirement for a storage battery meter is that the armature shall rotate in either direction and give equally accurate readings in both. In this meter this requisite is fully preserved. The reading of the meter represents not the amount of energy put into the battery, but the amount available, and when the needle points to zero on the dial, it shows that the battery is completely discharged.

For motor carriage, street car and electric launch service a meter of this character is a most necessary adjunct. Without it the operator is absolutely ignorant of the power upon which he can depend, and would run serious risk of finding himself at a standstill far from home with no means of getting either forward or backward without recourse to some mechanical method.

These meters are manufactured with any desired percentage difference between charging and discharging rates, and in all of the standard sizes in which two-wire Thomson recording wattmeters are built. Since, however, this percentage varies in almost every case, the General Electric Company manufactures them only to order. One size, that reading to 50 amps., however, may be considered as standard, and will be more promptly furnished than any other.

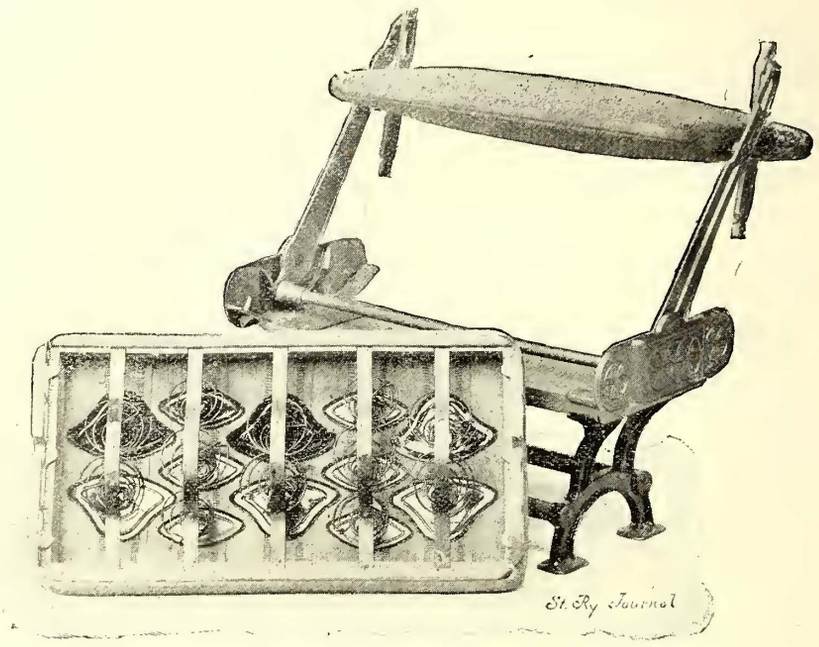
New Type of Car Seat

The accompanying illustration shows a new type of seat for street cars, which is manufactured by Heywood Bros. & Wakefield Company. This seat is known as the Henry seat, and a number of strong features are claimed for it. It is very simple in construction, and has very few different parts. The back, which is upholstered with springs on both sides, is reversible in two ways. It swings over, permitting both sides to be used, and also when the top of back becomes soiled or worn, it can be reversed, bringing the bottom edge to the top by simply removing four screws. In this way, all the upholstery wears evenly and really gives double service. This is a very strong feature. As will be seen from the illustration, the springs in the seat are provided with steel disks. These disks prevent the springs from cutting or injuring in any way the covering of the seat.

Heywood Bros. & Wakefield Company also manufacture a number of other styles of street car seats, all of which are fitted with steel protecting disks. These seats are manufactured, both with single support, to be fastened to the floor of the car only, or they can be supplied to fasten to the side of the car and can be supplied with or without arms, as desired. These seats can also be furnished in rattan, imitation of leather, or plush, if desired.

Electric Heaters

The accompanying illustrations show the recent improvements which have been made in the "H. W. J." electric heaters, which are manufactured by the H. W. Johns Manufacturing Company. These heaters have been on the market for a number of years



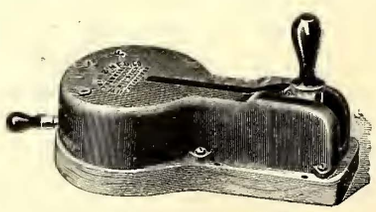
NEW TYPE OF CAR SEAT

and now are extensively used by many of the leading street railway companies throughout America and Europe. The principal advantage claimed for the "H. W. J." heaters is that they possess a very large radiating surface for the heat generated, thus avoiding very hot or overheated wires or surfaces and unsafe temperatures. Another feature about these heaters is that all the heaters in the car are in operation at the same time. They heat the car equally from end to end, and furnish the most effective and economical distribution of the heat throughout the car. The

NEW PANEL HEATER

switch which is provided with these heaters and which is shown herewith admits of the most perfect regulation to suit the requirements of the weather and the comfort of the passengers.

The heaters are attached to the faces of the seat panels by screws and special separating washers of waterproof asbestos are furnished to provide an open ventilating space ⅜-in. wide between the panel face and back of heater. Connections are readily made with the heater terminals by leading wires through small holes bored in the panels and all wiring is concealed back of the panels under the seats. No cutting of woodwork is necessary.



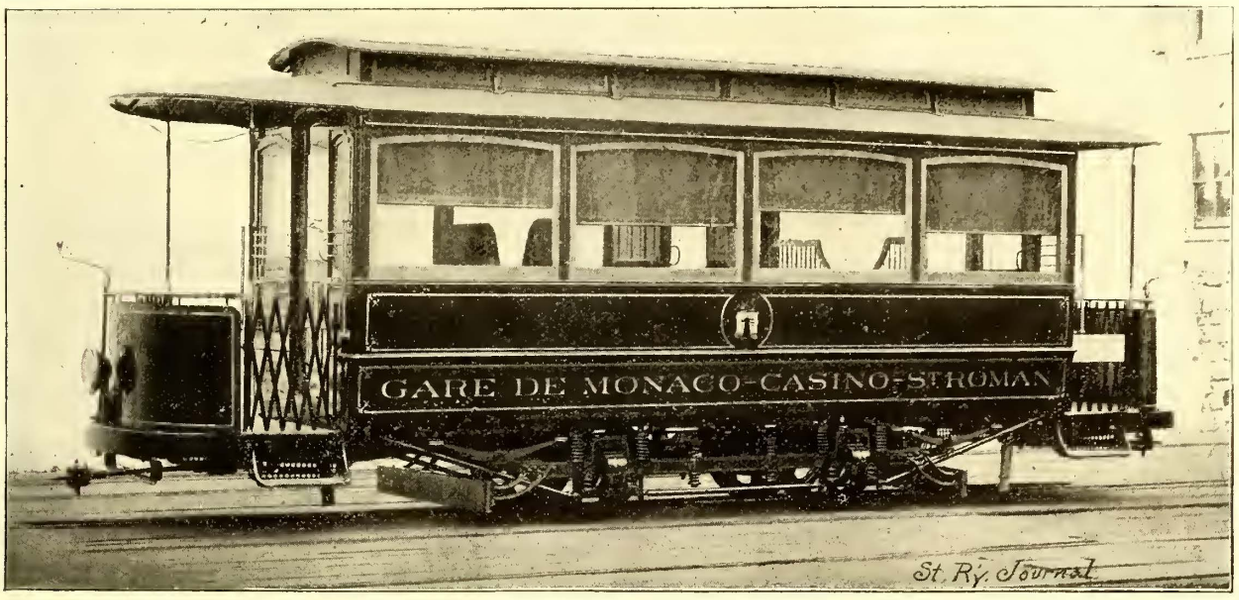
SWITCH FOR HEATER

With the "H. W. J." switch three degrees of regulation are furnished. The switch is a double brake knife switch, specially designed to meet in the most practical manner the requirements

of simplicity, high insulation and durability with ample contact surfaces and length of brake to prevent destructive arcing under the highest voltage of the trolley line. Its action is positive in all cases. Closing the knife blade automatically locks the switch in position, and any movement of the regulating handle is prevented until the knife blade is released. All parts are protected by a substantial cast iron cover. Regulation in the "H. W. J." system is effected not by cutting out a number of heaters, but by reducing the amount of heating surface equally in all the heaters.

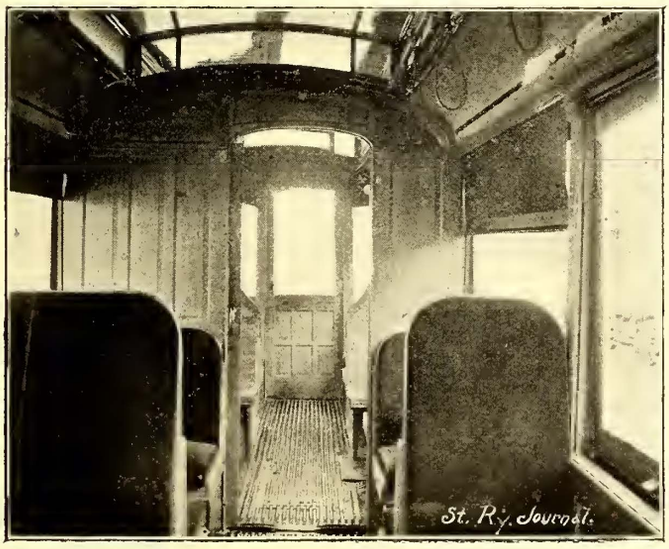
Cars for Monte Carlo, Monaco

The type of cars to be used on the new electric railway at Monte Carlo, Monaco, is shown in the accompanying engravings.



EXTERIOR OF CAR FOR MONTE CARLO, MONACO

The cars are being built by the J. G. Brill Company, and in many respects are unique and quite out of the ordinary American practice. They are 19 ft. 2 ins. long over the end panels, and with the 4 ft. 2 ins. platforms measure 27 ft. 6 ins. over the dashers. The body is 6 ft. 1¾ ins. wide at the sills and 6 ft. 8¼ ins. wide over the posts. The specifications state that the car cannot exceed 6 ft. 10¼ ins. at the widest point. This consequently makes a side with but little curvature. There are four enormous windows to a side, a feature specified by the owner in ordering. Short



INTERIOR OF CAR FOR MONTE CARLO, MONACO

as the body is, it is divided into two compartments, one for first and the other for second-class passengers. Stationary cross-seats accommodate twelve persons in each compartment. As will be seen from the interior view, the seats on one side of the aisle are designed for two persons, while those on the other side are single. The two center seats in each compartment are arranged back to back. In the first-class compartment the seats are upholstered and covered with olive plush. In the second-class compartment the seats are of cherry slats with high backs. This portion of the car is very plain, but the first-class compartment is highly ornamented and finely finished.

The car is mounted on No. 21-E trucks. The side frames are made of solid forgings, and the outer ends of the frame carry half-elliptic springs. At the axle boxes there are double journal springs, as well as a pair of spirals resting on the frame. The combined action of these springs gives a very easy riding car body, as well as great steadiness of motion. The truck is meter gage and 6-ft. 6-in. wheel base. It is fitted with G. E. 53 electric motors. The wheels are 33 ins. diameter, Brill pattern centers with steel tires. The car is fitted with electric, in addition to the ordinary hand, brakes. There are two sand boxes, two gongs and two electric headlights. The windows have a cherry sash and spring roller curtains. The platforms have Brill folding gates fitted to each opening. The total height from the head of the rail is 10 ft. 9½ ins. The exterior of the car is finished in dark olive green. The coat of arms of the principality appears upon the center of the window panel. Taken altogether, the cars have a very striking appearance.

New Foundry at Schenectady

The General Electric Company, in view of the constantly growing demand for apparatus of its manufacture, has decided to make a large increase in its manufacturing facilities. March 25 the company placed contracts for the construction, at its Schenectady Works, of a new foundry, which will be one of the largest in this country. The present foundry has been for some time entirely inadequate to meet the demands upon it, and considerable work has been passed on to the admirably equipped foundry which the company has at Lynn. The work to be done has, however, grown even beyond the capacity of both the Lynn and Schenectady foundries working overtime, and all is now to be concentrated in the new foundry, construction of which is to be begun immediately.

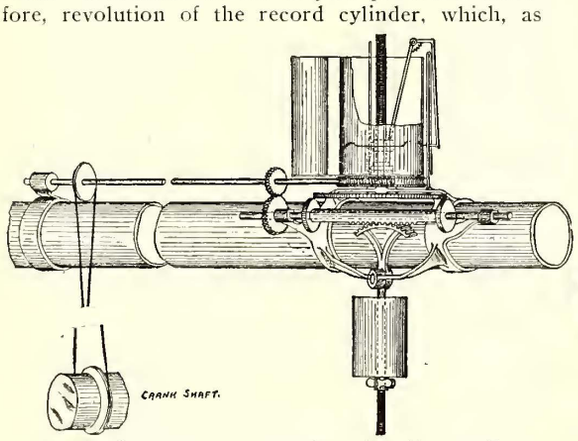
The building will be of brick, 500 ft. long and 140 ft. wide, with an "L" 100 ft. by 120 ft. The latter will be used as a cleaning shop. Besides these main buildings a number of sand sheds, several buildings for the storage of foundry material, and a new-pattern store house 200 ft. long and 80 ft. wide and two stories high, will also be erected. All combined, the floor space occupied will be about 12,000 sq. ft. Plans are also under consideration for a new machine shop, 650 ft. long by 165 ft. wide, but the appropriation for this has not yet been authorized.

