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Mistakes in Hurried Locations

The selection of the route for an electric railroad, operating over a private right of way, is a matter of immense importance, because mistakes in location will not only constantly affect the operation of a road, but they can never be corrected save by expensive changes in location or large sums spent in cuts and fills. It is surprising, therefore, to see the haste and lack of care in this particular given by many interurban railway companies. In many cases this is explained by the lack of experience which the projectors have had in this field; again, it may be due to a desire to pre-empt the district entered; in any event, it is imprudent and in many instances costly.

After the promoters have decided to build an electric road between certain points, the civil engineer with his party is usually sent out to survey, hurriedly, a preliminary route. Right at this point in the project there is likely to come in a race against time which is all out of proportion to the deliberation shown in connection with other matters of much less importance in the engineering of the road. Of course, quick work on the part of a surveying party is not to be condemned, but it does not stand to reason that in anything but an absolutely level country the best location for a railroad can be selected in a single survey carried on at the record-breaking rates we sometimes hear of. As one civil engineer remarked upon hearing of an unusually rapid piece of railroad surveying: "If I had done as quick a job as that I would be ashamed to tell about it." It is true that interurban lines are sometimes forced to take what they can get in the way of a location rather than what good engineering would dictate. On the other hand, it is quite too easily possible to go over almost any electric interurban line where rapid promotion and construction has taken place and point out numerous places where there is very defective location, or where unnecessary curves or grades have been introduced into the line. It is such mistakes as these that a second and careful survey and study would eliminate. Railroad location is as much a fine engineering art as the selection of motor equipments and location and design of a power station, and, in some respects, errors of judgment in this part of the work are even more fatal to satisfactory financial results than in the electrical engineering. The sooner electric railway companies realize this the better.

The Single-Phase Motor in 1904

In the opinion of a number of prominent electrical engineers, the present year will be known in the future as that of the single-phase motor. From the condition of an industry at the opening of the year it is impossible to tell the developments which the coming twelve months will produce, but it is certain that the single-phase motor, in its several forms, which have attracted so much attention recently, will be given that extended practical test which alone will determine its future. As yet, only one of the large manufacturing companies in this country has announced the commercial completion of this form of traction motor, but it is an open secret that the engineers of the other large manufacturers of electrical apparatus have been engaged for some time upon the development of a single-phase motor of another type, and that a public announcement will be made of it soon, in the form of a paper to be presented before one of the leading engineering societies of the country. In addition, we have the two single-phase motors developed abroad, one in Germany and one in Italy, which have been described in recent issues of this paper; the Leonard system, proposed by H. Ward Leonard, a number of years ago, and taken up by the Swiss engineer, E. Huber, of the Oerlikon Machine Works, and the Arnold combination single-phase pneumatic motor described by the inventor in the last issue of this paper. In this article Mr. Arnold has given dates for the construction and equipment of the Lansing, St. Johns & St. Louis Railway, which seem to indicate that he was the first to equip a commercial electric railway with the single-phase system and to make actual runs over it with a motor of this type. To him and to all who have advocated single-phase systems, in spite of considerable criticism, a great deal of credit is due. We anticipate during the coming year a most interesting competition on merit between all the various motors of the single-phase persuasion, and believe that our readers will find much to interest them in the developments of this new type of equipment.

Electric Road Schedules in Cold Weather

The recent blizzard and the exceptionally cold wave which has prevailed over all of the northeastern part of this country during the last week, have proved very clearly that interurban electric railways possess a number of advantages over steam railways in maintaining their schedules during the conditions which have prevailed. The snow-storm interfered somewhat with the regular operation of cars on a number of the city

systems, owing to the difficulties in the removal of the snow. With roads operating over their own private right of way, however, where the snow can be piled up on either side of the road, there has been little trouble of this kind.

As an instance of the difference of immunity from snow between a steam and an electric railway, we might cite an instance which occurred during the recent blizzard on an interurban road in one of the Middle States. The car, in running through drifts, kept plowing up the snow so that it became packed around the motor in the front end of the car, and was finally forced up through the trap-door over the motor into the car body. It came in so rapidly that the passengers were driven into the rear compartment, while the snow filled up the interior of the car to a height of over 1 ft. above the backs of the seats in the middle of the car. Three men with shovels and others with brooms were required to clear out the hard-packed snow.

Practically every interurban railway company in the Northern States has now, or should have, an efficient snow-fighting equipment. This usually includes several nose or shear plows and one or more rotary snow-plows. As the motors for these plows, and even the bodies themselves, in the case of the nose and shear plows, can be used for other purposes during the spring, summer and fall months, a large amount of extra equipment is not required, and the provisions for fighting snow on an electric road are, consequently, simpler and more complete than on a steam road, where special apparatus has to be employed. In addition there are few track switches to become frozen up, and no locomotive boilers to be chilled by the unusually low temperature, and as the motors will carry a higher load in cold weather than in warm, electric railways are far better equipped for operation under frigid weather conditions than are their steam railroad rivals.

Electric Power on the New York Central

We have already commented on the curious coincidence that the great contract of the New York Central for electric equipment should have been closed on the very eve of the announcement of success in traction by alternating currents. Such things must necessarily happen in the history of any rapidly changing art, as when the advent of the Monitor in the Civil War revolutionized naval architecture. But in the present instance, since the officials of the great railway must have received information of the coming changes, and undoubtedly took the step of ordering direct-current apparatus only after full consideration of the matter in every light, there has been somewhat free criticism of their decision, and a statement of the reasons which led to it would undoubtedly be of public interest. Although the railroad officials naturally do not care to take the public into their counsels in a matter which would have evoked criticism whatever the decision, we understand from an authoritative source that the following considerations carried much weight in the final settlement of the question:

Foremost, we judge, should be placed those larger reasons of policy which must of necessity be considered by a great railroad system. The facts, as they stand, are that the metropolis is now partly and is still being equipped, at expense of very heavy investments, public and private, with electrical rapid transit above, on and under the streets. This service is by a direct-current distribution, so far as all the operating equipment is concerned, and will not be changed over to a new alternating system until there shall be most weighty and conclusive reasons for a change involving so great expense. Whatever may prove to the advantages of alternating-current motors for interurban and long-distance work it is, in our opinion, long likely to remain an open question whether for heavy urban work the alternating-current equipments should displace the existing ones. Now, the New York Central and its immense suburban system is, or should be, an integral part of the great network of communications about New York. It was, therefore, judged unwise to adopt at the present time a system which would prevent free interchange of cars with existing lines when such action should become necessary. With the alternating-current system, as it was developed at the time the decision was made, this could not be done, and the company seemed likely to find itself, with respect to its present neighbors, in much the same position as if it had adopted a 6-ft. gage for its tracks. An interchange of motor trains with the elevated or subway systems of New York City may never take place, but its desirability is a question for the financiers and the operating managers to determine later, not to be settled at the present time by the engineers. At all events, with this possibility in mind the strategic advantage of a direct-current equipment was obvious and convincing, and even if a general change comes subsequently, it will quite certainly be deferred until the useful life of equipment bought now has been in great measure utilized.

Another consideration, we think, must have been strongly felt, and that is the need of prompt action. The railroad stood committed to the public in the matter of a change of motive power in the tunnels. It wished to carry out fully and promptly this public obligation, without taking any chances in the necessarily somewhat slow development of a new system of motive power. However ably such an innovation may be engineeered, and however fully it may be guaranteed as to final results, a complete success on a colossal scale and under exceptionally trying conditions cannot in the nature of things be regarded as immediately certain. We think it greatly to the credit of the railroad officials that they did not attempt to use the impending change as an excuse for protracted delay in meeting a public demand, but took the chances of future loss by re-equipment and went ahead.

Looking at the question in these broader aspects the decision reached is fully comprehensible whatever may be one's judgment as to the purely technical issues. Of these latter the most serious is that of the actual status of the alternating-current apparatus, taking into account the magnitude of the proposed operations and the importance of immediate action. It seemed, therefore, to the responsible officials of the New York Central that for handling the great complex traffic of the system as it exists at the New York terminal, the alternating-current equipment had by no means shown immediate fitness, however hopeful the outlook might be. This position, we must admit, is well taken, in spite of our belief in the commanding future of alternating currents in electric traction. This judgment involves no criticism of the strong advocacy and unqualified guarantees of the alternating system on the part of big electrical companies. It simply voices the fact that alternating-current traction on such a scale is as yet untried, and that the railway system which controls the entrance by land to a metropolis of hard upon 4,000,000 inhabitants is not exactly a conservative place in which to try it.

This decision also sets no precedent as to future extensions of electric power over other parts of the system. Each will be judged by its surrounding conditions, just as the decision to equip the New York terminal was reached in the light of local circumstances. In fact, the section from New York to Croton,

on the Central division, and that to White Plains, on the Harlem division, which are the ones to be equipped with electric power, have been aptly termed a "direct-current zone." Each of these places practically marks the limit of the purely suburban or commuter traffic on its division, and within the zone so delimited the suburban traffic will be cared for by motor-car trains, operated on the multiple-unit system, while the through trains, made up largely of cars from other roads, will be hauled into New York by electric locomotives. This plan, of course, would not interfere with the successful operation in the future of any other "alternating-current zones," and if a change at Croton or White Plains was necessary it could be made as easily from an alternating-current to a direct-current locomotive as from steam to direct eurrent as the present plan contemplates.

Of the specific technical difficulties involved in the change of motive power on the New York Central, and considered by the engineering committee, the most considerable appears to have been the question of working conductors. The space above the cars in the terminals is very limited, the clearance being sometimes reduced to hardly more than 4 ins., while that between the tunnel and the stacks of the locomotives, which must be retained in use during the conversion, is a bare 1½ ins. This renders the problem of safely installing high-voltage working conductors overhead a very troublesome one. If the alternating system were adopted without high-voltage working conductors the gain in economy of distribution within the zone at present to be equipped for electrical traction would be somewhat problematical. If the third-rail plan must be adopted, it is better fitted for continuous than for alternating currents, on account of the considerable virtual resistance to the latter, while to lower the tracks enough to give easy head-room would require the expenditure of at least half a million dollars. Moreover, both the subway and elevated systems in New York are equipped with the third rail, and if the interchange of traffic already hinted at as possible should ever be consummated, the cars must be interchangeable, not only as regards collecting devices, but also with respect to clearances. In other words, an overhead collecting system in the Park Avenue tunnel would involve clearance problems for the interchangeable Interborough cars in the subway which would be as serious at least as those over which the Central engineers themselves had direct control. It is, of course, possible that means of dodging the space difficulty could be found, but granting this, there would still remain a troublesome question as to relations with abutters in case of the installation of an overhead conducting system on the Park Avenue viaduct. In the tunnels and on this viaduct a third rail forms by far the simplest means of getting power, although in the yards an overhead system seems to be necessary. It is most unfortunate that these difficulties of overhead construction should exist, since they tend to obscure the real issue between alternating-current and direct-eurrent apparatus, and because we consider adherence to third-rail practice a hindrance to the development of large work in electric traction. When the third rail is so arranged as to permit operation at high voltage or safe operation at any voltage it becomes a lateral or overhead conductor, and eeases to be a rail. The hooded third rail meets the requirements of safety fairly well, but even it is objectionable on lines with grade crossings. However, in the case in hand constructural difficulties exist and must be taken into consideration.