The contemplated machine shop will be devoted almost entirely to very large machine work. The size of the great generators which the General Electric Company has been manufacturing has of late been increasing, until to-day a generator of 4000 h.p. is not regarded as of unusual size. In fact, generators of 5000 h.p. are now in course of design, and the demand upon the shop in which the large machinery has heretofore been built has far outgrown its present proportions.

Device for Making Preliminary Surveys for Street Lines

The demand for a speedy method of making preliminary surveys without the usual array of engineers and instruments, seems to have been met by a device, recently invented by John Riddell, of the General Electric Company's Schenectady works, and entitled an instrument for delineating topographical peculiarities and measuring recording distances. It is small and compact, and may be mounted upon a bicycle or upon any wheeled vehicle drawn by a horse or pushed by hand or foot. It is shown in the illustration mounted on a horizontal upper bar of a bicycle and consists, briefly, of a vertical revolving cylinder carrying the record, and a marker moved upward and downward by the inclination upward or downward of the upper bicycle bar.

The metal cylinder carrying the paper for the record is provided at the lower end with a worm wheel engaging with a worm on a shaft running toward the rear of the bicycle and driven by a lace belt from a pulley on the crank shaft. Movement of the bicycle produces, therefore, revolution of the record cylinder, which, as it revolves, unwinds the paper for the record from a small drum.

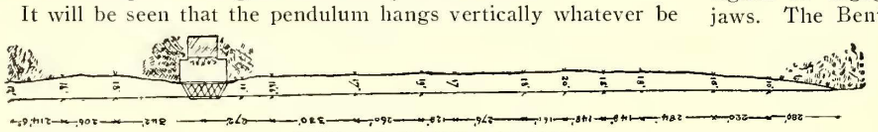


DEVICE FOR MAKING PRELIMINARY SURVEYS

The marker is mounted on a nut on a threaded vertical rod, movement of which raises or depresses the nut and the marking point. The lower end of the rod is fastened to a horizontal disc free to move clockwise or the reverse. Beneath the disc, and just clearing it on each side, are two smaller discs, at each end of a toothed sleeve, and revolving vertically. Through the sleeve passes the disc shaft, provided with a gear wheel meshing into a small gear on the main shaft driven from the crank axle.

Suspended beneath the bar of the bicycle, and consequently beneath the entire machine, is a pendulum having at its upper end a toothed quadrant, meshing into the teeth of the sleeve on the shaft carrying the vertical discs. As the small discs revolve in the same direction, one in contact with the large horizontal disc revolves it clockwise and causes the marker to ascend, the other counter clockwise depressing the marker. The nearer the center of the large disc the small disc comes, the faster the former moves and the sharper the angle described by the marker.

It will be seen that the pendulum hangs vertically whatever be the angle of inclination of the bicycle. If the machine is ascending the horizontal bar assumes an obtuse angular position to the pendulum, the rear vertical disc is brought beneath the horizontal disc and the marker moves upward; if a declivity is descended the angle of the bar and the pendulum becomes acute, the forward disc comes into play and the marker moves downward. On the level both vertical discs are out of contact with the horizontal disc and the marker records, a plain horizontal straight line.


PART OF SURVEY RECORD

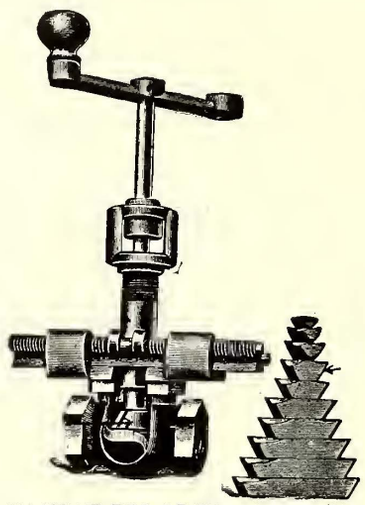
A part of a record is shown herewith. The number of feet above the level are shown by the horizontal line, the distance traveled by the length of the record. It is part of a record made on a wheel ridden from the gates of the General Electric Company's factory to the main street in Schenectady.

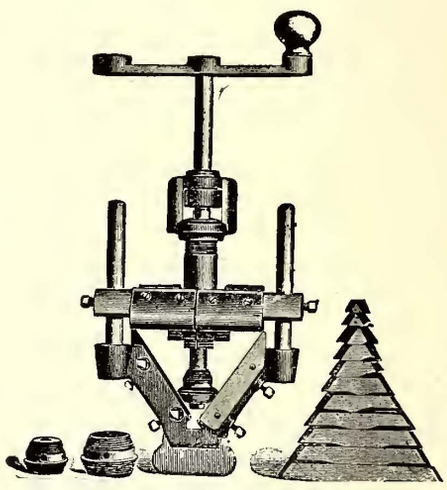
The value of a device of this character will readily be appreciated by street railway engineers. At present if a piece of road requires survey, or the lay of the land in a certain direction is to be ascertained, a system of survey is necessary, involving considerable time and labor. Recent mention was made of the rapidly accomplished survey of 49.22 miles in nineteen hours by means of a bicycle and compass. The mapping of the line surveyed occupied several hours additional labor. With a device of the character of that mentioned the completed topographical profile could have been ascertained in the time taken to propel the wheel over the length of the road surveyed.

It could also be widely used by military engineers and by bicyclists and drivers of horses or livery stable keepers in the development of road maps, which, at present, give distances only and not gradients.

Block-Chuck Valve Reseating Machine

The value of a practical and reliable valve-reseating machine is now recognized by engineers everywhere, and the saving effected by the use of same is very large, as about 1 lb. of steam per minute will escape through a 1-in. opening, with 1 lb. absolute pressure. The flow is proportioned to the pressure carried. A little leak in a steam valve soon becomes a big one, and is a constant source of expense. Wendell & MacDuffie are placing on the market a reseating machine, which is claimed will pay for itself in a very short time by the amount of steam saved from loss through leaky valves. This machine is known as the Benton valve reseating machine, and it can be attached to all makes of valves regardless of the size of thread or diameter of opening in the valve hood. The valve seat is cut with reversible self-clearing tools, which may be ground when dull. This is the only method of invariably obtaining a true seat. As will be seen from the accompanying illustrations, the attaching device consists of a block-chuck, with gibs placed between the two blocks and the bar to take up the slack. Upon the under side of the blocks is a series of parallel segment-shaped steps, the curved face of each step being threaded to correspond with the threads of valve casings with which the steps are designed to engage. The screw rod opens or closes the chuck jaws. The Benton outfit includes a disc dressing device. The cutters for dressing tapered-seated valve are on the inner opposite edges of a V-shaped bar. These cutters or blades are attached to this bar by means of screws that pass through slots in the bar, and thus permit of a rigid angular adjustment of the cutters. It is to be noted that the cutters or blades, by being located on the sides of said bar, have their cutting edges presented on lines tangential and not radial to the axis of the valve being ground. The result of this is that the cutting edges do not catch or unduly bite into the valve, and hence objectionable chattering is avoided and a smooth, easy and free cut is produced.


MACHINE FOR RE-SURFACING AND DRESSING FLAT-SEATED VALVE


MACHINE FOR TRUING THE DISC OF A TAPER-SEATED VALVE

Electrical Exhibition in New York.

The Electrical Exhibition Company, which is conducting the electrical exhibition to be held at Madison Square Garden in May, 1898, has issued a revised list giving the names of all firms who will exhibit at the coming show. This list is corrected up to April 1, and contains the names of about 150 exhibitors. The Exhibition Company states that arrangements for the exhibition are progressing nicely, and that the complete success of the venture is assured.

A New Steam and Electric Passenger Truck

The John W. Cloud Company's pressed steel truck has been introduced extensively within the last year in steam railway service. The patents covering the construction of this truck were granted to John W. Cloud and W. A. McGuire, of the McGuire Manufacturing Company, and by a compromise the John W. Cloud Company controls the patents for steam railroad purposes, while the McGuire Manufacturing Company controls the patents for electric railway purposes.

The patented features of the truck are as follows: The method of mounting the springs over the journal box outside and inside the frame. The rocker housing, which carries the elliptic springs and serves the same purpose as a swing bolster, or, rather, permits the bolster of rock laterally with a motion that is claimed to be easier than the old swing hanger style. The elastic brake hanger, which combines the release spring and is an absolute preventive of kicking brakes, which is so objectionable in a passenger coach. It will be noticed that the position of the elliptic springs is quite unique in this, that the support upon which they rest is suspended from the transom and takes up all the space between the wheels on either side of the truck, this being necessary in electric railway practice to make room for the motors. The trucks built by the McGuire Manufacturing Company for the Alley Elevated and Brooklyn Bridge are of the same wheel base, and the motors take up every bit of room between the axles and the transoms, so that there is not an unoccupied space of two inches in any part of the interior of the truck. In the case of the Alley Elevated and Brooklyn Bridge all the springs are carried upon the outside of the frame, on or under the equalizers, while in the Cloud truck it should be noted all the springs are carried on the inside of the frame, with the exception of those shown in the cut, over the journal boxes, and no equalizers are used.

The truck has gone into use very rapidly in steam railway service, several thousand having been put into use last year. It is claimed for them that they are the strongest trucks in use, and, while they are only 5 ft. 6 in. wheel base, they ride as easily as a six-wheel sleeper coach truck.

This truck is well adapted to meet the requirements of steam railroads that propose introducing electricity into their suburban service. The long experience of Mr. Cloud and the McGuire Manufacturing Company well fits them for designing a truck of this kind, and their latest production should find a ready place in the market.

The truck throughout is of steel, excepting the brake shoes. The sides and bolster are made from heavy boiler-plate steel. The swinging bolster is made from low carbon cast steel. It was designed especially to meet the modern requirements of the heaviest service, such as is met with on suburban and inter-urban lines and on the elevated railways in the large cities, where the maximum acceleration and the maximum retardation are the main problems to be solved. In the accompanying engravings Fig. 1 shows a side elevation of the truck and Fig. 2 shows a half-transverse sectional view and half-end elevation.

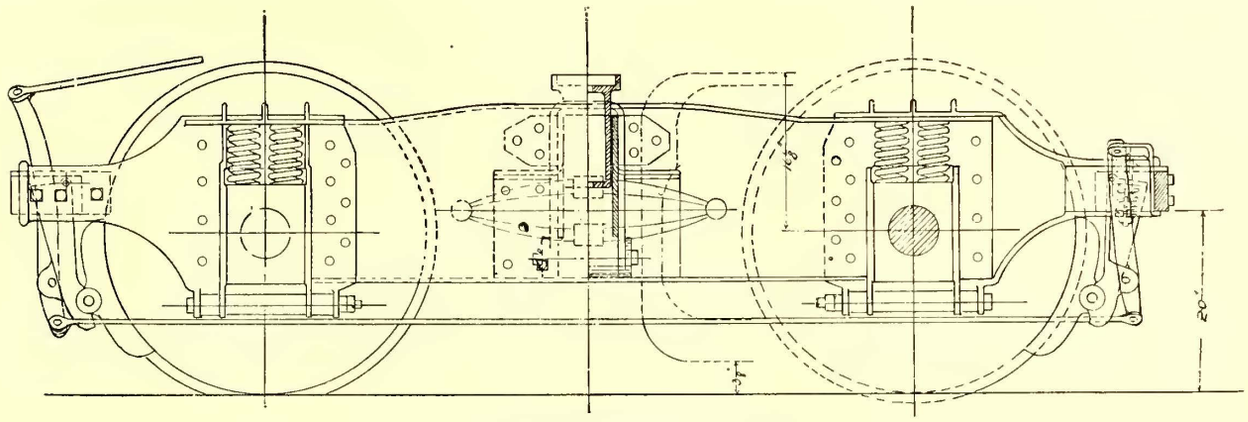


FIG. 1—SIDE ELEVATION OF TRUCK

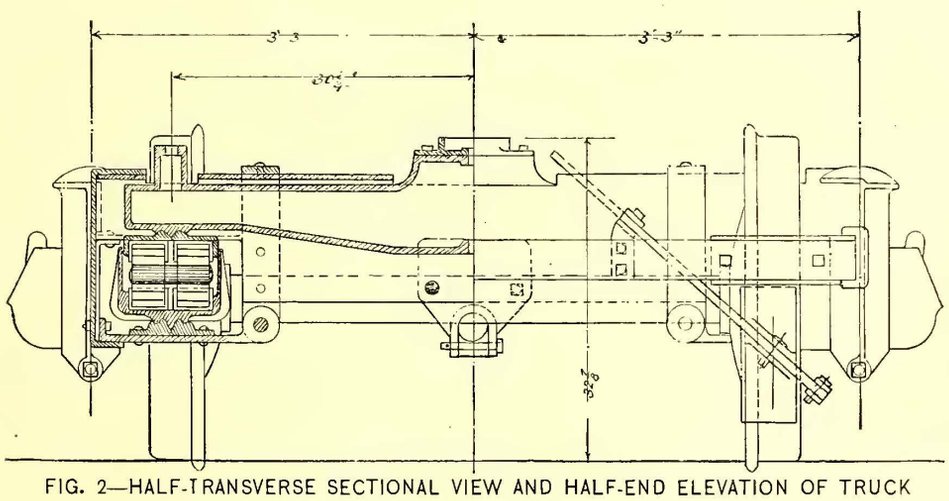


FIG. 2—HALF-TRANSVERSE SECTIONAL VIEW AND HALF-END ELEVATION OF TRUCK

Safety Devices for Steam and Power Plants

Accidents which cause an engine to run away or a steam pipe to burst have occurred in even the best managed stations, and, probably owing to the higher speeds and pressures which are being employed in steam work, the number of these accidents, it is alleged, is increasing. However this may be, the importance of guarding against all danger is self-evident, so that the Monarch engine stop and speed limit, which have lately been perfected and put on the market, are worthy of study.