The other technical reasons which are understood to have entered into the New York Central decisions were the greater weight of alternating-current locomotives, supposed to offset the advantages in distribution; the greater cost of maintenance of alternating apparatus and equipment, particularly in gearing, and the greater depreciation of value of the alternating apparatus when discarded for change in the art, as compared with the more saleable direct-current equipment. It might be desirable to take these up seriatim and consider the effect which each had on the ultimate decision.

In considering the greater weight of the alternating apparatus the fact should be borne in mind that the conditions on the New York Central differ materially from those of some other installations in which electric locomotives have been used. The specifications call for locomotives capable of making a maximum of 75 m. p. h., which, with the trains to be hauled, is equivalent to an average effort during acceleration of 2500 hp. The direct-current locomotive selected has a weight of 85 tons, which is in excess of that required for traction purposes, so that, other things being equal, additional weight to the locomotive, as required by the alternating-current equipment, would be a detriment instead of an advantage. The question of relative depreciation between direct-current and alternating-current equipment is one which can be determined by experience only. Without intending at all to detract from the admitted advantages which alternating-current motors possess over direct-current motors in many particulars, it must be admitted that the design of the motor is such as to call for better insulation, and, hence, greater care in maintenance. Moreover, in the New York Central equipment the direct-current motors adopted are of the gearless type, whereas the submitted designs of the alternating-current locomotives were of the geared type, so that the question of the wear of the gears alone might have made a considerable difference in the total maintenance account of the propositions.

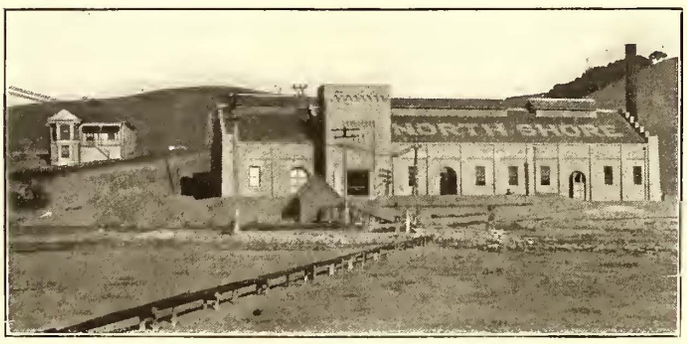
The final consideration, viz., the supposedly greater depreciation due to change in the art, is one upon which there may be considerable difference of opinion. As a rule, in the past, antique electrical apparatus has had a saleable value in inverse ratio to its seniority of design. It should be remembered, however, that direct-current apparatus has now become so standardized that future machines of this type will probably not differ greatly in design from those used at present. For this reason, unless we consider the entire direct-current system as one which is rapidly becoming obsolete for traction work, motors of this size and type will have a usable value for some considerable time to come. On the other hand, alternating-current motor history is being rapidly made, so that it is not unlikely that motors of this size might become antiquated more quickly than their direct-current counterparts.

These, at least, are technical arguments for the adoption of direct-current apparatus, which are reported to have affected the final decision, and which, consequently, are worthy of consideration. If to them we add the larger arguments, based on the general questions of policy and local conditions referred to above, we are inclined to believe that thinking engineers and managers will endorse the judgment of the engineers of the great road in their decision in favor of direct-current working. If the future shall prove that they have underrated the as yet undemonstrated powers of the new alternating-current systems they will, at least, have erred on the side of caution, and will already have promptly and faithfully discharged their obligations to the public.

ELECTRICAL EQUIPMENT OF THE NORTH SHORE RAILROAD FROM SAN FRANCISCO TO SAN RAFAEL—II

POWER SUPPLY

The railroad receives its power supply at the standard direct-current railway potential of 550 volts, from a main power station at Alto, a little over 4 miles north of Sausalito, and from a motor-generator sub-station at the San Rafael terminus. The Alto power house is designed to receive three-phase current at



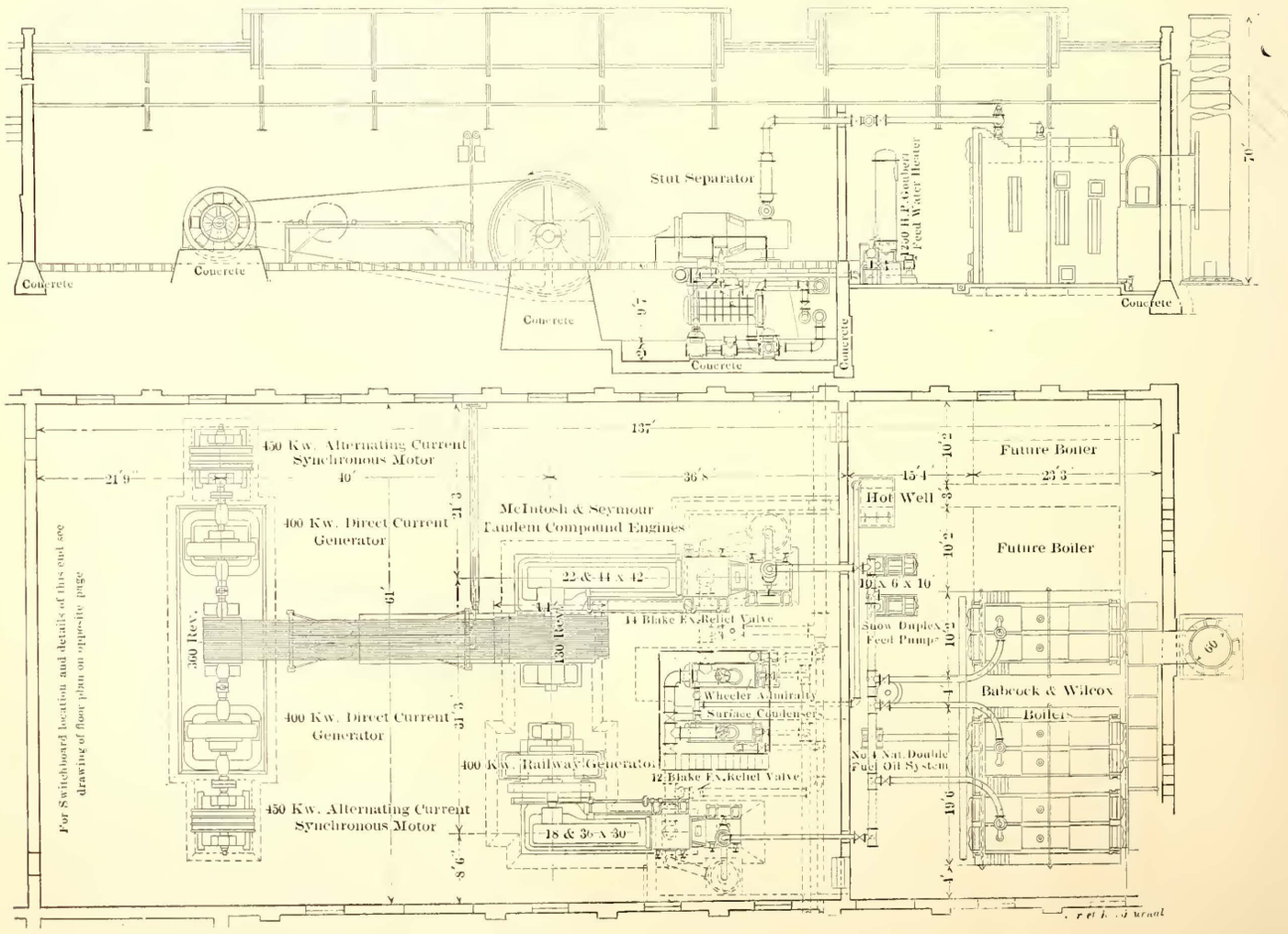
ALTO POWER HOUSE, RETURN TRACK FEEDER IN TROUGH IN GROUND

50,000 volts from the transmission lines of the Bay Counties Transmission Company, and after transforming it down to 4500 volts, to convert it to the direct-current railway voltage, by means of two motor generator sets. To serve as both reserve and auxiliary plant a modern steam equipment has been installed, consisting of a direct-connected, direct-current railway generator unit, and an engine connected by means of rope drive to the motor-generator sets, so as to operate the inductor alternators of these sets to supply alternating current to the transmission line when necessary. This latter arrangement has been made so that the North Shore station may be used as a steam reserve for the Bay Counties system, supplying power, in case of a shut-down on the high-tension system, to the California Central Gas & Electric Company, which is the distributing sub-company of the Bay Counties system in the vicinity of San Rafael and Sausalito. That this arrangement is a beneficial one to the Bay Counties system has been demonstrated many times since the Alto power house was started up, as it has enabled the management to cut off the main supply from this part of the State during certain parts of the day, thus affording opportunity for repairs or new work without shutting off the supply to customers in this section. It is also interesting to note that the Alto power house is the terminus of the longest transmission line of the Bay Counties system, it being 180 miles from the power house at Colgate. Power has been occasionally transmitted over longer distances by this company, but it has been by connecting with the lines of the Standard Electric Company.