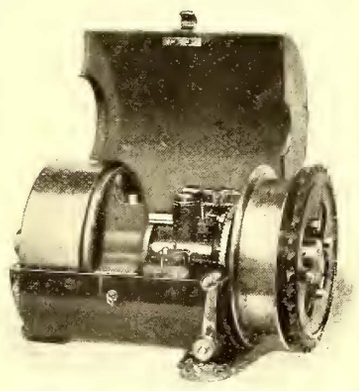


FIG. 1—ENGINE STOP

The engine stop, Fig. 1, is attached directly to the stem of an engine's throttle valve by means of a sprocket chain, one sprocket wheel being secured to the shaft of the stop machine while the other is immovably fixed upon the valve stem. The operating power of the stop is either gravity (i. e., a weight), or a spring. A very flexible wire rope has one end coiled around the sheave next to the sprocket wheel, which in turn is on the shaft of the stop. The other end of this rope is attached to the weight or spring. When the hand wheel of the valve is turned so as to open the throttle, the sprocket chain turns the shaft in the Monarch stop, the rope coils around the sheave pulley, and the weight is lifted or

the spring extended, whichever may be used. By or before the time the valve is opened there is sufficient energy stored in the weight or spring to return the valve rapidly to its seat. This energy is prevented from acting by being held in check by a pawl and ratchet wheel, which may be seen just inside of the case next to the sheave pulley. The pawl can be instantly pulled out of the ratchet tooth, however, by an electric clip device. When this is operated the valve is closed by the spring or weight. To prevent danger of destruction from too rapid closing, a dash pot forms a part of this machine. This allows a rapid closure up to the last three turns of the valve, when the air cushion arrests the motion of the valve, which then goes to its seat easily but positively.

To operate this stop and close a valve in five seconds, therefore, the engineer has merely to press a push button. Any number of push buttons can be used, and they may be placed in as many different positions as required.

When an engineer is at his valve to stop his engine he is directly in the path which would be taken by the parts of a ruptured fly wheel, so that it is not surprising to read in many accounts of fly wheel accidents, that the engineer was killed while shutting down his engine. In certain cases this danger has led the engineer to hesitate before going to his throttle to perform his duty. With this stop on the other hand a press button is placed directly upon the engineer's desk or in some position in the engine room out of the path of danger, as well as in the boiler room. When distant buttons are pressed, not only is the engine shut down, but a large electric gong is rung in the engine room, which informs the engineer at once that trouble has occurred and that his engine is being stopped.

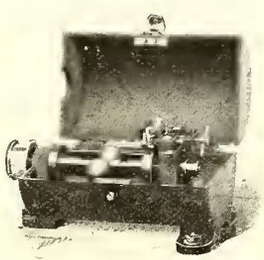


FIG. 2—SPEED LIMIT FOR ENGINES

This stop machine is by no means confined to the use of engines, as it is applied also to stop valves in steam pipes where, in case of bursting pipes or fittings, the valve can be closed in a few seconds by pressing a distant button. This may also be done automatically by an ingenious and simple arrangement which this company provides. It can also be applied to water wheels, gas or oil engines, or for stopping the engines of a cable railway. In the latter case a small wire is carried in the cable conduit, with push buttons at frequent intervals.

The Monarch speed limit, Fig. 2, consists of two governor balls mounted on two flat leaf springs. The flat springs are secured at one end, to a collar fixed immovably upon the shaft of the device. The other ends of these springs are attached to a sliding collar which moves along the shaft lengthwise. The position of the latter collar depends, therefore, upon the speed at which the governor shaft is driven, and when the speed reaches a predetermined limit, an electric circuit is closed through the two electric contact springs, located immediately over the sliding collar. This closes the engine stop, shutting down the engine at once.

The speed limit is revolved by means of a belt running direct from the crank shaft of the engine to the pulley shown on the shaft of the limit. As it takes but little power to run this device the 1¼-in. flat belt employed is more than ample to secure absolute and positive operation.

It will be seen from the cuts that both of these machines are placed in compact, neat, and dust proof iron boxes, locked by Yale locks, so that it is impossible to tamper with them.

Punching and Bending Machine

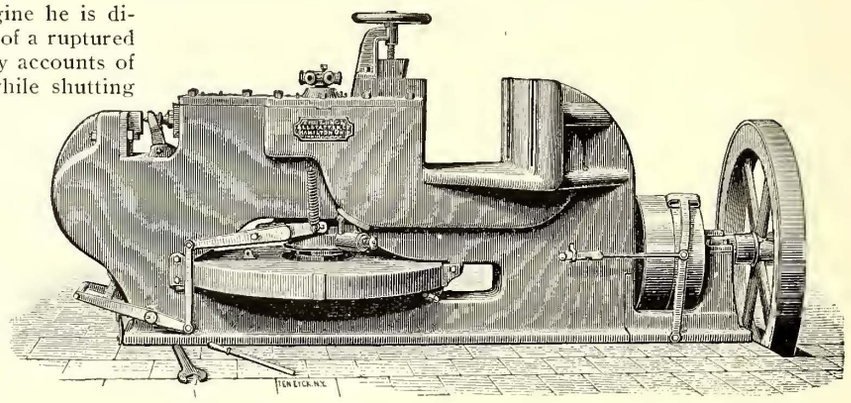
In the accompanying engraving is shown a machine manufactured by the Long & Allstatter Company for use in punching, bending and straightening rails, beams, structural bars, etc. The punch works horizontally and the punch and die project above and clear of the top of the machine so that flanges can be punched close to the web. An automatic holder or stripper is provided for the punch.

The bending and straightening jaws can be fitted with any desired style of dies and the dies are adjustable while in motion, by means of a hand wheel, thus permitting the accurate adjustment of the bending or straightening dies so as to produce precisely the effect desired. The rail or beam as it passes between the dies is supported upon rollers which are adjustable vertically.

A movement is provided by which the ram can be operated by hand, this device being of great convenience in adjusting the punch to the die, and it is also found quite convenient for some delicate jobs of bending and straightening.

The machine is also fitted with an automatic stop-motion which causes the ram or slide to come to rest at any desired point of the stroke, thus leaving the dies open and permitting the careful adjustment of work before the machine is started again.

Several sizes of this machine are carried in stock and the makers are prepared to furnish them of any desired capacity. The particular machine illustrated is adapted for punching 1-in. holes through 1 in. thickness of steel and for straightening 15-in. beams. The machine is very compact and all its parts work in the simplest and most convenient manner.



PUNCHING AND BENDING MACHINE

Electricians' Sheet Insulation Manual

Probably one of the most useful and interesting books of insulation ever gotten out is now being mailed to the electric street railways and electrical manufacturers throughout the country by the Mica Insulator Company. The book is made up of several pages of reading matter, each one of which, aside from the title and index pages, is descriptive of a sample of insulation preceding same. The first four pages are given up to describing the company's flexible and extra-flexible "Micanite" cloth and paper. The different thicknesses are given and the average break-down test runs from 296 to 439 volts per mil. These "Micanite" insulating cloths and papers are non-absorbent and remain flexible, and are made with one, two or three layers of pure India sheet mica. The cloth averages 8, 11 and 14 mils in thickness respectively, while the paper averages 5, 8 and 11 mils in thickness respectively.

A Tasteful Souvenir

The Sargent Company is sending its friends and customers a set of maps showing the West Indian Islands as a group, the Island of Cuba in particular, and the world, showing the relative positions of various countries. These maps are printed in several colors and are very interesting, particularly at this time. The Sargent Company will be glad to send a copy of these maps to street railway men, or to users of steel castings.

A New Rail Drilling Machine

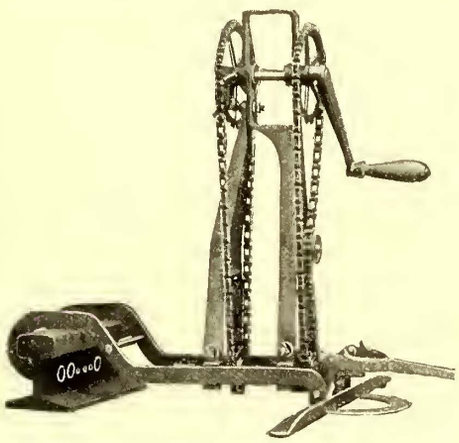
A new rail drilling machine is being placed on the market by the Buda Foundry and Manufacturing Company. This tool is specially designed for use on street railways where it is necessary to drill holes from ¼ in. to ⅜ in. in diamefer for bond wires.

The construction of the machine admits of its being attached to and detached from the rail in a moment's time. By simply throwing back a lever, which is connected to a link motion, the frame slides back far enough to clear the drill point from the ball of the rail so that the machine is entirely free.

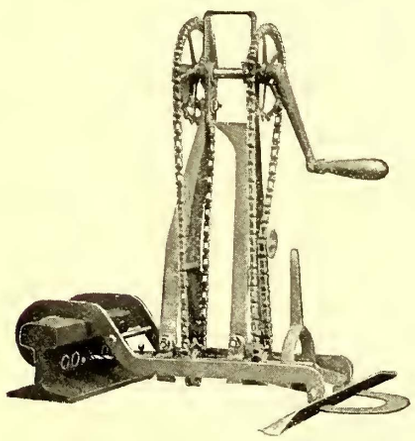
Particular attention has been paid to the designing of the automatic feed. The driving gear is a sprocket and chain. On the crank shaft are two sprocket wheels; one is fastened rigidly to

the shaft and revolves with it and drives the feed nut on the drill spindle; the other is placed loosely on the shaft and revolves with it only when engaged by a pawl on the end of the shaft. This wheel when engaged by the pawl drives the drill spindle, thus the drill spindle and the feed nut both revolve in the same direction, but the gearing is so arranged that the feed nut travels a little faster than the drill spindle and imparts to it an even and continuous feed either forward or backward as the crank is turned.

Another peculiar feature and one that makes the machine very desirable, is that by disengaging the pawl the sprocket wheel which drives the drill spindle remains stationary while the feed nut revolves, imparting a quick forward or backward movement to the drill spindle. The pawl is disengaged when the machine is placed on the rail, and by a few forward turns of the crank the drill is moved quickly forward until it comes in contact with the rail; then by simply engaging the pawl the quick feed is cut out and the slow automatic feed is brought into action until the hole is drilled. The pawl ean then be quickly disengaged, thus cutting out the slow feed, and a few backward turns of the crank will retract the drill bit. The machine which is shown in the accompanying illustrations is very simple, being composed of very few parts. It is very light and the feed nut is mounted on ball bearings to reduce the friction of the thrust.



RAIL DRILL, READY TO ATTACH TO RAIL



RAIL DRILL, READY FOR WORK

New Type of Electric Heater

The Safety Car Heating & Lighting Company has recently developed and placed upon the market a new type of electric heater for street cars. The manufacturers think they have succeeded in producing a heater which is compact, strong and durable, designed to stand the wear and tear of service, and which has an unusual efficiency due to the freedom of air circulation through and around the heating coils.

In appearance the heaters are highly ornamental and in keeping with the finish of modern cars, and in operation they produce a large volume of moderately heated air, bringing all the portions of the car to a uniform temperature. The general appearance of the heater is shown in Fig. 1.

The heater proper consists of a resistance coil of non-oxidizable wire, which is wrapped back and forth around the core, the core being built up. The core is shown in Fig. 2. It is made up of sections of porcelain placed upon a square iron bar. The ends of the bar terminate in cross pieces, which fit in slides in the end of the case.

The construction of the heaters is such that the resistance coils may be easily cleaned of an accumulation of dust or dirt by the use of a jet of compressed air, thus keeping them in a most efficient condition.

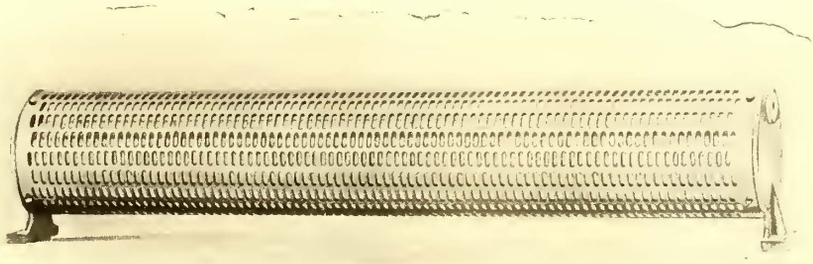


FIG. 1—NEW ELECTRIC HEATER

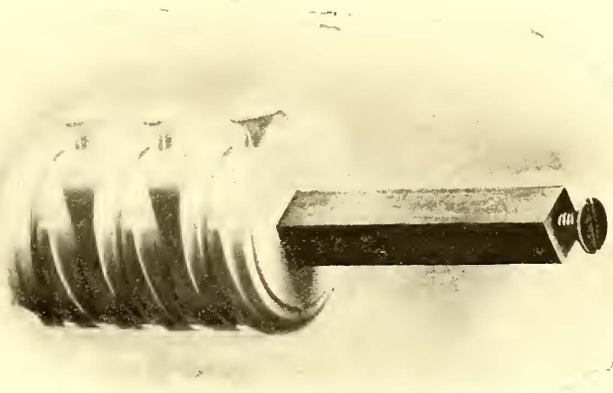


FIG. 2—CORE OF ELECTRIC HEATER

The New Walker Trolley

By reason of a recent patent decision in its favor, the Walker Company is again in a position to furnish to its customers either roller or pivotal trolleys, as they may desire, and has brought out an improved form of its pivoted trolley which has been for several years working successfully in many places. The well known "Walker base" has been changed but slightly, and by the use or omission of a latching device the base becomes adapted for either roller or pivotal trolleys at will. The springs on this trolley base serve two purposes. The main spring provides for an upward pressure of the wheel on the wire, and the auxiliary spring prevents a too sudden upward motion of the pole in case the wheel comes off the wire. These two springs are carefully proportioned and adjusted to serve their respective purposes. It will be readily seen that this base is so constructed as to allow the wheel to run close to the top of the car and to successfully pass under bridges which permit the use only of the lowest form of trolley. The whole device turns freely on the standard, which is bolted to the roof of the car. The pole is grasped by a four-bolt clamp, a great improvement over the socket and set screw which has been used

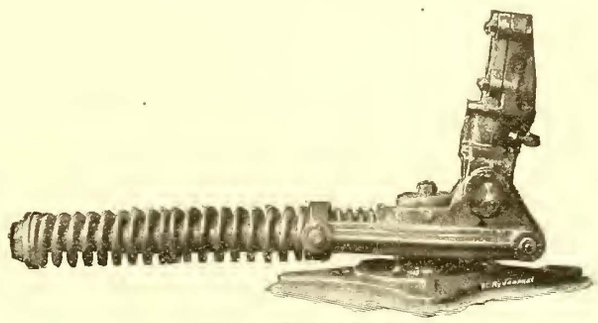
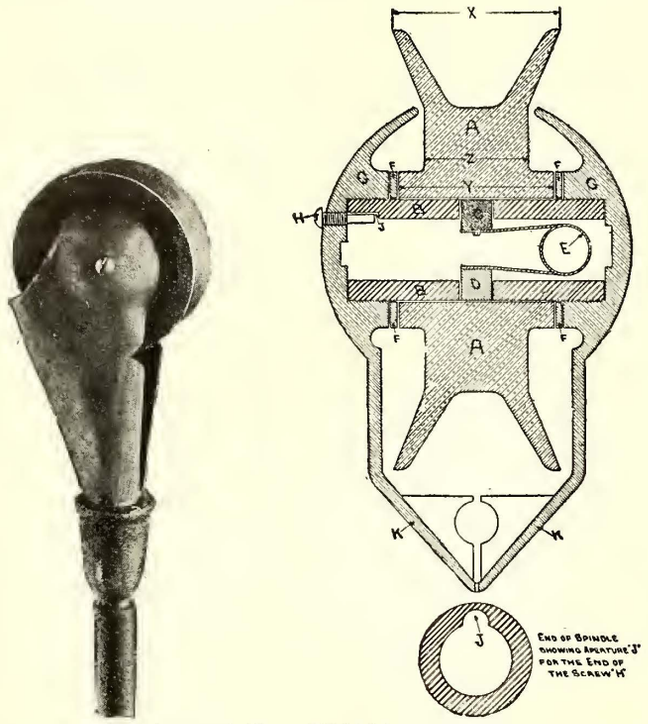


FIG. 1—TROLLEY BASE

by some makers. There is a set screw on the base of this clamp which may be forced against the pole, thus insuring good contact The Walker trolley base is shown in Fig. 1.

The trolley head, including harp and wheel, is shown in the accompanying engraving, Fig. 2. Its novel design and many points of superiority are covered by the Grover patents, which are owned by the Walker Company. It will be noticed that the wheel is inclosed in the trolley harp, except where it projects for the necessary contact on the wire. This arrangement effectually prevents the head from catching in any modern overhead trolley wire construction, thereby preventing the usual destruction to trolley lines caused by the head becoming accidentally entangled in the wire hangers. Another advantage is that the wheel cannot catch on top of the wire and pull the line down. The trolley head is shown in section in Fig. 3.



FIGS. 2 AND 3.—TROLLEY HEAD

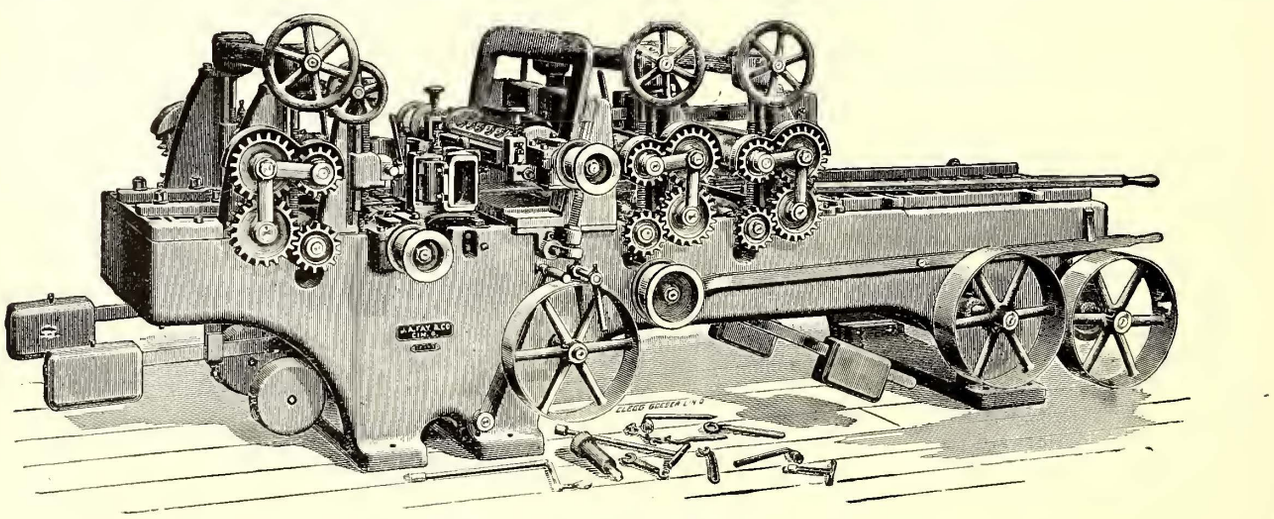
The wheel, A, is of phosphor-bronze, and the hole for the spindle is made with a standard 1-in. reamer. The spindle, B, is made of steel, case hardened. In one end of this spindle is a small aperture, "J," for receiving the end of the screw, H, which prevents the spindle from turning in the fork, G. The small copper plunger, C, which is attached to the wire spring, E, is placed on the inside of the spindle, projecting upward through an appropriate orifice and bearing against the wheel. The iron plunger, D, projects downward through a similar orifice, and is provided with four recesses or ducts, through which the grease passes to lubricate the wheel and spindle. The spring, E, forces the plungers, C and D, against the wheel, and maintains constant electrical contact between wheel and spindle, thereby preventing arcing in the trolley head. If, for any reason, the wheel be not properly lubricated, the friction resulting heats the copper plunger, C, which immediately softens the grease, causing it to flow through the ducts of the opposite plunger, where it restores the proper lubrication. FF are brass washers placed between the ends of the wheel hub and the fork, G. These washers are to prevent the wheel from wearing against the fork, and may be renewed when they themselves are worn out.

The spindle is filled with grease, of varying consistencies according to the season, by means of a special lubricator, which forces it in through the screw hole when the screw, H, is removed. The spindle once filled, the wheel will run several days without attention, and it is said that there will be no perceptible wear on the spindle or in the wheel hub by the time the wheel itself has been entirely worn out by the trolley wire. The sides of the fork, GG, are curved in at the top to prevent the trolley wire from getting between the wheel and the fork when putting the wheel against the wire.

The Walker trolley poles are made of seamless steel tubing of two lengths, 11 ft. 6 ins. and 13 ft. respectively; they are 1 11-16 ins. at the base, tapering to 1 in. at the junction of the trolley head. The walls of the tube are ⅛ in. thick.

New Planing and Matching Machine

The new style planing and matching machine shown in the accompanying illustration is manufactured by J. A. Fay & Company. This machine will plane one or two sides of material up to 26 ins. wide and 8 ins. thick. It will also plane two pieces of uneven thickness at the same time up to 12 ins. wide and 8 ins. thick, and will dress four sides of material from 2 ins. to 18 ins. wide and 8 ins. thick. Flooring, ceiling, partition, casing and base battens are produced on this machine perfectly and economically. The cylinders are made of forged steel and slotted on all four faces. The journals are 2¼ ins. in diameter, machine ground, and supported in long connected bearings that are constructed with large oil jumpers for constant lubrication. The feeding rolls are six in number and 7 ins. in diameter. The feeding-in rolls are divided in the center, so that two pieces of unequal thickness may be planed at one time. These rolls are independently weighted and are raised and lowered by means of hand wheels, their position in reference to the material being indicated by an accurate gauge set in a recess in the roll stands.



PLANING AND MATCHING MACHINE

Walker Company at the Electrical Exhibition

The Walker Company will exhibit at Madison Square Garden during the Electrical Exposition the following apparatus: Two No. 20 L motors mounted on truck; one No. 20 L motor, dismantled to show construction; two No. 4A street car motors, mounted; one 50-k.w. belted alternator; one 50-k.w. steel lighting dynamo, direct connected to Armington & Sims engine, complete with switchboard; type "S" controllers, assembled and dismantled; railway switchboard complete, with feeder and generator panels; ornamental arc lamps; new Walker recording wattmeter and a large display of photographs of its apparatus. Besides this there will be a complete section of the new underground conduit with a Broadway car shown in operation.

Annual Report of the General Electric Company

The following is an abstract of the sixth annual report of the General Electric Company:

PRESIDENT'S REPORT.

Schenectady, N. Y., April 25, 1898.

To the Stockholders of the General Electric Company:

The past year witnessed a revival in business which increased rapidly in activity and volume during its latter months. In the last annual report attention was called to the fact that your company began the year with less orders on hand than previous seasons. As a result of this the actual output of your work has been slightly smaller than in previous years, although the orders received during the period have shown a marked increase. This increase will be reflected in the shipments of the ensuing year.

A careful scrutiny of the assets of your company, other than its patents, leads to the belief that previous values were conservatively fixed and no changes of any significance have been necessary. The patent account of the company has been kept at substantially the same amount on its books since the organization of the company. The question of a revaluation of patents is one to which consideration should be given at the proper time.

The business of the year, given in detail elsewhere, has resulted in a reduction of the deficit of previous years by $1,231,852.37.

In addition to the purchase of $2,000,000 of debentures referred to in previous annual reports, your company has purchased during the year just ended $2,000,000, and the entire $4,000,000 have been destroyed. Since the books were closed $290,000 additional have been acquired and are now held in the treasury of the company. An increase is shown in the amount received from interest and dividends from securities owned. It is expected that the income from this source will still further increase from year to year, unless considerable sales of such securities should be made by the company.

The growth of your business has made it necessary to make further expenditures for additions and changes at your factories and in acquiring much additional machinery. Plans have been prepared and contracts partially closed for a new foundry and a large and important machine shop, the largest buildings yet erected by your company. In anticipation of the investment in the construction and equipment of these new shops, which it is estimated will cost about $500,000, the sum of $250,000 has been deducted from the profits of the past year and carried to the factory reserve account. It has been the practice of the company to write off the amounts expended for additional factory facilities. It is thought that these allowances are not more than are required to properly provide for depreciation in all your factory plants taken as a whole.

At the annual meeting of the stockholders, held four years ago, the question of reducing the company's share capital in the manner prescribed by law was referred to the directors. Since that time the matter has had the earnest attention of your board, and it is their hope that a plan will be submitted for your consideration at an early date, designed to provide for a suitable reduction of the share capital of the company, with a view to the resumption of dividends.

The patent situation has not materially changed since the last report to the stockholders. The company has secured many important patents during the year, by inventions of its engineers and experts and by purchase.

One of the Van Depoele trolley patents which had been uniformly sustained by the courts up to last summer has been adversely passed upon by the Court of Appeals for the Second Circuit. This decision was on a motion for preliminary injunction and is not final. The invention was an important contribution to the electric railway art, and no court has questioned its great merit. There is reason to believe that the technical objections to the claims of the patent, upon which was based the decision of the Appellate Court over-ruling that of the Circuit Court in favor of the patent, will be found upon full consideration at final hearing to be insufficient to defeat the patent. In view of the fact that nearly all of the railway companies in the country that would be likely to use the overhead trolley system are now electrically equipped, and that the third rail and underground conduit methods are being rapidly adopted for the important new enterprises, an adverse decision in this case will have but slight effect upon the business of your company. Many other cases based upon patented inventions of great value, including a number on the overhead trolley system, are being pressed against infringers, in which early and, it is believed, favorable decisions are expected.

Your directors desire to express their appreciation of the valuable service of your admirable engineering and commercial staff, as a result of whose ingenuity and vigilance the company has more than maintained its position of pre-eminence in the varied and constantly increasing applications of electricity.

By order of the Board of Directors.

C. A. COFFIN, President.

FIRST VICE-PRESIDENT'S REPORT.

Schenectady, N. Y., April 19, 1898.

C. A. Coffin, Esq., President:

I submit herewith a condensed report of the operations of the Sales Department for the fiscal year ending January 31, 1898:

Total sales (amount billed to customers)	$12,396,093
Cost of goods sold, general expenses and taxes, including sundry losses and allowances for losses	10,896,578
Profit on sales	$1,499,515

From this profit should be deducted debenture interest, etc., as shown in the report of the second vice-president.