MAIN POWER HOUSE

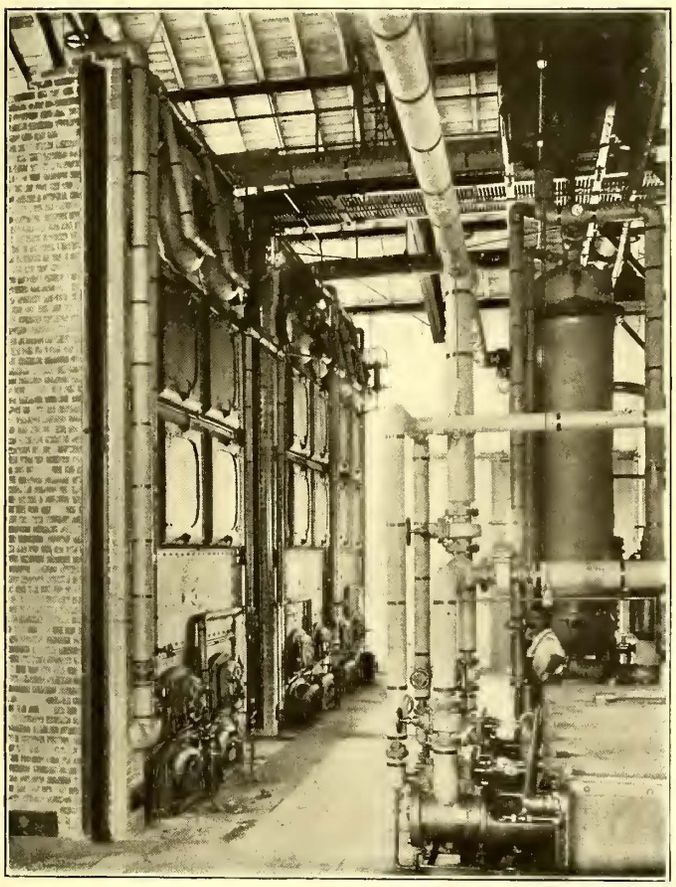
The Alto power station is situated on the side of a hill close to a salt-water marsh and lagoon, which connects with San Francisco Bay. Water for condensing purposes is thus convenient, and a short siding, connecting with the main track, affords facilities for delivering material and fuel.

The building was designed by Dodge & Dolliver, architects, San Francisco, and is constructed of brick, with steel roof trusses and slate roof. The general dimensions of the building are 61 ft. x 171 ft., and it is divided by cross partitions into a storage battery room, 35 ft. x 61 ft.; an engine room, 98 ft. x 61 ft., and a boiler room, 38 ft. x 61 ft. A three-story high-tension

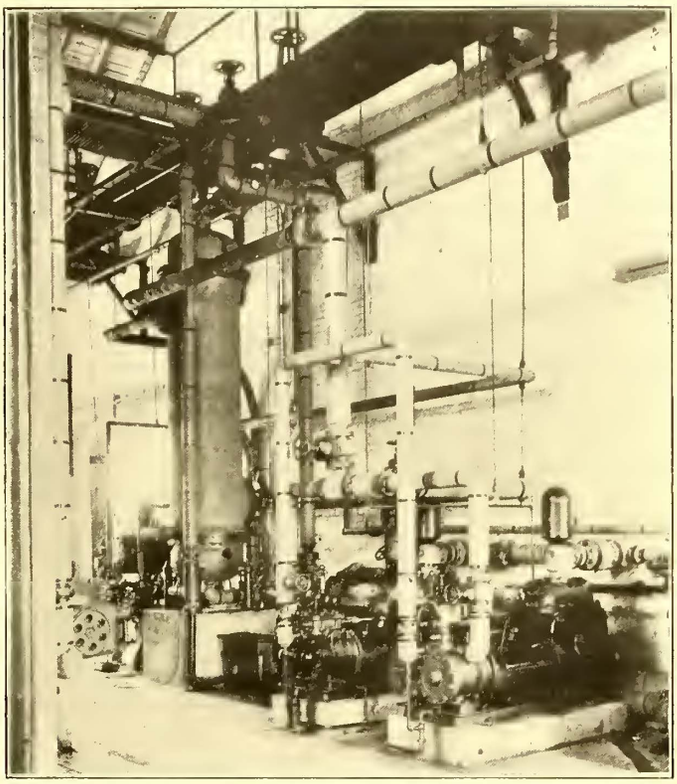


PLAN AND SECTION OF POWER HOUSE

tower, with interior dimensions of 10 ft. x 20 ft., adjoins the engine room at its northwest corner. There is a clear height below roof trusses of 19 ft. in the engine room, and of nearly 23 ft. in the boiler room, thus providing excellent ventilation. The floors consist of a 6-in. layer of sand and a 6-in. layer of concrete. In the engine room on top of the concrete has been laid a select tongued and grooved 1½-in. floor with an oil finish. In the high-tension tower and battery room the flooring consists of vitrified brick laid on edge. The battery room has a wooden truss roof supported by a center row of 12-in. x 12-in.



BOILER ROOM



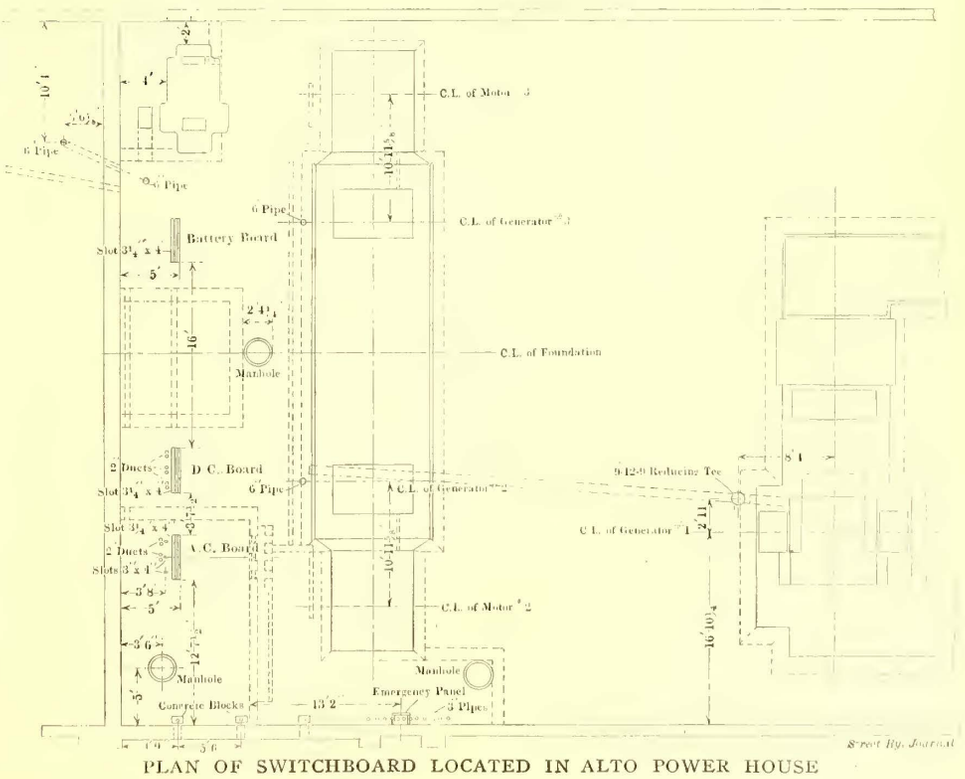
BOILER FEED-WATER PUMPS; FEED-WATER HEATERS, AND FUEL-OIL CIRCULATING PUMPS IN POWER HOUSE

posts. The roof of the high-tension tower is composed of 3-in. terra-cotta book tile, and the partition walls in the tower are also constructed of terra-cotta tile. The walls of the building are 1 ft. 5 ins. thick. The general arrangement of the power plant and important details are shown in diagrams and half-tones reproduced herewith.

BOILERS

Owing to the use of crude oil as fuel the boilers are set facing the engine room, thus placing the boiler room under the direct observation of the engineer, and, at the same time, providing space in the rear of the boiler room for the later addition of fuel economizers, should this prove desirable.

There are three Babcock & Wilcox water-tube boilers of the vertical-header type, each containing 2646 sq. ft. of heating surface, and consisting of twelve sections of twelve 4-in. tubes, 16 ft. long, and two steam and water drums, 36 ins. in diameter. Two of these boilers are set in one battery, and the third is set singly, with provision for later increase in boiler capacity. There is a nominal capacity of 800 boiler horse-power to take care of 1600 ihp on the two engines at rated load. The boilers are fired with crude oil, and are equipped with the latest marine oil furnace designed by the Babcock & Wilcox Company. The bridge wall is moved to the rear of the boiler, giving the furnace a length of about 10 ft. The burner is put in from the front of the boiler and reaches clear to the bridge wall, whence it points forward, discharging its flame toward the front of the boiler, contrary to the older practice in firing fuel

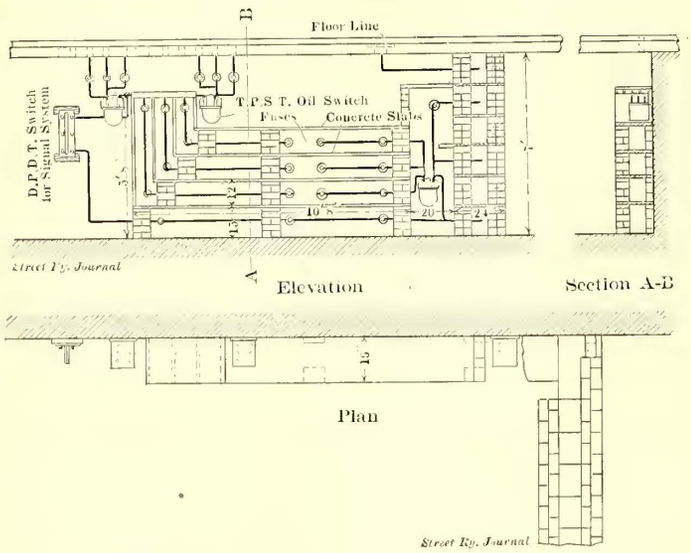


PLAN OF SWITCHBOARD LOCATED IN ALTO POWER HOUSE

oil. By means of this arrangement not only is there obtained an increased efficiency in combustion, but also a uniform distribution of flame over all the lower row of tubes exposed to the furnace, greatly increasing the boiler capacity and removing the danger of burning out of tubes.

CONDENSING SYSTEM

There are two Wheeler "Admiralty" surface condensers, each mounted over combined direct air and circulating steam-



BARRIER FOR FEEDERS, ALTO POWER HOUSE

driven pumps. The condensers contain respectively 1800 sq. ft. and 900 sq. ft. of cooling surface, and have respective rated capacities of 18,300 lbs. and 9500 lbs. of steam per hour.

Salt water is used for condensing purposes, it being impounded at high tide by means of a flood gate in a reservoir above the power house. Condensing water is pumped from this reservoir and discharged by a flume and canal to the upper end of the reservoir. During high tide the hot-water is discharged below the dam, and a new supply of cool water is impounded. The difference in elevation between tides being from 5 ft. to 6 ft., and high tide coming about every 11 hours to 13 hours, afford a very convenient and inexpensive method of obtaining cool condensing water.