I stated in my last report that "the orders actually booked in 1896 were considerably less than the orders secured in 1895." As a result, we entered upon the last fiscal year with less unfilled orders on hand than usual. Our orders during the first six months of the year were far from satisfactory; the second six months showed a very marked increase in orders, and as we were not able to increase our output to such an extent as to fill these orders within the limits of the fiscal year, we enter upon the present year with a larger list of unfilled orders on hand than ever before. "Sales" include the total billed amounts for goods actually shipped. "Orders" include business secured, and become sales only when the material is shipped and billed. Our sales for 1897 are somewhat less than our sales for the previous year, while our orders are considerably in excess of the orders secured in 1896. The following figures are based on orders secured and not on sales:

Lighting Department.—We have received during the past year orders for 60,826 k.w. capacity of arc and incandescent lighting machines as against orders for the year 1896 of 57,476 k.w. capacity, an increase of 5.8 per cent. Among the important lighting contracts secured during the year may be noted the equipment for the new station of the Brooklyn Edison Company and the equipment for the new station of the Boston Electric Light Company.

Railway Department.—Orders received (money value) for railway apparatus has shown an increase of 33⅓ per cent over 1896. Orders for railway generators aggregated over 60,000 k.w. The average size of the railway motor has increased to 34.7 h.p., while the average railway generator for 1897 was 484.3 h.p., as against 356.3 h.p. in 1896.

Among the important railway contracts secured during the year may be noted, the equipment of the Metropolitan Street Railway of New York City, the large motor order for the additional service of the Boston Elevated Railway (Lessees of the West End Street Railway), and the contract for the substitution of electric traction for cable traction on the entire system of the Capital Traction Company, of Washington, D. C. The development of interurban electric railway service has been a marked characteristic of the past year. This is well illustrated in the Cleveland & Lorain, the Akron, Bedford & Cleveland, and the Cleveland & Eastern Roads, each of which is equipped with powerful motors operated at speeds up to, and at times exceeding, 60 miles per hour.

Power and Mining Department.—The growth of business in the class of electrical apparatus handled by this department is strikingly shown by the following comparison of orders received for various years past:

Orders for	1893	were	36	per cent	in excess of orders for	1892
"	1894	"	126	"	"	1893
"	1895	"	10	"	"	1894
"	1896	"	60	"	"	1895
"	1897	"	60	"	"	1896

Orders for direct current and induction motors aggregated 19,531 h.p., as against 15,171 h.p. in 1896. Orders for multiphase generators aggregated 49,902 h.p., as against 25,007 h.p. in 1896. Total transmission lines installed in connection with GE apparatus aggregated 326 miles, as against 232 miles in 1896.

Supply Department.—The supply department has handled 114,229 separate orders during the year, or 43 for each working hour. The "orders received" in 1897 exceeded by 20 per cent those of 1896. The supply stocks carried at our local offices have been decreased about 7 per cent during the year, and of the present total 90 per cent consists of active supplies, a great improvement over previous years.

The following are some of the principal articles handled by the supply department:

Wattmeters.—Total number ordered during the year, 36,874, an increase of 42 per cent over 1896.

Measuring Instruments.—Total number ordered during the year, 3369, an increase of 38 per cent over 1896.

Transformers.—Total number ordered during the year, 11,499, an increase of 36 per cent over 1896.

Arc Lamps.—Total number ordered during the year, 24,158, an increase of 75 per cent over 1896.

Sockets and Receptacles.—Total number ordered during the year, 2,357,629, an increase of 36 per cent over 1896.

Foreign Department.—The orders of the Foreign Department have shown a gratifying increase over the orders for 1896. Several notable contracts have been placed with us by our foreign companies—the equipment of the Central London Underground Railway, and the equipment of the street railways in several European cities.

Incandescent Lamp Sales.—The incandescent lamp orders for the year aggregated 6,857,239, of which 6,706,624 were shipped. This is an increase of about 10 per cent over the year 1896.

The success of the sales department is, in a great measure, due to the administrative ability and untiring energy of the department managers, and I desire to particularly commend their good work to your notice. Respectfully submitted,

EUGENE GRIFFIN, First Vice-President.

THIRD VICE PRESIDENT'S REPORT.

Schenectady, April 19, 1898.

C. A. Coffin, Esq., President:

I submit herewith a report on manufacturing and engineering for the fiscal year ending January 31, 1898:

Manufacturing.—The percentages added by the three factories to their raw material and labor in estimating factory costs have been found ample to cover all items of general expense, including a proper allowance for depreciation. The inventories have been taken with great care and counted and valued item by item. The stock is in excellent condition and covers only apparatus and material for which the demand is constant and active.

The press shop, mentioned in my last report as nearing completion, was finished and occupied early in the year and its use has resulted in economies which more than justify the cost of its construction. It was found necessary to increase our testing, assembling and shipping facilities by adding to our existing building an extension of 36,000 sq. ft. floor space, admirably adapted to the purpose for which it was built. We have added to our Schenectady plant about 87 acres, a portion of which was covered by buildings which we are now using for manufacturing and storage purposes. The growth of our business, together with the demand for electrical machines of increased capacity, has made inadequate our present facilities for the production of iron castings and we are now constructing a new iron foundry containing 94,000 sq. ft., which should be completed during the present year. The demands upon our engineering and drafting force have required increased facilities, which have been provided in a new drafting room, of ample size, thoroughly lighted and complete in all its appointments.

Our increased business in foreign countries has disclosed the fact that in design, cost and efficiency our machinery compares most favorably with that of European manufacturers. Valuable data, drawings, patterns and tools, necessitated by the large amount of special apparatus which we have successfully designed and manufactured in the past, are now frequently available in the construction of new apparatus, thus reducing the cost of developing such apparatus.

Engineering.—The number of undertakings requiring machinery of large capacity and special design has increased materially during the past year. This has been due largely to the application of electricity to the operation of underground, suburban and interurban railroads, and also to the concentration of power in large units due to the demonstrated economy of our three-phase machinery and the rotary converter mentioned in previous reports. A most notable and important installation is that of the underground Central London Railway, which we are equipping with three-phase generators, rotary converters and thirty-two large electric locomotives. Another remarkable undertaking is that of the mammoth new station of the Metropolitan Street Railway Company, of New York. From this station enormous electric generators will operate, through the medium of rotary converters and other machinery of our design and manufacture, the electric street cars throughout nearly the entire Borough of Manhattan.

In my last report I called attention to the value of our rotary converter, a species of connecting link between the alternating and continuous current systems which enables existing continuous current plants to add the advantage of alternating current generation and economical transmission to the simplicity and effectiveness of the continuous current distribution. The economies which thus result from the substitution of a single large alternating current power station for a number of small stations is well illustrated in a notable installation of such apparatus made during the past year by the Brooklyn Edison Company, using our three-phase generators, rotary converters, synchronous motors and other appliances.

The number of long distance transmission plants has greatly increased during the past year, so that we have now a total generating capacity in such plants of over 100,000 h.p., and among these some twenty installations are operating at potentials of over 10,000 volts and transmitting a total of some 50,000 h.p. to distances varying from ten to forty miles. The 5000 h.p. plant at Ogden, Utah, has been in operation for nearly a year, transmitting power to Salt Lake City, a distance of 36½ miles, at a potential of 16,000 volts. We have now under construction apparatus intended for the transmission of over 4000 h.p. from a distant water power 80 miles to the city of Los Angeles, Cal., at a pressure of 33,000 volts. The St. Anthony Falls plant, mentioned in my last report, has been completed and is now in regular operation, furnishing power to the street railways of Minneapolis and St. Paul, Minn. In the city of New Orleans, La., we shall soon have in operation a novel plant of some 4000 h.p., which will be used to operate pumps for the drainage of the city. Three-phase machinery will be employed. The driving of all machinery in cotton mills and factories by electric motors is increasing rapidly, even where the original source of power is a steam engine located in or near the mill or factory itself. The United States Navy is adopting the electric drive in place of steam or hydraulic machinery for ventilating, pumping and hoisting on shipboard and for lowering and elevating guns and for turning turrets on the warships. This is in addition to the recognized use of electricity for lighting and small power work.

We shall soon be operating our Schenectady works from a distant water power. We have contracted for a supply of 2000 h.p. from the Falls of the Hudson River at Mechanicsville, 19 miles from Schenectady. A novel feature of this transmission is that the generators, each of 1000 h.p., have been constructed by us to produce directly a pressure of 12,000 volts, thus saving the cost of the usual intermediate step-up transformers.

Our older transmission plants, such as Portland, Ore., and Fresno, Cal., operated with great success and have largely increased their capacity, demonstrating the advantages of our system and apparatus in the electrical utilization of water powers. There has been a great improvement in the efficiency and quality of our numerous small articles of manufacture, such as arc lamps, transformers, meters, switchboards, etc., many features of novelty and value having been developed by our engineers. Our business in this line has shown a gratifying increase. We have continued to protect our new and important engineering designs as far as possible by application for letters patent.

The efficient work of the factory managers and the unequaled ingenuity, skill and industry of our engineers, are worthy of special commendation. Respectfully submitted,

E. W. RICE, Jr., Third Vice-President.

SECOND VICE-PRESIDENT'S REPORT.

From the report of Second Vice-President J. P. Ord the following figures are taken and comparison made with reports of previous years:

CONSOLIDATED BALANCE SHEET.

Dated Jan. 31.	1895.	1896.	1897.	1898.
ASSETS.				
Patents and franchises ..... Factory plants	$12,059,263	$8,000,000 3,468,002	$8,000,000 3,400,002	$8,000,000 3,400,002
Real estate (other than factory plants)	423,787	453,585	643,016	586,529
Stocks and bonds.....	5,329,011	5,479,332	8,545,796	7,455,873
Notes and accounts receivable	5,508,499	6,584,123	4,578,601	4,537,301
Work in progress	846,291	961,386	517,866	283,832
Inventories	3,913,787	4,219,884	4,034,753	3,860,553
Cash	404,236	879,686	703,484	1,425,875
Miscellaneous, including Ft. Wayne Claims	1,176,666			
Profit and loss.....	14,294,717	13,917,071	12,957,413	11,725,561
Totals	$43,956,257	$43,963,069	$43,380,931	$41,275,526
LIABILITIES.				
Capital stock, common.....	$30,460,000	$30,460,000	$30,460,000	$30,460,000
Capital stock, preferred.....	4,252,000	4,252,000	4,252,000	4,252,000
5 p. c. gold coupon debentures	8,750,000	8,750,000	8,000,000	6,000,000
Accrued interest on debentures	72,917	72,916	66,666	50,000
Accounts payable	421,341	428,153	402,265	263,526
Mortgages.....			200,000	
Reserve for extension to factory plants.....				250,000
Totals	$43,956,257	$43,963,069	$43,380,931	$41,275,526

CONSOLIDATED PROFIT AND LOSS ACCOUNT.

Years ending Jan. 31.	1896.	1897.	1898.
EARNINGS.			
Sales	$12,730,058	$12,540,994	$12,396,093
Royalties and sundry profits	585,609	279,402	128,845
Interest and discount	100,784	88,336	90,371
Dividends and interest on securities owned	320,257	282,144	299,418
Profit on sales of stocks, bonds		79,817	116,356
Discount on debentures purchased and canceled		57,139	14,015
Balance forward	13,917,071	12,957,413	11,725,561
Totals	$27,653,779	$26,285,245	$24,770,660
EXPENSES.			
Balance from previous year	$14,794,717	$13,917,071	$12,957,413
Cost of goods sold	9,860,216	9,691,501	9,241,822
General expenses and taxes, sundry losses and allowances	1,926,819	1,834,419	1,654,757
Patents and patent expenses		349,919	333,335
Interest on debentures	437,500	431,250	333,333
Depreciation of inventories	101,191	50,355	.....
Depreciation of consignments	22,013	10,730	.....
Written off	511,322	.....	
Reserve for factory extensions	.....	.....	250,000
Totals	$27,653,779	$26,285,245	$24,770,660

The three plants at Schenectady, Lynn and Harrison cover about 160 acres of ground, and the total factory floor space of all three factories is, approximately, 1,600,000 sq. ft. All are free from mortgage or other lien.

The three factory plants were valued on Jan. 1, 1897, at $3,400,002. During the year additions were made costing $438,920, and this sum was written off for depreciation, so that the book values of the three plants together remain the same. The book value of the Schenectady plant has, however, been increased $143,000, that of Lynn reduced $93,000, and that of Harrison reduced $50,000 during the year.

Stocks and bonds having a par value of $1,224,650 were sold during the year for $1,038,055, which is $116,356 more than the figures at which they were carried on the books. The cash received from these sales was used toward the purchase of the company's debentures, as stated elsewhere, and none of the money realized from the sale of assets was required for the current business of the year. The policy of the previous three years was adhered to, and sales maintained on a basis of cash or short credit to desirable customers.

"Notes and accounts receivable" are carried in the balance sheet at $662,615 less than their face value, to provide for possible losses. Of the total amount, $3,510,241 are counted as "current notes and accounts," $1,504,874 as "slow notes and accounts," and $184,545 as due from local lighting and street railway properties wholly owned by the company.

None of the estimated profit to be derived from "work in progress" is included in the earnings of the year, and no allowance is made thereon for possible loss.

In making the inventories, raw materials have been valued at the market prices prevailing on Jan. 31, 1898; active selling finished and partly finished apparatus and supplies at factory cost; inactive or slow selling apparatus and supplies at about 50 per cent. of factory cost; obsolete apparatus and supplies at scrap value; and tools, instruments, furniture, etc., at present value. On the above basis, the inventories of the factories showed an excess over book value of $275,097.72, which is not taken as a part of the year's profit, but is retained as a reserve. All other inventories showed a shrinkage from book value of $79,238.39, which has been written off as a loss for the year.

The company has no notes payable, nor is any paper bearing the company's indorsement or guarantee under discount. All purchases have been paid for in cash, and it has not been necessary to borrow money, nor has the company's credit been used during the year by issuing notes, indorsing customer's paper for discount, or in any other way lending its name.

At the close of business on Jan. 31, 1898, there were no unpaid vouchers on hand. The amount appearing in the balance sheet under "accounts payable," $263,526, represents expenditures belonging to the year, vouchered between Jan. 31 and Feb. 26, and is considerably less than the average sums which have to be taken over from month to month.

A New Catalogue

The Pennsylvania Steel Company has just issued its general catalogue for 1898. This handsome and complete book has 375 pages and contains a large number of diagrams of rail sections, special work, frogs, etc., and many engravings showing views of bridges, buildings and structures of various kinds which the Pennsylvania Steel Company has built. The book is a valuable addition to the library of any track engineer, and is an exceedingly creditable publication.

A Brigade of Engineers for War Service

Capt. Eugene Griffin, first vice-president of the General Electric Company, has forwarded to the Secretary of War at Washington a formal tender of his services to the Government in connection with the present war with Spain, and has made a special proposition of the most interesting character. Capt. Griffin suggests that he could probably best serve the Government by undertaking the recruiting and organization of a Volunteer Brigade of Engineers, to number about 3,500 men, who are to be regularly enlisted and commissioned in the service of the United States. The brigade would be composed of three regiments, each organized as follows:

One colonel, one lieutenant colonel, three majors, one lieutenant and adjutant, one lieutenant and quartermaster, six lieutenant, adjutants and quartermasters of the three battalions; one sergeant major, one quartermaster sergeant; twelve companies A to M inclusive, each company officered as follows: one captain, two lieutenants, one first sergeant, five sergeants, seven corporals, seventy-seven privates; total officers and men in each company, 93; total officers and men in each regiment, 1,131.

The brigade will be composed of civil, mechanical and electrical engineers, practical electricians, mechanics, artisans, draughtsmen, and men familiar with all kinds of engineering work, all capable of being rapidly converted into military engineers with proper training.

In his letter to the Secretary of War, Capt. Griffin calls attention to the following interesting statistics concerning the engineer forces of our army during the civil war, this information being obtained from the official records:

"The strength of the Army of the Potomac under Generals Grant and Meade, in January, 1865, was 107,923 men. The Volunteer Engineer Brigade (Benham's) had present for duty 4,390 men, or about 4 per cent of the total—not including the Regular Battalion of Engineers, which was also with the Army of the Potomac, nor the engineer regiment with the Army of the James.

"The strength of the Army of the Cumberland (General George H. Thomas), Oct. 31, 1864, was 76,988, and the engineer troops present for duty were 3,860, or 5 per cent.

"The strength of Gen. Sherman's army in the march to the sea, Nov. 10, 1864, was 60,000, and the engineer troops constituted 4,575 out of the total, or 7½ per cent.

"These were the organizations near the close of the war, when Grant, Sherman, Meade and Thomas had learned by bitter experience the value of the different arms and the best proportions to suit our needs. The experience of all foreign armies confirms these proportions."

Capt. Griffin further says:

"In the contemplated occupation of Cuba, the character of the country and the probability of siege operations against Havana make it obvious that an unusually large proportion of engineer troops will be required. The President has called for 125,000 volunteers. Five per cent of this number, or 6,250, would be a reasonable minimum number to fix as the strength of the volunteer engineers. The proposed Volunteer Brigade is about one-half of this number.

"One regular battalion of engineers, of only 500 men, even if expanded to a war footing of 750 men, is entirely inadequate for such work, and, moreover, considerable numbers are now detached on torpedo work in connection with our sea coast defenses.

The Volunteer Electrical Corps, raised from the employees of various electrical companies, which has been assisting the regular engineer officers in torpedo work at Boston, New York, Philadelphia and elsewhere, has demonstrated the feasibility of using such men in the planting of torpedoes, in the absence of engineer soldiers.

"Detachments from the proposed Volunteer Brigade could, if it be deemed best, relieve nearly all of the regular engineer soldiers, and many of the engineer officers, from their present torpedo duty, and leave the Regular Battalion of Engineers free for service with the rest of the regular army. Such detachments are also capable of installing and maintaining all electrical appliances used in connection with our coast defenses.

"Like the engineer troops of all armies, the proposed Engineer Brigade would be armed and drilled as infantry and would be quite ready to take its place in the line of battle, in case of necessity. The record of our engineer troops in the last war, the good work done on the line of the Fifth Corps in the Battle of the Wilderness, and in other places, shows that the higher technical skill and training exacted of the engineers, detracts in no wise from their fighting capacity. The fact that they must be drilled as infantry, in addition to the necessary technical instruction and train-

ing, makes it specially imperative that the Volunteer Engineers should be among the first troops to be organized, to the end that time may be given for them to reach the highest possible state of efficiency."

Information concerning Capt. Griffin's tender of services for the purposes described having become privately known in engineering circles, he has received so large a number of letters and offers of service from prominent mechanical, electrical, civil and military engineers throughout the country as to make it certain that there will be no difficulty in organizing the proposed brigade with picked men. It is understood that his plan is favorably considered in Washington, and that his offer will probably be accepted, if the laws as they stand at present permit of the raising of such a body of troops from the nation at large.

Capt. Griffin's appointment for a service of this character would be almost ideal in every respect. He has a fine army record. He

CAPT. EUGENE GRIFFIN

was graduated from West Point, in 1875, and was at once appointed second lieutenant of engineers in the United States Army, and was assigned to duty at the Engineering School of Application at Willets Point, where he remained until 1877. During the next two or three years he was in charge of a party of engineers in the United States Geographical Survey, in Colorado, New Mexico, Arizona and Texas, and in 1879-80, in which last year he was promoted to the first lieutenancy, he was in charge of the surveys of Governor's, Ellis, Bedloe's and David's islands, in New York Harbor. From 1881 to 1883 he was adjutant and quartermaster of the battalion of engineers, and instructor in photography, and from 1883 to 1885 was assistant professor of civil and military engineering and the art of war at West Point. In 1885-6 he became aid-de-camp to Major General W. S. Hancock, and chief engineer of the military division of the Atlantic and Department of the East. From 1886 to 1888 he was assistant engineer commissioner of the District of Columbia, having charge, under the commission, of pavements, country roads and all matters relating to electric lighting, telegraph and telephone companies in the City of Washington. In 1887 he was promoted to be captain in the corps of engineers, and resigned his commission on Oct. 5, 1889, in order to take charge of the railway department of the Thomson-Houston Electric Company, which he organized in 1888.

Since his resignation from the army, Capt. Griffin has been one of a small group of able and far sighted men who have organized a great manufacturing business extending to all parts of the world. He is well known in the principal financial, engineering and business circles of Europe and the United States, and his thorough training and special ability in so many important branches of work which a position of such responsibility as that contemplated will involve makes it difficult to see how a better appointment could possibly be made. In common with many other graduates of the Military and Naval Academies, who have resigned their commissions and been engaged in active commercial or engineering work during the last few years, Capt. Griffin will be forced to make serious private sacrifices in again re-entering the army, and as his proposition to the Government is one by which the latter is to be relieved of the expenses for recruiting the brigade, it will be seen that his action is in the highest degree disinterested and patriotic.

When asked about this matter, Captain Griffin said: "I have tendered my services to the War Department and have offered to raise a body of Engineer troops. I can say nothing further till action is had upon my proposition."

Third Rail Electric System

The development and trial of sectional conductor system of the Safety Third Rail Company, whose system was illustrated last month, will undoubtedly be watched with great interest, on account of the new features introduced and the intent of the company to demonstrate the value of its system. The financial policy of the company is to build and equip roads with its apparatus and for this purpose it is contemplating the construction of an extensive factory. In addition to this it proposes to incorporate branch companies to control the territory not easily accessible by the parent company. Exclusive independent rights, it is understood, are not for sale, as the company prefers to retain an interest in its branches.

The United States is to be divided into four sections, and the financial arrangements for promoting this system in Great Britain and Canada are nearly completed. The parent company is capitalized at a moderately small capital, $500,000, most of which is paid in. It is incorporated under the laws of the State of New Jersey and chartered to do business in the State of New York. In its rooms the company has built a miniature railway, to which current is distributed by means of its system, and appliances are provided for making the most exacting tests for the edification of those who are interested. This apparatus is now in operation. The company is ably officered as follows: William M. Keepers, president; David F. Halstead, treasurer; J. McLeod Murphy, secretary. This latter gentleman is also the inventor of the system. Among the prominent stockholders are the following: R. H. Beach, Thomas B. Bissit, George R. McDougal, Algeo F. Ripton, John Renwick, William L. Renwick, Edward L. Jenkins, Francis W. Munn and Alexander Beech.

An Important Book on Track Construction

The Street Railway Publishing Company will shortly issue a treatise on track construction, written by Mason D. Pratt and C. A. Alden. The standing of these gentlemen in the engineering field is sufficient guarantee of the high character of the publication. The selling price of the book will be announced later.

Personals

MR. C. P. COLEMAN, formerly general storekeeper of the Lehigh Valley Railroad Company, has resigned to accept the position of purchasing agent of the Bethlehem Iron Company.

MR. HARRO HARRSEN, who was the private secretary to Mr. Thomas H. McLean while Mr. McLean was general manager of the street railway lines in the City of Mexico, was in New York recently on his way to Toledo.

MR. G. S. JOHNSON, president of the Consolidated Street Railway Company, of Grand Rapids, Mich., was recently in Chicago, investigating some new machinery and looking over electrical plants.

MR. I. FUYIOKA, of Tokio, Japan, president of the Tokio Electric Railway Company, is in America on a pleasure trip. While making a tour of the Continent, however, he will inspect the electric railway systems of the leading cities.

MR. W. H. EDGAR, of the Dearborn Drug & Chemical Company, is on a business and pleasure trip through California and to the Hawaiian Islands. The company has recently been reorganized with a capital stock of $250,000. The officers are: W. H. Edgar, president; Robert F. Carr, vice-president; Charles M. Eddy, secretary and treasurer.

MR. JAMES F. HEYWARD, formerly general manager of the City & Suburban Railway, of Baltimore, Md., has completed arrangements for engaging in business in New York as consulting expert of railway companies, capitalists and investors generally. Mr. Heyward's long experience in street railway management will fit him eminently for such work as he intends to undertake.

MR. R. M. DOUGLASS, secretary, treasurer and general manager of the Schuylkill Valley Traction Company, Norristown, Pa., has recently been elected a director of the Electric Mutual Casualty Association. This company is doing a large street railway insurance business throughout New England and the Eastern, Central and Southern States.

MR. H. H. BOKER, 101 Leipsigerstrasse, Berlin, W., Germany, will be in America during the month of May in the interest of the "Bergische Industrie," a large manufacturing firm having its works at Remscheid, Germany. Mr. Boker will make this trip for the purpose of securing for his company the foreign agencies of American manufacturing companies of electric railway apparatus. Manufacturers of this class of apparatus caring to open negotiations along this line, should address the American agents of the "Bergische Industrie," who are Messrs. Hermann Boker & Company, 101-103 Duane Street, New York.

Mr. THOMAS H. McLEAN, who has just entered on his new duties as president and general manager of the Toledo Traction Company, is one of the ablest and broadest minded street railway men in America. He has had an unusually extensive experience in the street railway field, having been connected for over sixteen years with the Metropolitan Street Railway Company, of New York City, holding the position of general manager when he severed his connection with this company and became general manager of the Citizens' Street Railway, of Indianapolis, Ind. After holding his position in Indianapolis for two and one-half years, Mr. McLean accepted the position of president and general manager of the Ferrocarriles del Distrito Federal de Mexico, the company operating the street railways of the City of Mexico. While in Mexico, Mr. McLean was extremely successful in the management of the street railway lines under his care and succeeded in introducing a number of new operating details, thereby effecting considerable saving in operating expenses. The employees of the Mexican street railway presented Mr. McLean, when he left for the United States, a handsome water-color painting, together with a set of resolutions, setting forth the high esteem in which he was held by his former employees. Mr. McLean has already made a number of changes in operating methods in Toledo, which will tend to engender a better feeling between the employees of the road and the management.

Obituary

MR. REUBEN FRANKLIN BAKER, president of the Columbia City Railway, of Washington, D. C., died recently at his home in Washington. He was sixty years of age, and had long been identified with the business interests of the city where he lived.

AMONG THE MANUFACTURERS

ELMER P. MORRIS, of New York, is receiving many compliments as to his new railway incandescent lamp. This lamp has an exceptionally long life and is guaranteed to be equal to the claims made for it.

HAROLD P. BROWN, of New York City, reports an excellent business in plastic bonds during the last month. A large number of these bonds have been shipped to Ireland, England, South America, Switzerland and Japan, in addition to the regular home trade.

ROBERT A. KEASBEY, of New York City, is sending out a notice to the effect that he has removed his office and store room to 83 Warren Street, where he will carry an extensive stock of coverings, paper, felt, etc., and be prepared to fill all orders promptly and correctly.