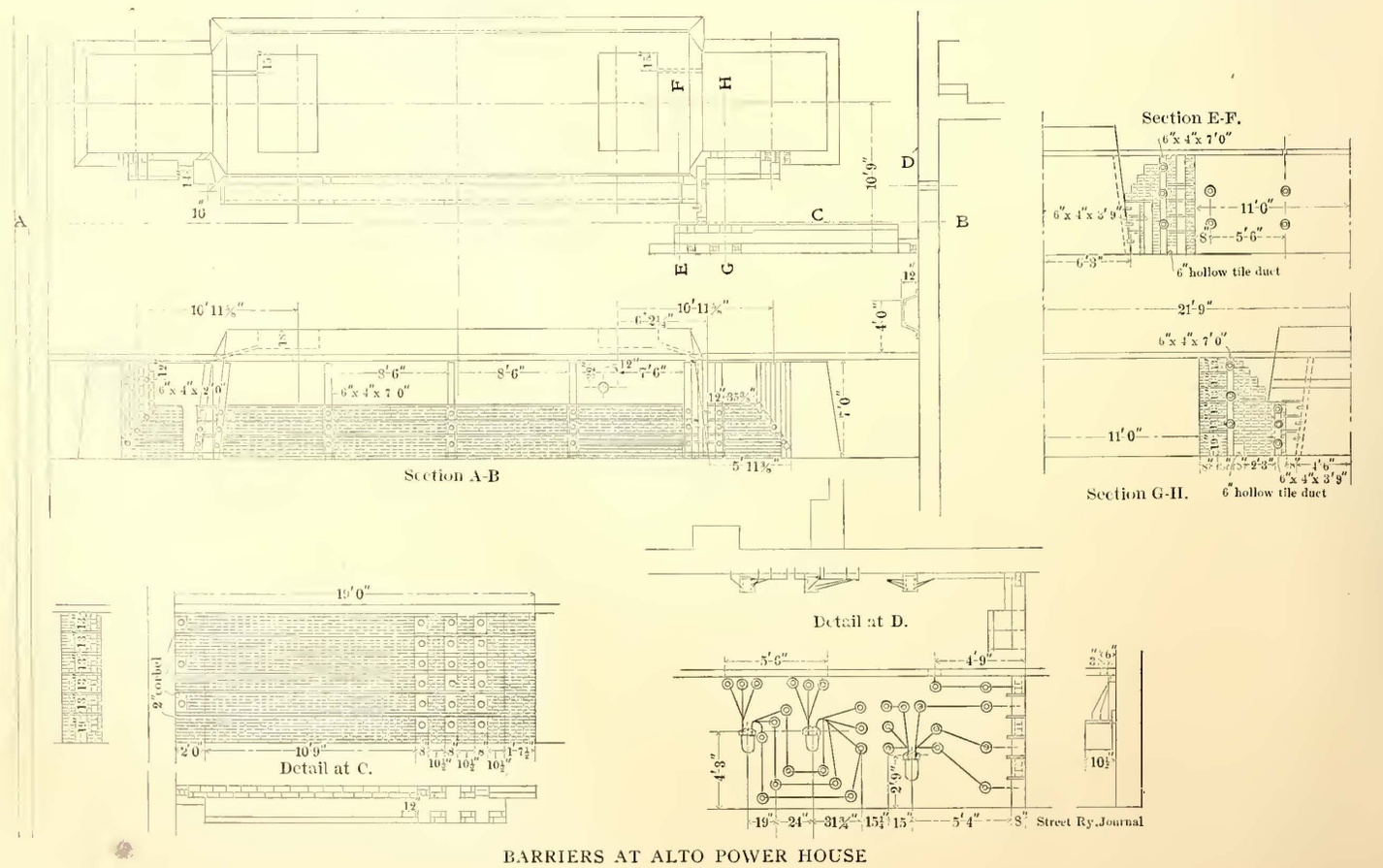
STEAM AUXILIARIES AND PIPING

Owing to the fact that there is no lift on the circulating pumps, except the pressure necessary to overcome friction in the piping, the steam consumption of auxiliaries is comparatively small. All of the auxiliary exhaust steam, including trap discharges from the reheater receivers, is led to a vertical Goubert auxiliary feed-water heater, having 400 sq. ft. of heating surface on a rated capacity of 1200 boiler horse-power. Water is fed from a hot well and enters boilers at a temperature of about 190 degs.

It is thus seen that the amount of exhaust steam is comparatively small; it is all condensed in the feed-water heater and the heat is returned to the boilers. At no time is exhaust steam visible from the exhaust pipe leading from the auxiliary feed-water heater to the atmosphere. It is, therefore, evident that the actual fuel cost of the steam to drive the auxiliaries is but a small fraction of the total steam supply to the auxiliaries, on account of utilization of all of the exhaust steam. Under these circumstances the economy of the plant, probably, could not have been increased had electrically-driven auxiliaries been installed. All steam condensed in the feed-water heater is drained to the filtering hot well and returned to the boiler feed.

There are two Snow 10-in. x 6-in. x 10-in. duplex boiler feed pumps. One pump is of ample capacity to operate the entire plant, leaving the second pump as reserve. Fresh water is piped about 2 miles from Mill Valley, and is stored in a 50,000-gal. tank outside the power house.

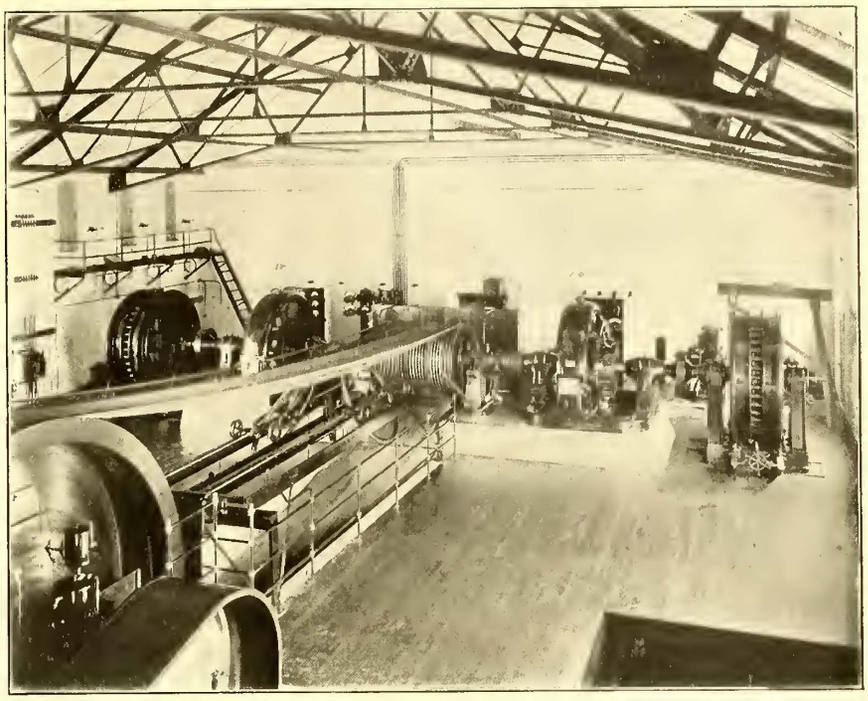
Mounted on the throttle valve of each engine is a vertical Stuts separator. These separators are of neat design, and, while having considerable receiver space, are still of light weight, owing to their special construction. The steam is led in a roundabout course through the central pipe through the bottom of the separator. In addition to the action of centrifugal force in separating steam and water, steam is caused



BARRIERS AT ALTO POWER HOUSE

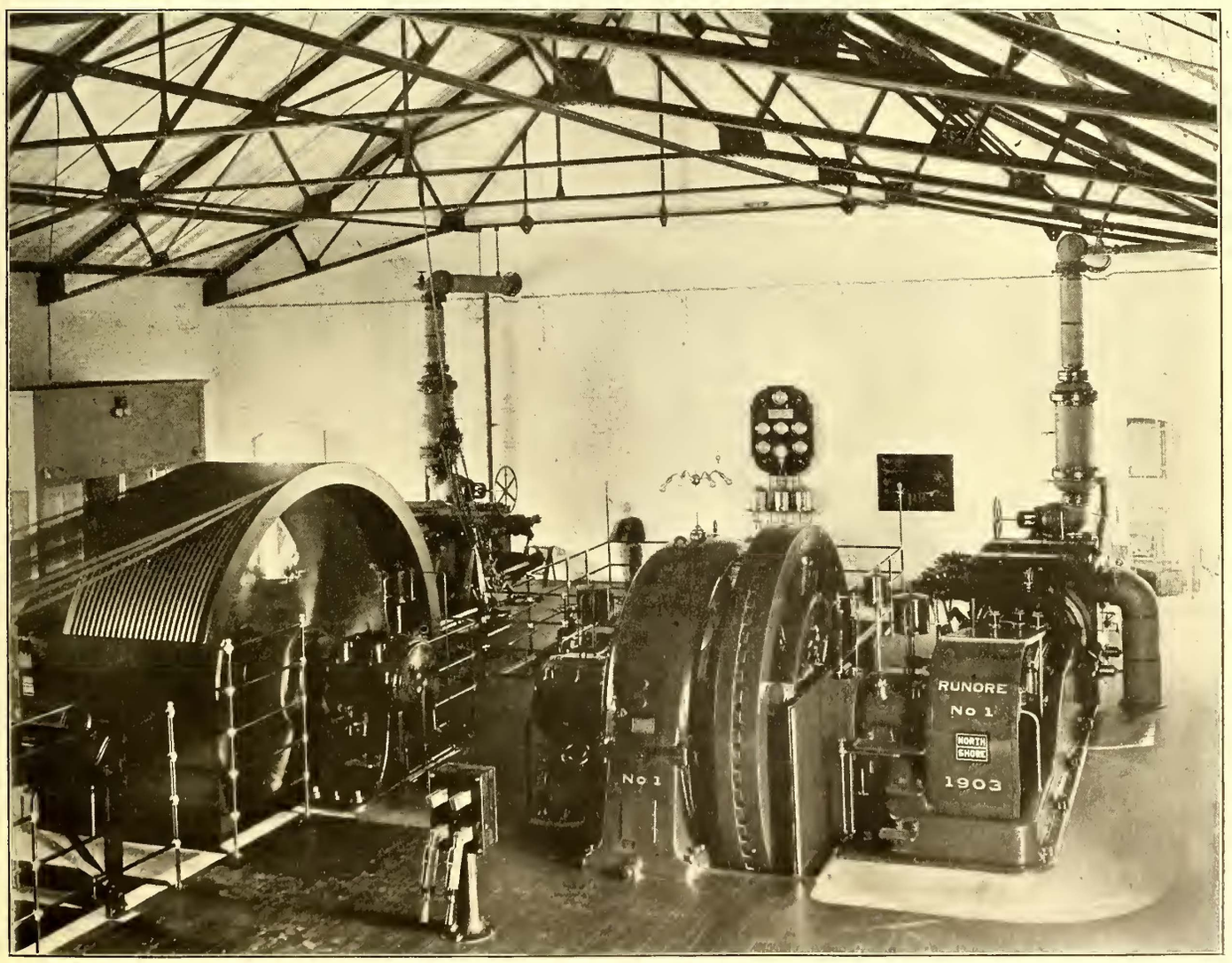
to pass through two sets of long, narrow slots, making it practically impossible for any large body of water to pass into the engine cylinders.