P. H. GRIFFIN MACHINE WORKS and the New York Car Wheel Works desire to emphatically contradict the rumor that they contemplate moving their works from Buffalo to Pittsburg, New Castle, or any other place. The works of these companies will remain in Buffalo.

McINTOSH, SEYMOUR & COMPANY, of Auburn, N. Y., have changed their New York office from room 1211 Havemeyer Building to room 1011 of the same building. This company reports an excellent business in engines, and anticipates a number of large orders from street railway companies.

NORMAN & EVANS, of Lockport, N. Y., have one of the best equipped plants in the country for the manufacture of steam merry-go-rounds. Merry-go-rounds are undoubtedly one of the best attractions which can be installed at a pleasure resort, as the first cost is not excessive and the cost of operation is very small.

PAIN'S FIREWORKS COMPANY, of New York City, is sending out an extremely interesting and artistically arranged pamphlet containing large full-page engravings made from photographs showing a few of the large exhibitions of fireworks where Pain's productions have been used.

EDWARD W. CADY, of Washington, D. C., has opened an office at 908 G Street, Washington, where he will practice before the United States Patent Office and in the United States Courts. Mr. Cady has had a long experience in electric patent cases, which will well fit him to care for any cases of this kind which may be intrusted to him.

A. O. SCHOONMAKER, 158 William Street, New York City, reports a good demand for his solid sheet mica segments, which he is prepared to furnish to any pattern and built to any thickness. Each sheet is stamped to full size of segment, thus insuring perfect insulation. He will be pleased to furnish samples to any one wishing to give them a trial.

WARREN WEBSTER & COMPANY, of Camden, N. J., have just been awarded a contract for the use of the Webster system by the Hudson Electric Light Company, Hoboken, N. J., to supply steam heat for eleven model tenement houses, 1500 ft. from power station. This is the largest of recent contracts received by Warren Webster & Company.

THE MURRAY IRON WORKS COMPANY, of Burlington, Ia., have issued a catalogue containing a number of very fine half-tone engravings showing the high-pressure tubular boilers which they manufacture. These boilers are all riveted by the most powerful hydraulic riveters in the country, and are well adapted to the high-pressure work for which they are designed.

THE PATTON MOTOR COMPANY, of Chicago, Ill., is now constructing a large combination car, which will be equipped with the Patton motor. This car will be 50 ft. long over all, and will be divided into three compartments—a power room, a baggage room and a passenger compartment. The passenger compartment will have nine cross seats on each side, with an aisle down the center.

THE WESTERN ELECTRIC COMPANY, of Chicago, has recently opened a branch office in the Security Building, St. Louis, in charge of Irvine S. Jackson, who will devote his entire attention to the business in that city and the surrounding territory. This office will be furnished with every convenience for meeting the large requirements of the trade, both as regards prompt delivery of goods and satisfactory prices.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, of Pittsburg, has just opened a new branch office at Austin, Texas. J. E. Johnson will have charge of the office and of the further extension of Westinghouse business in the southwest. The large contracts which this company has been handling in Mexico and the Texas region have led to the establishment of this new center of electrical trade.

THE JACKSON & SHARP COMPANY, of Wilmington, Del., has on hand at its factory a number of open cars for prompt delivery, and has also shipped cars to Vera Cruz and several other Mexican ports. This company thinks that the prospects for business during the coming season are exceedingly good and feels that its long experience in building street railway cars will undoubtedly secure for it a large part of this business.

THE AMERICAN STOKER COMPANY, of New York City, is about to issue an unusually fine catalogue, which will contain a great deal of valuable information for steam users. No expense is being spared to make this catalogue a work of art in every way. The American Stoker Company has recently moved from the Garfield Building, Brooklyn, N. Y., and is now occupying large offices in the Washington Life Building, New York City.

LAING, WHARTON & DOWN, Ltd., of London, have secured from the Glasgow Corporation, Electric Power Supply Department, an order for a compound, vertical, inverted engine, direct coupled to two Walker generators, each of 300 k.w. capacity. Delivery is to be made at an early date. The generators will first of all be used in connection with a three-wire lighting supply system, and will finally supply power for the operation of a tramway line.

THE WESTERN GEAR COMPANY, of Milwaukee, announces that it has placed its agency for the New England States with Wendell & MacDuffie, of No. 26 Cortlandt street, New York, vice George C. Ewing, of No. 8 Oliver street, Boston, resigned. The New England business will be handled through Wendell & MacDuffie's Boston office, at No. 53 State street, and any orders or inquiries mailed them at that address will receive prompt and careful attention.

THE ILLINOIS STEEL COMPANY, of Chicago, Ill., has issued a very attractive pamphlet, giving a full history of the company from the time of its incorporation to the present day. The pamphlet is handsomely illustrated with full-page engravings and gives a complete description of all the different plans and departments which the Illinois Steel Company now carries on. The pamphlet also contains an interesting description of the different methods of tempering and working steel and other metals.

F. H. NEWCOMB, of Brooklyn, N. Y., has just received an order from the Postal Telegraph Cable Company for supplying that company's entire force with caps of a different color from those formerly worn. The new caps will be sky blue, and this order is an excellent testimonial to the high-grade caps which F. H. Newcomb manufactures. Mr. Newcomb states that he is supplying summer caps to a large number of street railway companies, many of which have for several years bought their caps from him.

THE WESTERN GEAR COMPANY, of Milwaukee, Wis., has moved into considerably larger quarters. This move was necessitated by the large increase in its business, which has grown very rapidly during the past year. It will install new and improved machinery in addition to that which it already has, and expects to have one of the best equipped gear plants in the country. The officers of the company state that the roads using its gears send very flattering reports regarding the service which they are giving.

THE PARTRIDGE CARBON COMPANY, of Sandusky, Ohio, has issued a complete price list of Partridge carbon brushes for Edison, General Electric and Thomson-Houston motors and generators. These brushes have now been introduced extensively throughout this country and have been accepted as standard by a large number of the leading street railway and electric light companies. The Partridge Carbon Company reports a number of good orders received recently for its brushes and anticipates a good business this season.

THE HARRINGTON RAIL BONDING COMPANY, of New York City, has made an arrangement whereby it now handles the Protected and Columbia rail bonds in addition to the Harrington bond. The Harrington Rail Bonding Company is now prepared to take the entire contract for furnishing and installing any of these bonds throughout an entire street railway system, however large it may be. The company has a number of appliances for this purpose, the results of many tests and experiments, and is, therefore, well qualified to design and install work of this kind.

THE LUNKENHEIMER COMPANY, of Cincinnati, O., has issued its new catalogue and price list for 1898. This company makes a specialty of furnishing fittings and valves for steam, water and gas systems. The aim of this company has always been to use only the very best metal in its work, and all its steam goods, such as brass valves, etc., are made according to the United States Government standard of steam composition or gun metal, this fact accounting in a large degree for the satisfaction which these goods always give.

J. W. GORMAN, of 180 Tremont Street, Boston, Mass., has issued a large pamphlet giving a description of the different amusement companies which he controls and which he supplies to street railway companies for park attractions. Mr. Gorman's companies cover a wide range of amusements, and include vocalists, dancers, minstrels, tight-rope walkers, sleight-of-hand performers, and musicians of various kinds. Mr. Gorman has been in this kind of work for a number of years, and so is well qualified to handle this class of business.

THE PELTON WATER WHEEL COMPANY, of San Francisco, Cal., and New York City, has issued a very complete catalogue describing the construction and operation of the Pelton water wheel and showing a number of installations of these wheels. The Pelton system of power offers so many advantages for the general utilization of streams of water, both large and small, that such streams favorably situated for power purposes are now being eagerly sought for and appropriated, and a large number of installations of the Pelton system have already been made.

WILSON, THOMSON & COMPANY, of Brooklyn, N. Y., have received from the Brockton Street Railway Company, Brockton, Mass., a contract for equipping the summer cars of that company with the Wilson patent trolley pole catcher. The Brockton Street Railway Company has already equipped its winter cars with this device, and the order was given to equip the summer cars after a thorough trial. Wilson, Thomson, & Company report that their trolley pole catcher is securing recognition from many street railway companies, and a large number of flattering testimonials are being received.

ARMINGTON & SIMS COMPANY, Providence, R. I., have issued a very attractive catalogue of their high-speed cut-off engines. The Armington & Sims Company are builders of a great variety of sizes and types of engines designed to meet the requirements of any service. In all of their engines materials used are the best of their various kinds, and the workmanship throughout is of the highest quality. All parts are made to gage, and duplicates can be furnished at short notice. This catalogue describes in detail the valves, governors and oiling devices which this company supplies, in addition to the regular line of engines which they carry.

EUGENE MUNSELL & COMPANY, of New York and Chicago, are enjoying an excellent trade in their India and amber "Mica" segments for railway motors. Several heavy orders have recently been received, one of which was probably the largest ever taken for "Mica" segments from an electric railway. It consisted of more than 800 lbs. of the India and amber segments. This firm carries a large stock of "Mica," both in the sheet and cut to size, and has unequaled facilities, both at New York and Chicago, for executing orders promptly. It will take pleasure in sending samples for trial to any electrical manufacturer, repair concern, or street railway who may write requesting same.

WENDELL, FAY & COMPANY, of New York, have recently received an order from the Postal Telegraph Cable Company for supplying their line of uniform cloth for the latter company's entire force. Wendell, Fay & Company have for a number of years supplied all the uniforms for the Postal Telegraph Cable Company, and this order speaks well for the satisfaction which this cloth has given. The color which has hitherto been used for the uniforms of the Postal Telegraph Cable Company has been cadet grey, but the new uniforms will be a sky blue. Wendell, Fay & Company are also filling large orders for their well-known Middlesex cloth for the use of the United States Government.

CHARLES A. BOYD, superintendent of the Walker Company of Cleveland, resigned his position on April 12. He will enter business for himself, doing general engineering work, with offices in the American Trust Building, Cleveland, Ohio. Mr. Boyd has been with the Walker Company for the past four years, starting as engineer in the railway motor department, having charge of design and construction. About three years age he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on Jan. 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has been granted a contract for building a new power house, car barn and several steel bridges for the Port Jervis Electric Railway Company, of Port Jervis, N. Y. The buildings will be of a very substantial character, entirely fireproof, covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron. The bridges will be built girder type, constructed in a substantial manner for carrying the heaviest loads. The Berlin Iron Bridge Company has just completed for the Conway Electric Street Railway Company at Conway, Mass., a steel bridge to carry its electric line across the Deerfield River. This bridge is about 300 ft. in length.

THE ALLEN & MORRISON BRAKE SHOE COMPANY, of Chicago, Ill., has opened handsome offices in the Fisher Building. The brake shoe manufactured by this company is meeting with excellent success. Shoes are now in service on the Atchison, Topeka & Santa Fe, and the Chicago & Northwestern, the Lake Street Elevated, Metropolitan Elevated, South Side Elevated, Chicago City Railway and Calumet Electric of Chicago; Manhattan Elevated of New York, and Metropolitan Railway of Kansas City. Orders are also in hand for many others. This shoe was described in the Street Railway Journal for September, 1897. It consists of a cast frame of soft gray iron, into which is pressed composition of iron borings and mineral cements. The special claims are for long life, minimum tire wear and maximum breaking power.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, announces that it will have a complete exhibition of both switchboard and portable instruments at the com-

ing electrical exposition to be held in Madison Square Garden. The company will show a slate switchboard on which will be mounted a full set of Keystone switchboard instruments suitable for use in central stations, street railway and power houses and in isolated plants. This exhibit will also include a line of ground detectors and instruments designed for series arc light service. Portable testing instruments will also be shown. In connection with this exhibit, the company will have a pair of type "R" instruments mounted on a panel board, showing them in practical service on a working generator circuit. The exhibit will be in charge of Elmer P. Morris, whose office is 15 Cortlandt Street, New York.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, of Philadelphia, Pa., has issued what is probably one of the finest catalogues ever issued by a manufacturer of electrical apparatus. The catalogue contains 222 pages, is bound in heavy cloth, and contains a very large number of half-tone illustrations and several attractive color plates. This catalogue was compiled by Albert B. Herrick, and takes up in a very comprehensive manner the subject of modern switchboards and the appliances used thereon, and it also contains an historical resume of early practices and expedients, indicating the advance recently made in this class of electrical apparatus. The work is divided into eleven chapters, among which may be mentioned Switchboard Construction, Switchboard Appliances, Protective Devices, the Low Tension Switchboard, Railway Switchboard, Circuit Breakers, with their use in Power Transmission, etc.

THE CONTINENTAL IRON WORKS, of Brooklyn, have recently issued a very extensive catalogue, bound in cloth, illustrating and describing the Morison suspension furnaces, which they manufacture. It is claimed for boilers fitted with suspension furnaces that they contain relatively a greater volume of water which acts as a reservoir of heat to be used as occasion demands and aids in keeping the steam at constantly uniform pressure, which is a feature of great importance. It is also claimed for this type of boiler that, by means of the manhole, all deposits and accumulations can be removed with less trouble than in any other type of boiler. The catalogue contains designs and working drawings for boilers from 75 h.p. up to 300 h.p., and also gives the results of a number of interesting tests. The catalogue also contains a number of strong testimonials from users of the boilers manufactured by the Continental Iron Works.