The fuel oil circulating system is that of the National Supply Company, of Chicago, and consists of two 4½-in. x 2¾-in. x 4-in. Snow pumps, mounted on a cast-iron stand of substantial construction. Mounted above the pumps and oil heater is a receiver of ample capacity, which utilizes the exhaust steam from the pumps for heating the oil before passing to the burners. There is also provided a pump governor to govern the speed of the pumps, so as to maintain a constant oil pressure. The relief valve, set at a pressure slightly in excess of the working oil pressure, has a safeguard to operate in case of failure of the pump governor. The whole system is neatly arranged and piped with all necessary drips, drains, etc. Oil is stored in a 70,000-gal. tank outside of the building, from which it is pumped under suction by means of the pumping system. It is found necessary in the colder weather to heat the oil in the main storage tank by means of a steam coil; the steam pipe from the power house being run along beside the main suction piping, so that the heat is maintained in the oil on its way to the oil pumps.



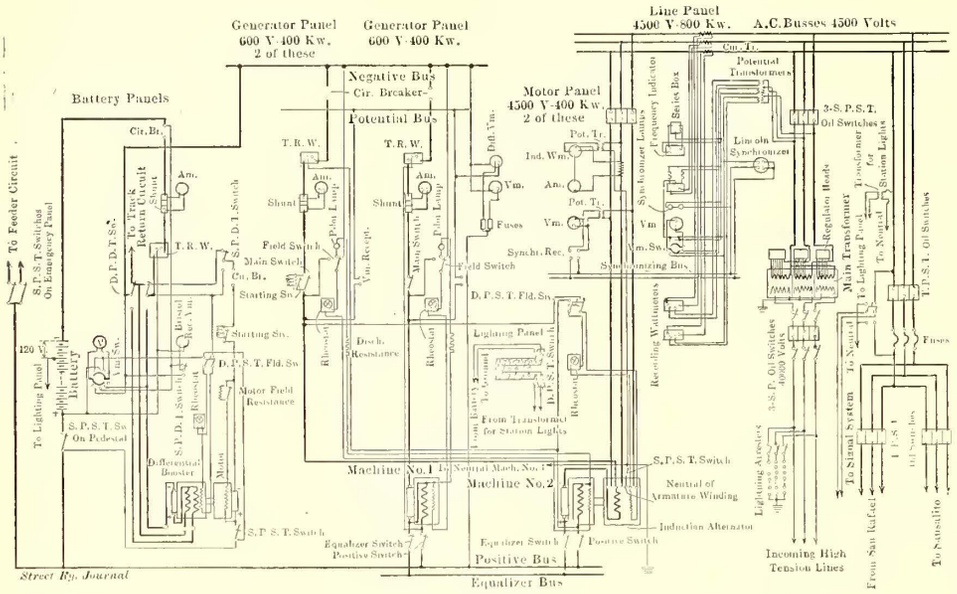
MOTOR GENERATOR SETS, ROPE DRIVE, SWITCHBOARDS AND WIRING IN MAIN POWER HOUSE

The arrangement of piping is shown in the illustrations and drawings. Chapman straightway double-seated gate valves and Chapman flanges are used throughout. All fittings are of special thickness, designed for 150 lbs. pressure. Long-radius bends are used wherever possible for flexibility and to reduce friction.



DIRECT-CONNECTED RAILWAY UNIT AND ENGINE WITH ROPE DRIVE IN MAIN POWER HOUSE

In each boiler branch there is, in addition to one Chapman gate valve, one Pearson automatic steam check and stop valve. This valve is so adjusted as to open only when the pressure in the boiler is in excess of the working steam pressure, and to close whenever the pressure in the boiler is reduced below the working pressure, making it unnecessary to operate the valves by hand whenever putting boilers in or out of service. The valve can also be closed down by hand, serving as a boiler stop valve, thus giving in effect two valves in each boiler branch, which can be closed whenever it is necessary to open up or clean the boilers.



WIRING DIAGRAM, ALTO POWER HOUSE SWITCHBOARD

The exhaust piping is so designed that either one or both engines can be operated condensing or non-condensing, also so that either one or both condensers may be used at the same time, or independently.

There is provided in the exhaust line from each condenser a Blake automatic exhaust relief valve, which is designed to open the exhaust passage automatically and quickly to atmosphere whenever vacuum in the condenser is lost.

All piping above 4-in. diameter is flanged. All valves 2½ ins. and larger have flanged ends, so as to be easily removed should occasion require. The piping is well supported and anchored at critical points to prevent vibration. An iron platform is provided for easy access to the steam header and valves on the steam branches.

On account of the slight draft required when burning fuel oil, there is provided a short-guyed stack of steel construction. This stack is 60 ins. in diameter and 70 ft. in height, and while its rating when burning coal is comparatively small, it will easily develop a boiler capacity considerably in excess of the requirements when burning fuel oil. It has been found on the Pacific Coast that under ordinary conditions stacks will develop with oil from two to three times the boiler horsepower given by "Kent's" rating when burning coal.

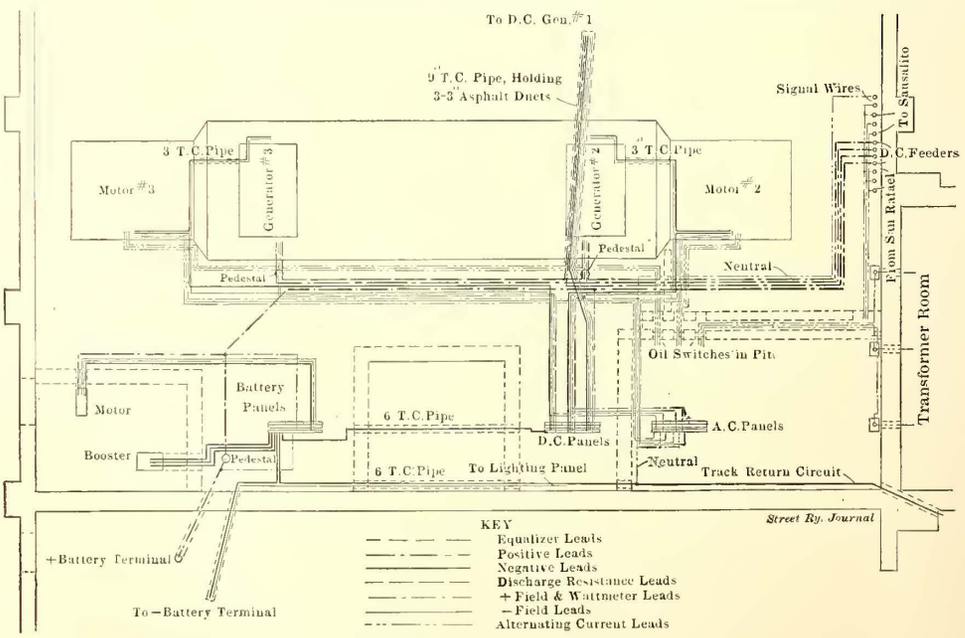
ENGINES AND GENERATORS

The direct-connected railway unit consists of an 18-in. x 36-in. x 30-in. horizontal tandem-compound condensing McIntosh & Seymour engine, driving a 400-kw Stanley railway generator. With steam at 150 lbs. pressure, and when running at 150 r. p. m., this engine will develop 600 ihp at .23 cut-off. It is guaranteed to develop 1 ihp at economical load with 14 lbs. of dry steam, 26 ins. effective vacuum.

The other engine is a 22-in. x 44-in. x 42-in. horizontal tandem-compound condensing McIntosh & Seymour engine, arranged with a grooved wheel for rope drive. This engine has a rated capacity of 1000 ihp, and is guaranteed to develop 1 ihp at economical load with 13 lbs. of dry steam, 26 ins. effective vacuum.

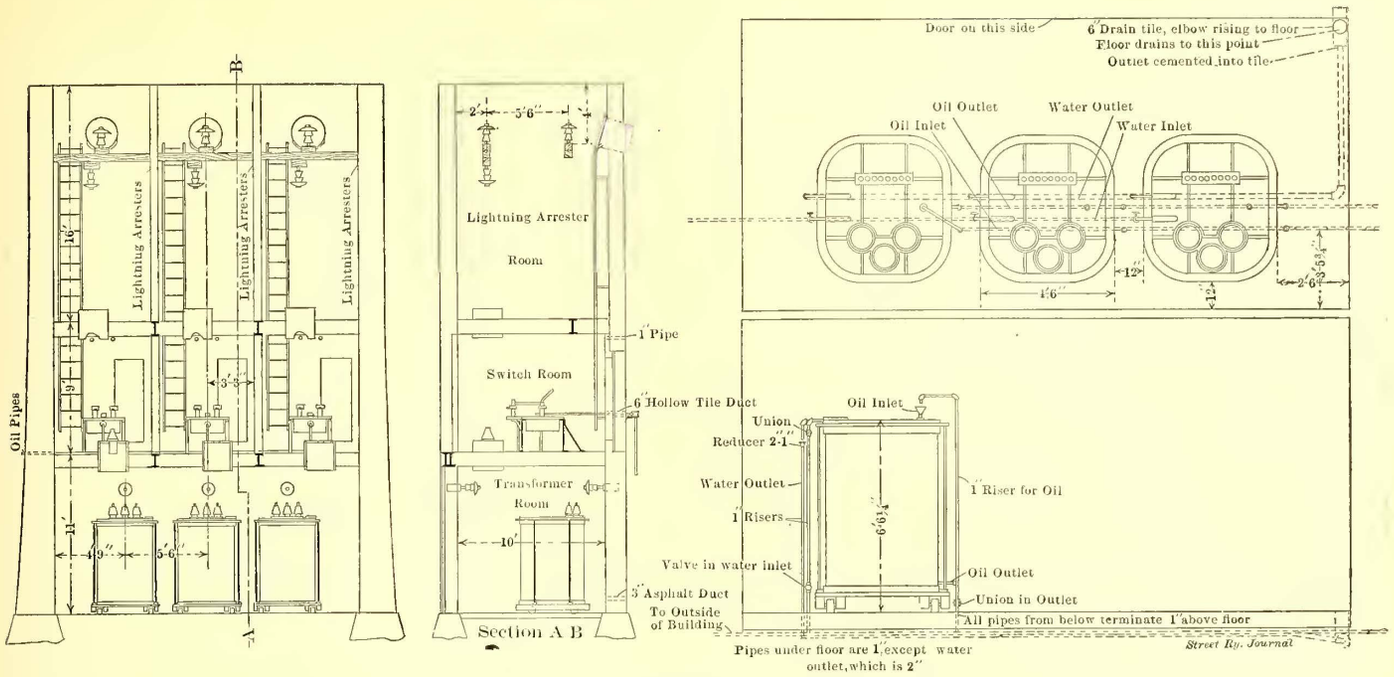
Both engines are built to withstand safely a continuous overload of over 50 per cent, and temporary overloads of from 75 per cent to 100 per cent. The high pressure cylinders of both engines are jacketed, and there are also supplied with each engine superheating receivers of large capacity between the high-pressure and low-pressure cylinders. About 10 per cent of the amount of steam required by each engine is condensed in reheater coils and returned to the feed-water practically at a temperature of the water in the boilers, thus adding to the economy of the plant.

The speed of each engine is controlled by means of a powerful shaft governor, situated in the fly-wheel. The governor operates a shifting eccentric to which are connected the auxiliary steam valves on both high-pressure and low-pressure cylinders. The main distribution valves on both cylinders are connected to a fixed eccentric, as are also the main exhaust valves. As the load changes the cut-off is varied alike on both cylinders, maintaining at all times an equal division of the work between high-pressure and low-pressure cylinders. The valves are of the quick-opening grid-iron type, giving a large port area as well as a minimum clearance. Each engine is fitted with an automatic lubricating system, delivering a supply of oil to all wearing parts under pressure.

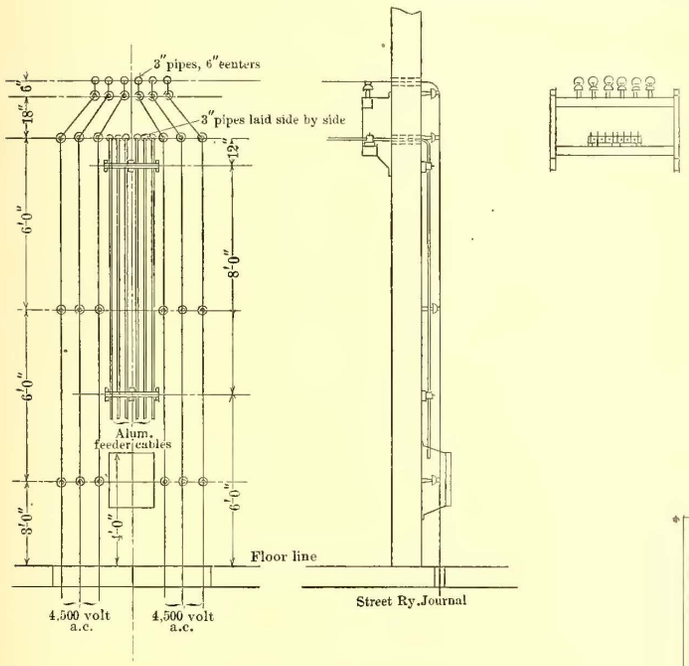


WIRING PLAN OF ALTO POWER HOUSE

A feature of special interest is the use of McIntosh & Seymour compound-delaying dashpots on the larger engine that



ARRANGEMENT OF APPARATUS IN TOWER AT ALTO



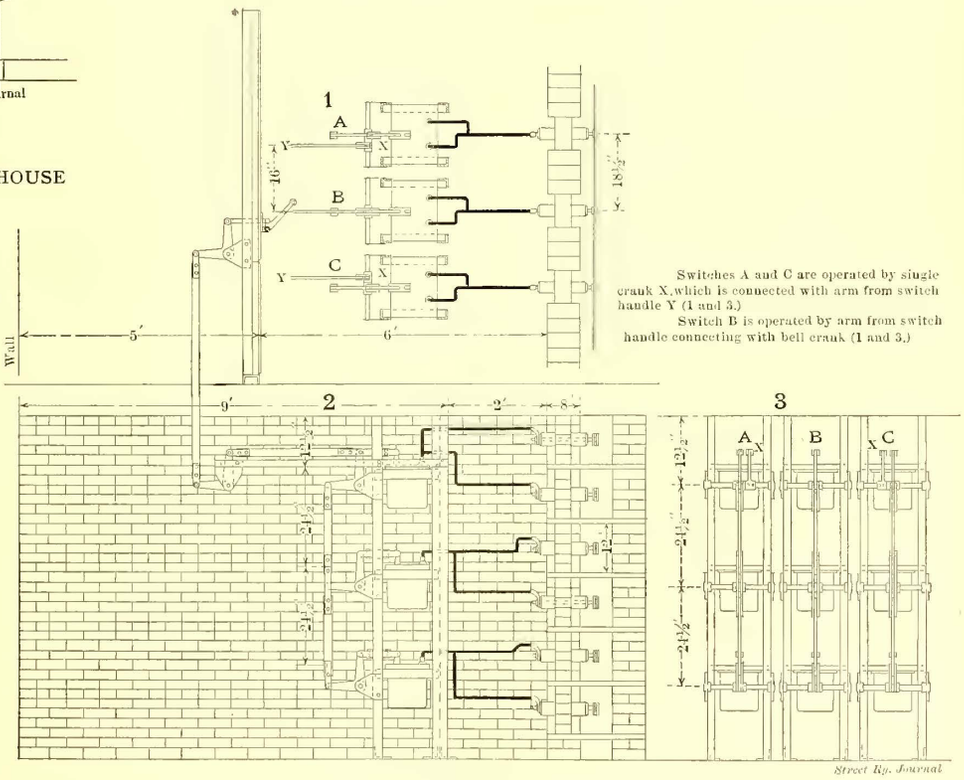
CABLES LEAVING POWER HOUSE

drives the motor generator sets. This comes into play when synchronous motors are driven as alternators in parallel with the transmission circuit. At each end of the main dashpot there is an auxiliary dashpot which is so adjusted as to require a certain interval of time before the governor can respond to any change of load. As a result of this the governor is practically locked against any tendency to surge or hunt when operating in parallel with transmission or other circuits, and successful parallel operation is easily accomplished.

The rope drive connecting the larger engine and the motor generator sets consists of twenty-four 1¾-in. manila ropes, installed as two independent transmissions of twelve ropes each on the American system. To prolong the life of the ropes there is furnished for each half of the system a rewinder sheave, running loosely on the driver shaft. The tension carriage moves horizontally on an angle-iron frame between engine and motor generator sets. This system is installed with about 35-ft. centers.

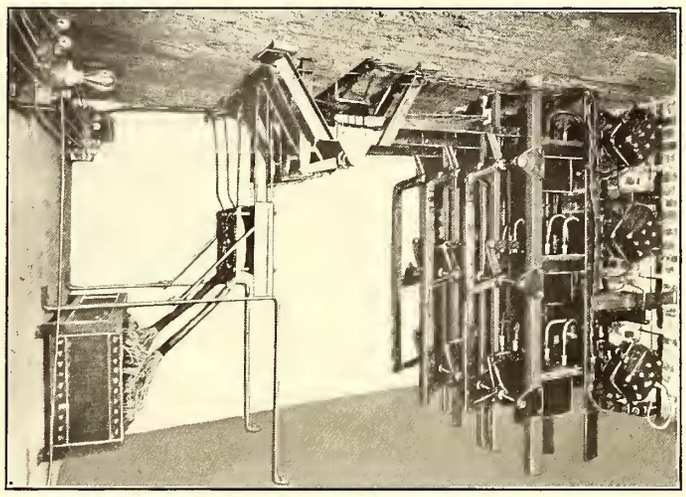
Clutches are arranged on both sides of the pulley so that the motor generator sets may be operated independently, or that either one or both sets may be driven by the main engine, thus furnishing direct current for railway purposes, also alternating current from the inductor alternators. The clutches are mechanically operated, and are of the jaw type, so arranged as to couple to the main shaft, so that the synchronous motors, when operating as generators, will always be in synchronism; in other words, they clutch in only one position.

The two motor generator sets are duplicates, each consisting



LOW POTENTIAL SWITCHES

of a 400-kw, direct-current 550-600-volt railway generator, and a 450-kw Stanley, type 15, 4500-volt, 7200-alternations, three-phase induction alternator, which operates normally as a synchronous motor. The motor generator sets have a speed of 360 r. p. m. Under normal operating conditions the small direct-connected generating unit and one motor generator set are run, the steam set being necessary so as to meet instant demands for power in case of failure of the transmission line.



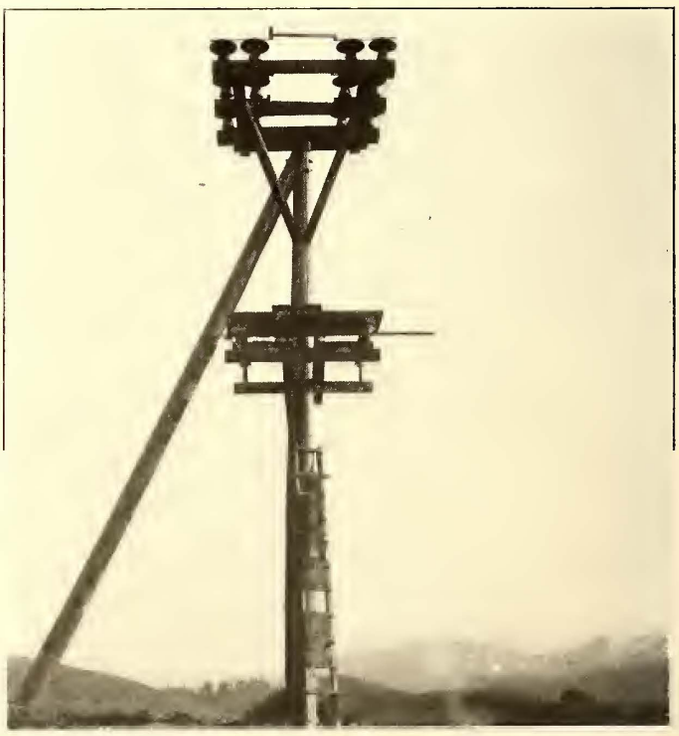
4500-VOLT OIL SWITCHING GEAR IN BASEMENT OF POWER HOUSE

As it is necessary to keep steam up on the plant anyway, there is but little lost in running the small engine, and, by its operation, the road is assured of continuous service under practically all possible conditions.