THE MICA INSULATOR COMPANY, whose offices are at New York and Chicago, with a branch at London, England, recently received from one of the large builders of electrical machinery orders for over 5,000 "Micanite" segments of a large pattern (many of which were more than 17 ins. in length), and from another leading manufacturer of electrical apparatus an order for 2,000 segments, also from one of the leading motor builders, an order for 26,000 segments. This volume of business would indicate that this company's "Micanite" segments are meeting with favor among machinery builders. The company claims that its segments are softer and wear down more evenly than mica segments. Therefore, they give better satisfaction. A sample set of segments for any one of the smaller machines will be furnished free of expense to electrical manufacturers or repair concerns who are desirous of demonstrating their value.

THE PECKHAM MOTOR TRUCK & WHEEL COMPANY, of Kingston, N. Y., reports that its business this spring is larger than any time before in the history of the company, and that in order to fill its orders the company is obliged to put on a night crew and run all night as well as day. The company is making shipments abroad to Middleboro, Eng.; Buenos Ayres, S. A.; Bradford, Eng.; Coventry, Eng.; Cork, Ireland; Zurich, Switzerland; Plymouth, Eng.; Dublin, Ireland, also to the following cities in this country and Canada: Dayton, Ohio; Omaha, Neb.; Cleveland, Ohio; Sherbrooke, Canada; Jewett, Ohio; New York City; Cincinnati, Ohio; Jersey City, N. J.; Attleboro, Mass.; Hoboken, N. J.; Indianapolis, Ind.; Auburn, N. Y.; Oakland, Cal.; Salem, Mass.; Hyde Park, Mass.; Newport, R. I.; New Paltz, N. Y.; Fall River, Mass.; Quincy, Mass.; Haverhill, Mass.; Webb City, Mo.; Milwaukee, Wis.; St. Louis, Mo.; Council Bluffs, Ia.; Bradford, Pa.; Joliet, Ill.; Bridgekater, Mass.; Pensacola, Fla.; Pueblo, Colo.; Meriden, Conn.; Lewiston, Maine; Natick, Mass.

THE BETHLEHEM IRON COMPANY, South Bethlehem, Pa., has been given the order for the shafts for the engines which the Metropolitan Street Railway Company, of New York City, will install in its new power house. These shafts are 37 ft. in diameter, 27 ft. 4 ins. long, with a 16 ft. hole through them. They are made of fluid compressed open hearth steel, annealed, and are hydraulically forged on a mandrel. The Bethlehem Iron Company claims to be the only forge in this country equipped for turning out work of this character and magnitude. The cranks will also be made by this company. Notwithstanding the fact that the Bethlehem Iron Company has on its books large orders for finished guns of various calibers, up to 12-ft. gun carriages, and forgings for guns which are to be completed at the various Government yards, the number of orders which it is taking for merchant work, such as shafting of various descriptions, both solid and hollow, and of plain steel, as well as nickel steel, are increasing daily. The products of this well-known concern have a world-wide reputation, as their several contracts for armor plate for the Russian Government prove. This company was recently asked to quote a price on shafting for a Japanese torpedo boat which is being built in Japan.

THE SPRAGUE ELECTRIC COMPANY, of New York, is now installing in Buenos Ayres, Argentine Republic, the first outfit of electric motors for supplying all of the motor power in a factory that has ever been installed in that country. The plant is for a weaving factory, owned by Walker Bailey & Company, and it is to be driven by Lundell electric motors of such power that each motor will drive six machines. The Lundell motor seems to be gaining rapid recognition among the large power users, owing to the fact, it is stated, that it has never lost in competition with other motors at the hands of engineers, and the further fact that it has given invaluable satisfaction during all the years it has been upon the market. One of the largest contracts awarded the Sprague Company recently was awarded by the John Stephenson Company, of New York City. Each of the Stephenson machines will have an independent Lundell motor, and the sizes used will be from 3 to 40 h.p. Some of them will be direct connected, and some of them will be geared. In addition to the power motors, the Sprague Company has secured a contract for exhaust fan outfits. This plant will be one of the largest of its kind, and will employ only Lundell motors. The Sprague Electric Company has recently issued two unusually artistic catalogues, one describing at some length the different types of Lundell fan motors, and the other describing the application of Lundell motors to printing presses.

THE WALKER COMPANY, of Cleveland, O., has recently secured a very handsome and commodious suite of offices on the sixteenth floor of the Commercial Cable Building, 18-20 Broad Street, New York, where its General Sales office will hereafter be located. The suite includes a private hall, general offices, private offices for the officials of the company, and all modern conveniences for the transaction of business. The Walker Company has recently received a number of large orders for its apparatus both from foreign and American companies. Among the foreign orders may be mentioned: 20 double No. 3 S. street car equipments, 3 single No. 3 S. equipments, and 18 double No. S. N. equipments for Paris, besides four 150 k.w. belted generators and 2 generator panels. In addition to this, an order has been received from Bagnall & Hilles, of Yokohama, for two 25 k.w. direct connected generators for Singapore. Among the recent domestic orders received by the Walker Company are the following: Two 150 k.w. three-phase synchronous motors for the Lachine Rapids Power Company; a 700 k.w. alternating single-phase machine for the Buffalo & Niagara Falls Electric Light & Power Company; two 400 k.w. belt-driven generators for the Syracuse Construction Company; one 120 k.w. belted generator for the Northern Electric Company, of Baltimore; four double No. 4—A—S— and two double No. 5—S equipments, besides 250 k.w. direct connected railway generators for the Norton & Attleboro Railway, of Attleboro, Mass. Besides the generators above referred to, the Northern Electric Company, of Baltimore, has ordered 100 Walker arc lamps, making in all 300 in three months. The Walker Company has also recently taken a contract from the Government to supply three disappearing gun carriages for 8-in. rifles. They are to be of the Crozier type, 1896 model.

THE FILER & STOWELL COMPANY, of Milwaukee, Wis., has secured an order from the Worcester & Clinton Street Railway Company, Worcester, Mass., for two heavy-duty engines with cylinders 20 ins. x 42 ins., one 600 h.p. jet condenser and one 600 h.p. heater. The Filer & Stowell Company is also building a 500 h.p. tandem compound, to be direct-connected to generator for the Bluff City (Ia.) Electric Railway Company; a 300 h.p. tandem compound, also for street railway work, for the Warren Electrical Light Company, Warren, Pa. All of these engines are of heavy-duty type, with Filer & Stowell Company's latest pattern, or 1900 style, heavy-duty frame. A 500 h.p. cross compound heavy-duty engine, with surface condenser, has recently been furnished, and is now being erected at the electric

light plant in the city of Jacksonville, Fla. The Filer & Stowell Company is also erecting two single-cylinder engines in the electric plant in the city of Donaldsonville, La., and will soon ship a 24 ins. x 48 ins. Corliss for plant of the Home Electric Company, Baton Rouge, La.; a 14 ins. x 30 ins. for electric light and water-works plant at city of West Point, Miss.; a 24 ins. x 42 ins. Corliss of the Filer & Stowell Company's make has just been started in the elevator of the Export Elevator Company, Buffalo, N. Y. This makes the third engine which the Filer & Stowell Company has furnished to these people within two years. It is now building a 500 h.p. cross compound for the Kimberly & Clark Company, who are large paper manufacturers at Neenah. Kimberly and Appleton, Wis. The Filer & Stowell Company takes just pride in having received this order from the Kimberly & Clark Company, who have been using two engines of its make for about three years and at the same time have been using for a number of years past as many as twelve engines of another manufacture.

New Publications

A History of the Yerkes System of Street Railways in the City of Chicago. 64 pages. Illustrated.

This is a large book, elaborately bound in white and gilt, giving a full history of the Yerkes system of street railways in Chicago from the earliest organization of the first horse railway to the present development of cable, electric and elevated railways of the North and West sides of that city.

Trade Catalogues

Electric Motors in the Art of Printing. Published by the Sprague Electric Company, of New York. Illustrated.

Lundell Fan Motors. Published by the Sprague Electric Company, of New York. 18 pages. Illustrated.

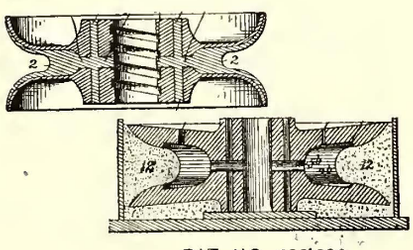
Gorman's Amusement Attractions. Published by J. W. Gorman, of Boston, Mass. 16 pages. Illustrated.

Modern Switchboards. Published by the Cutter Electrical & Manufacturing Company, Philadelphia, Pa. 222 pages. Illustrated.

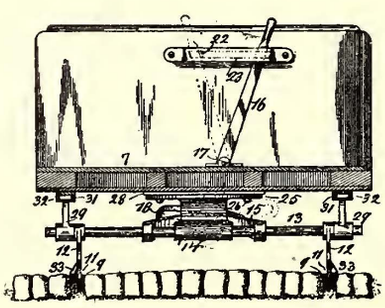
Armington & Sims Engines. Published by Armington & Sims Company, of Providence, R. I. 28 pages. Illustrated.

Morison Suspension Furnaces. Published by the Continental Iron Works, Brooklyn, N. Y. 36 pages. Illustrated.

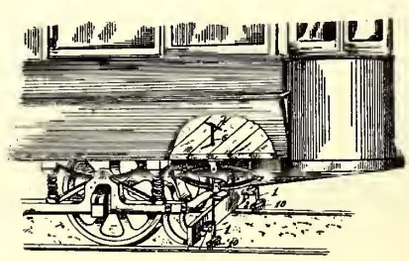
High-Pressure Tubular Boilers. Published by the Murray Iron Works Company, of Burlington, Ia. 12 pages. Illustrated.



PAT. NO. 600,890



PAT. NO. 601,229



PAT NO. 602,081

The Pelton Water Wheel. Published by the Pelton Water Wheel Company of San Francisco, Cal. 98 pages. Illustrated.

Pain's Fireworks. Published by Pain's Fireworks Company of New York. Illustrated.

Self Lubricating Motor Brush. Published by the Partridge Carbon Company, Sandusky, O. 32 pages.

Illinois Steel Company. Published by the Illinois Steel Company, of Chicago, Ill. 42 pages. Illustrated.

Catalogue. Published by the Lunkenheimer Company, of Cincinnati, O. 208 pages. Illustrated.

List of Street Railway Patents Issued

U. S. Patents Issued from March 22, 1898, to April 12, 1898, Inclusive.

March 22.

Trolley Wheel.—Elbert R. Robinson, Chicago, Ill. No. 600,890.

A grooved trolley-wheel comprising integral hub, sides and flanges, formed of one metal and with a deep peripheral groove and offshoots or bores, and a filling of another material cast into the deep groove of the wheel, partly filling the same while leaving the projecting flanges beyond said filling, and into the offshoots or bores to extend said filling to the mounting for the wheel.

Street Railway Car.—Caleb E. Garey and Eli T. Landon, New York, N. Y. No. 601,000.

Automatic Switch.—Percy S. Rogers, Boston, Mass. No. 601,045.

Otrell Car Fender.—Albert W. Routh, Pittsburg, Pa. No. 601,046.

Railway Switch.—Philipp Boch, Long Island City, N. Y. No. 601,050.

Ventilator and Dust Excluder for Railway Passenger Cars.—Geo. W. Garrett, Arkadelphia, Ark. No. 601,054.

Car Fender.—Jacob F. Eisenhower, Lehighton, Pa. No. 601,131.

Car Fender.—Susan F. Moore, Peabody, Mass. No. 601,155.

March 29.

Track Cleaner.—Frank M. Berkellerger, Hyde Park, Ohio. No. 601,229.

In combination with a car-body, a rock-shaft, 13 pivotally supported below the same, bars 12 connected thereto carrying scraper-points at their ends, a lever 15 for rocking shaft 13, a spring, 24, with a normal tendency to elevate lever 15, and correspondingly depressing the scraper-points, an operating-lever for actuating lever 15, a guard within which the latter moves and a notch 22 therein, which normally receives lever 15, thereby holding the scraper-points elevated against the action of the spring.

Car Fender.—George W. Douglas, San Francisco, Cal. No. 601,242.

Actuator for Tramway Switches.—Geo. F. McKay, Boston, Mass. No. 601,271.

Street Railway Switch.—Charles Stadtfield, Dayton, Ohio. No. 601,359.

Safety Buffer Car Fender.—John E. Jones, Kingston, Canada. No. 601,441.

April 5.

Mechanism for Lowering Car Fenders.—Robert Harris, Bridgeport, Conn., and Marcus K. Goldsmith, New York, N. Y. No. 601,751.

Fender for Cars.—Henry Haywood and George Totton, Toronto, Canada. No. 601,961.

Railway Switch.—Edwin L. Jenkins, Orangeburg, S. C. No. 602,014.

April 12.

Track Cleaner.—John Hyde, Trenton, N. J. No. 602,081.

A track cleaner having a guide, a brush hub or slide mounted for axial and rotary movement in the guide and yieldingly held in its depressed position, and an interlocking connection, consisting of axially-disposed grooves or channels in one of said members, one of said grooves terminating short of the others at its lower end and a feather or web on the other member to engage one of said grooves or channels, to maintain the hub or slide at the desired rotary adjustment while permitting upward axial movement.

Car Fender.—Frederick A. Harris, Andrew M. Cupples and Michael McCaan, Tyrone, Pa. No. 602,133.

Electric Block System.—Franz Burger, Ft. Wayne, Ind. No. 602,208.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of fifteen cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.