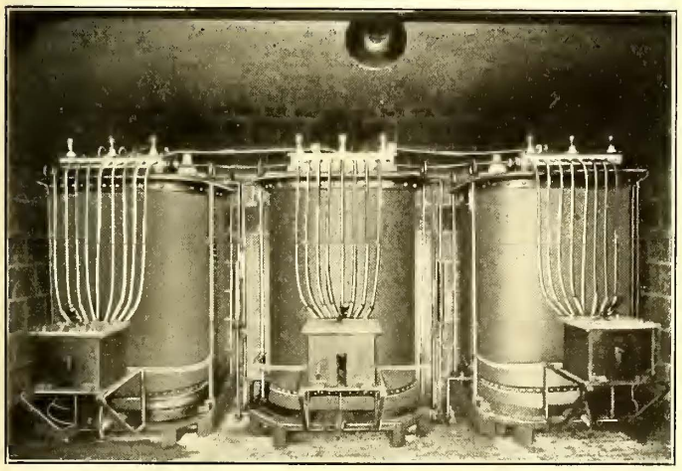
HIGH-TENSION SWITCHING

In the matter of protection against damage by fire or against liability of accident to employees, it would be hard to find a plant using high-tension current for operating motor-generator or rotary-converter sets for direct-current distribution in which greater precautions have been taken than are displayed in the design of the North Shore power station. The entire electrical engineering of the station has been performed by A. H. Babcock, electrical engineer of the North Shore Railroad Company, and the results of his experience, gained during his connection with the leading transmission companies in California, have been well applied in this station. The main idea sought, as may be inferred from the foregoing, is to give the minimum fire risk and the minimum danger to the attendant. To this end no high-tension wires or connections of any sort are placed inside of the engine and generator room, they being entirely are carried on insulators supported on a 6-in. x 6-in. wooden strip, that is fastened to the brick work by means of iron brackets. The wires pass through three circular windows, each composed of a 24-in. sewer pipe, inclined at a downward angle, to shed rain and moisture. Mounted in the pipes are glass plates with 5-in. central holes, through which the wires are carried to Locke brown porcelain 14-in. insulators, supported 4 ft. from the roof. Each wire enters a separate fireproof compartment, and the three wires are kept separate until they enter the transformer room on the ground floor. Mr. Babcock's experience has led him to believe that the greatest danger in handling high-tension circuits comes from the lightning arresters and switches, and as each of these for each phase has been mounted in a separate fireproof room it would seem as if the danger had been reduced to a minimum. It is a physical impossibility for trouble of any kind on any one of the three leads of the circuit to involve more than the one wire. It is not believed that fire can be prevented absolutely where such high potentials are used, but it is all the more the duty of every designing engineer to take the utmost pains to localize the possibility of fires. Already this design has demonstrated its value in a very practical manner at the North Shore power house.

From the lightning arrester rooms the wires are carried down through 24-in. sewer pipes and glass plates in the floor to the switches in the rooms below. A view in one of these switch rooms is shown. The switch used is the new Stanley horizontal 60,000-volt double-break oil switch that was recently so successfully tested on the Standard Electric Company's lines at Mission San Jose. The switches are operated mechanically from the floor of the engine room by means of a special gear, shown on the wall in the view of this arrangement.



plates, 28 ins. in diameter, are set in the bell of the pipe and cemented in, and the wires pass through porcelain transformer insulators mounted in the center of the slate plates. The object of this construction is to isolate the transformers from the switch rooms above, so that in case of fire or explosion of the switches the transformers would not be damaged. The idea of separate compartments might have been carried farther, so as to include the transformers, but this was thought to be an unnecessary precaution, and, besides, it would have made the connecting of the transformers difficult. The transformers have capacities of 400 kw each, and transform the 40,000-volt current down to 4435 volts, the primaries being connected in star and the secondaries in delta. This method of connections is contrary to usual practice, but was decided upon after due consideration of all the line and operating conditions. The transformers were built by the Stanley Electric Manufacturing Company, and are oil-insulated and water-cooled. In a small



STEP-DOWN TRANSFORMERS IN HIGH-TENSION TOWER OF POWER HOUSE, HANDLING CURRENT AT 40,000 VOLTS

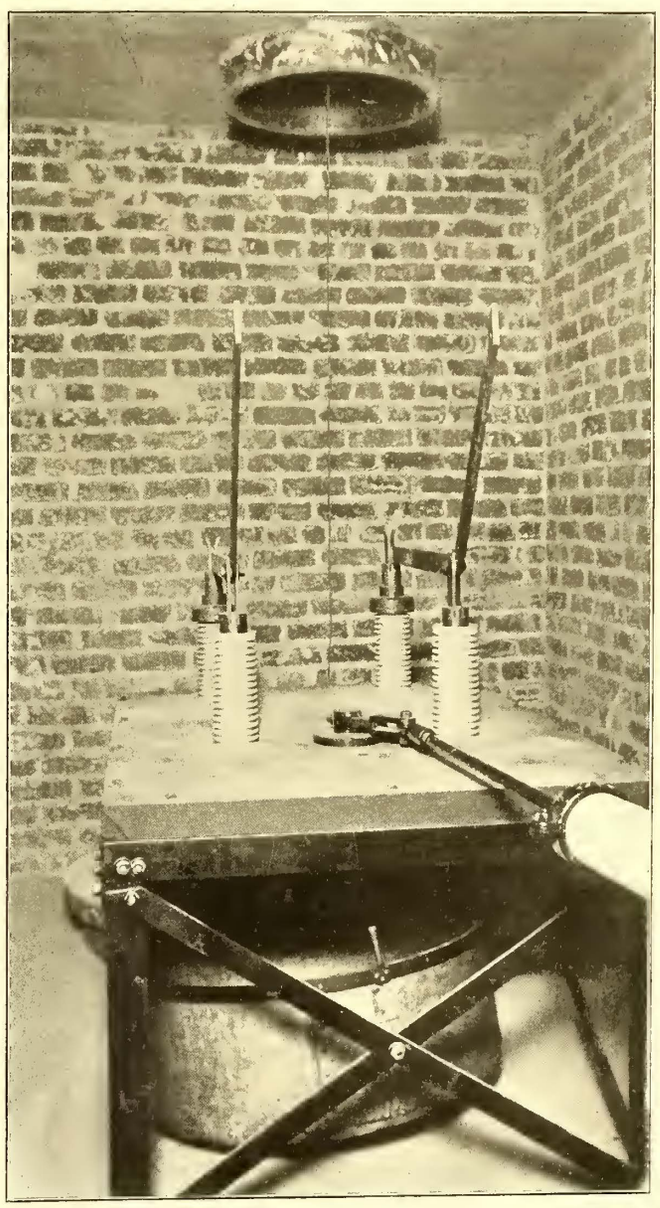
oil house near the transformer room there is a tank large enough to hold the oil from one transformer and half that from another, and a hand pump is provided for pumping the oil into the transformers. For circulating the water a centrifugal pump, with 1½-in. discharge, is provided in the oil house. The pump is driven by a 1-hp, shunt-wound, 500-volt motor, that operates continuously. The water from the transformer discharges into a small tank outside the shed, and a float in this tank actuates a throttle valve in the pump discharge pipe, so that the whole circulation system is automatic. The transformer room is drained through a 6-in. tile into the bay. A brick platform has been built in front of the transformer room, so that in case of accident a transformer can be easily rolled out of the room and repaired.

LOW-TENSION SWITCHING APPARATUS

All the switches and bus-bars of the 4435-volt three-phase system are located in the basement of the engine room, only the operating handles and instruments being mounted on the switchboard above. The leads from the transformers are carried down and connected to aluminum bus-bars, ½ in. x 1½ ins. x 22 ft., mounted in fireproof compartments, between brick walls and separated by horizontal 1-in. slate barriers. Back of the oil switching gear the machine busses are interspersed in compartments between the main bus-bars.

To operate motors at the Sausalito yard and depot, and also the lights at that point, the California Central Gas & Electric Company has a 4500-volt three-phase circuit, running from San Rafael to Sausalito. This circuit is brought into the Alto power house and connections are made so that this station may feed 4500-volt current in either or both directions on their line. Ordinarily this San Rafael-Sausalito 4500-volt line is not tied together through the Alto station. The barriers for these circuits are shown in the cuts and give some idea of the precautions that have been taken in isolating each feeder and bus-bar.

The alternating switchboard is a three-panel, black enameled slate board. Each of the two generator panels (or motor panels in case the inductor alternators are operated as synchronous motors) is equipped with a double-scale wattmeter, indicating the true power in the one-phase and the total power on the machines, a 110-scale ammeter, a 150-scale voltmeter, rheostat and oil-switch handles, synchronizing plug, and at the bottom



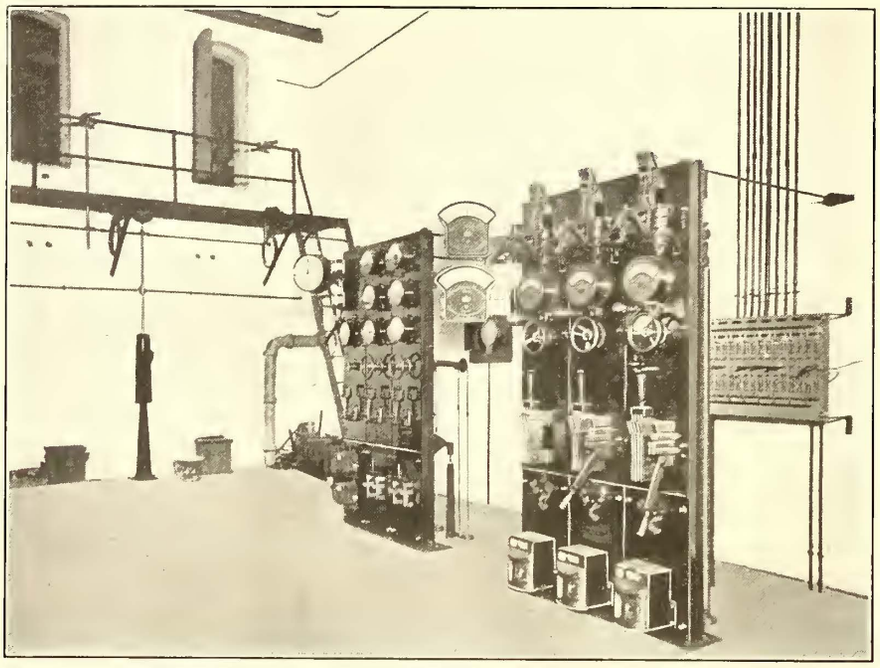
DETAILS OF HIGH-TENSION OIL SWITCH IN HIGH-TENSION TOWER. OIL TANK OF SWITCH IS DISCONNECTED, AND OPERATING TACKLE IS AT RIGHT

a double-pole, single-throw field switch with discharge resistance. On the line panel are mounted a frequency indicator, power-factor indicator, 150-scale voltmeter with switch, oil-switch handle, and two Stanley integrating wattmeters. A Lincoln synchronizer is swung from a bracket at the end of the board. To guard against accidents only 110-volt secondary circuits are taken to the alternating-current boards.

DIRECT-CURRENT SWITCHBOARD

The direct-current railway switchboard is composed only of generator panels. All the positive machine leads are carried from the generators directly to the line panel, which is mounted on the wall where the two feeders leave the building. This is purely an emergency device, intended not to be opened under load, but merely to enable the two parts of the system to be

worked independently, if necessary. For this reason it was placed away from the main boards, where its switches are not so likely to be opened under the excitement that sometimes accompanies station trouble. On each of the three generator panels are mounted a 1500-amp. I-T-E circuit breaker, 1500-scale ammeter, rheostat handle, one single-pole, single-throw, quick-break main switch and a Thomson recording wattmeter. On two of the panels are motor-starting switches, to provide for the starting of the generators as shunt motors. Each panel also contains a special field switch of Mr. Babcock's invention, which combines two switches and allows the direct-current machines to be started as shunt motors without short circuiting the series field. A differential voltmeter and a station voltmeter, both with illuminated dials, are swung from brackets at the left of the board. With the exception of the voltmeter leads no positive leads come to the direct-current boards, everything else being on the ground side of the circuit. It will be seen that all danger to boards and attendants is eliminated.



DIRECT-CURRENT AND ALTERNATING-CURRENT SWITCHBOARD IN POWER HOUSE; ALSO SHOWING HIGH-TENSION GALLERY AND TWO DOORS OPENING INTO OIL-SWITCH ROOM

STORAGE BATTERY

In order to regulate the heavy fluctuations on the station on account of the intermittent operation of the trains, a storage battery has been installed. It consists of 288 type G-15 chloride cells, with a discharge capacity of 560 amps. for an hour, and a capacity for fluctuating work 50 per cent greater. In connection with the battery there is operated a differential booster of the Western Electric type. The battery switchboard has the same arrangement as the direct-current boards, only negative circuits being controlled by it.

GENERAL ELECTRICAL FEATURES

All the switchboards were built from the designs of Mr. Babcock, and the same precautions against fire and danger to attendants as were used in other portions of the plant were incorporated here. The constructions are diagrammatically shown in the accompanying cut.

The three 800,000-circ. mil copper cables from the generator of the direct-connected set are carried to the switchboard in 3-in. asphalt paper ducts, the three ducts being laid in a 9-in. terra-cotta sewer pipe, shown in the wiring plan of the station. Another cut shows the arrangement of circuits leaving the power house.

The station lighting is controlled from ten circuits, connected to double bus-bars mounted on a marble panel. One bus is connected across sixty cells of the storage battery, and the other to the secondary of a lighting transformer off the 4500-volt mains. The battery connection is provided so as to allow the station to be lighted when everything else is dead.

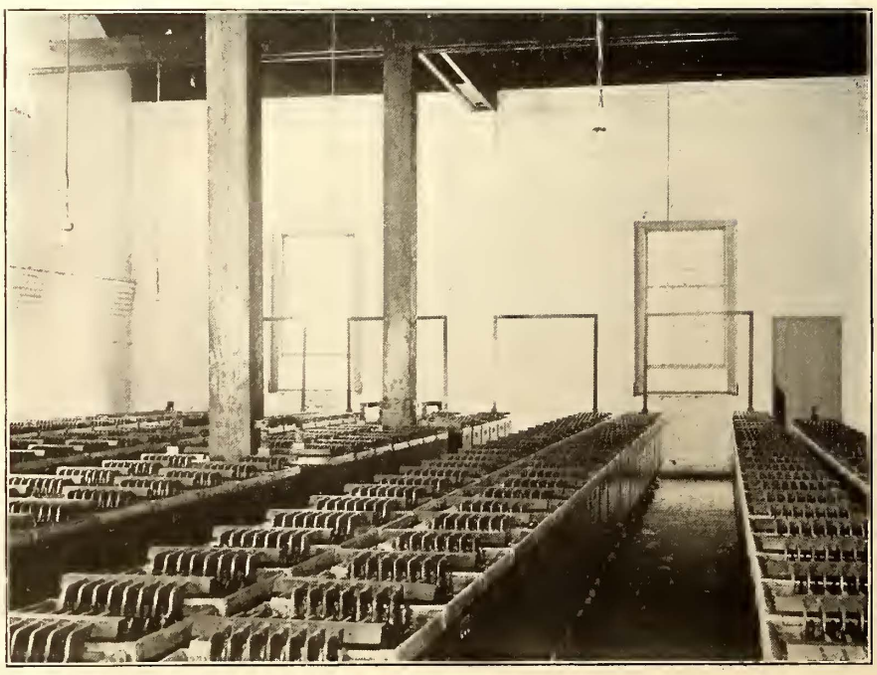
SAN RAFAEL SUB-STATION

In order to cut down the time of train operation over the 2 per cent grade near San Anselmo, a sub-station was installed at San Rafael. The outfit consists of a 225-kw, 550-volt General Electric direct-current generator, belt-driven by a S. K. C. synchronous motor. This station is fed regularly from the Bay Counties system, but connections are provided so that it can be operated from the Alto power house, either over the 50,000-volt system or the 4500-volt line. The present sub-station is only temporary, but it serves its purpose admirably.

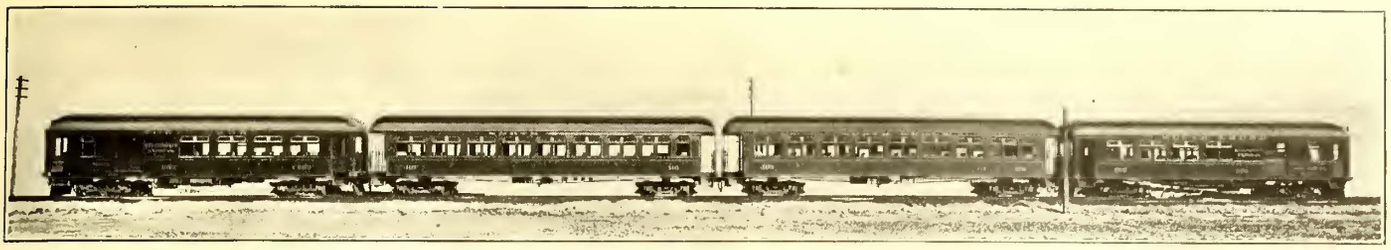
ROLLING STOCK

The types of cars used in the regular service on the North Shore Railroad were illustrated and described in the Street Railway Journal of May 16, 1903. The motor cars are of the combined baggage and passenger type, and are 50 ft. long over bumpers, while the passenger coaches are of the standard light passenger type, and are 56 ft. 4 ins. long over all. The coaches seat sixty-six passengers, and the motor cars have a seating capacity of thirty-six and a 12-ft. baggage compartment. The North Shore Railroad Company has in service nine of these motor cars and twelve coaches, which were built by the St. Louis Car Company. Also it has rebuilt in its shops three motor cars and eight coaches, these eleven cars being Pullmans that were used on the road during its operation by steam.

The motor trucks of the combination cars are of the Hedley

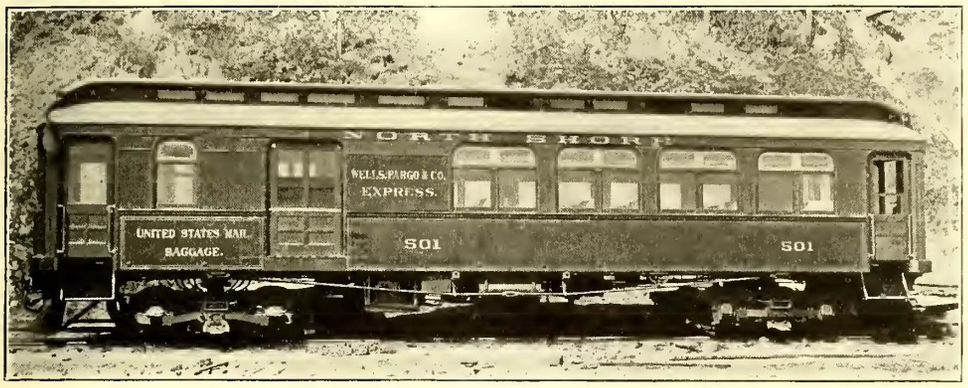


STORAGE BATTERY AUXILIARY AT ALTO POWER STATION

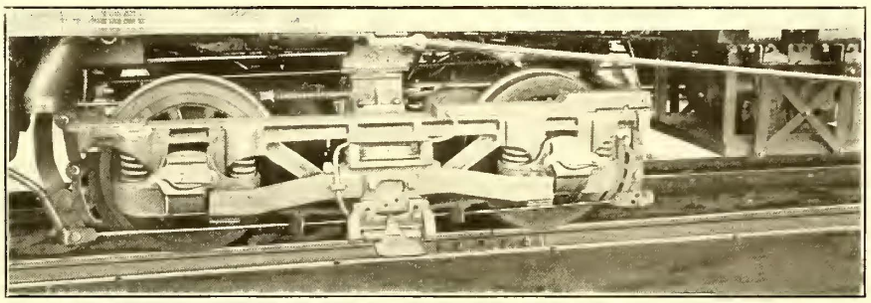


FOUR-CAR TRAIN, COMBINING PASSENGER COACHES, MAIL, EXPRESS AND BAGGAGE SERVICE

type, and are equipped with two General Electric 66-motors. For the contact the new Potter collecting shoe, made by the General Electric Company, is used. It is mounted on an oak bar fastened to the equalizer, as shown. This shoe is practically the same as that used on the Wilkesbarre & Hazelton third-rail road, and while its general design is very satisfactory in that it permits perfect protection of the third rail at station platforms, etc., the management of the company believes that its details must be modified before it can be satisfactorily adopted for general use.



STANDARD MOTOR CAR, CARRYING PASSENGERS, MAIL, EXPRESS AND BAGGAGE



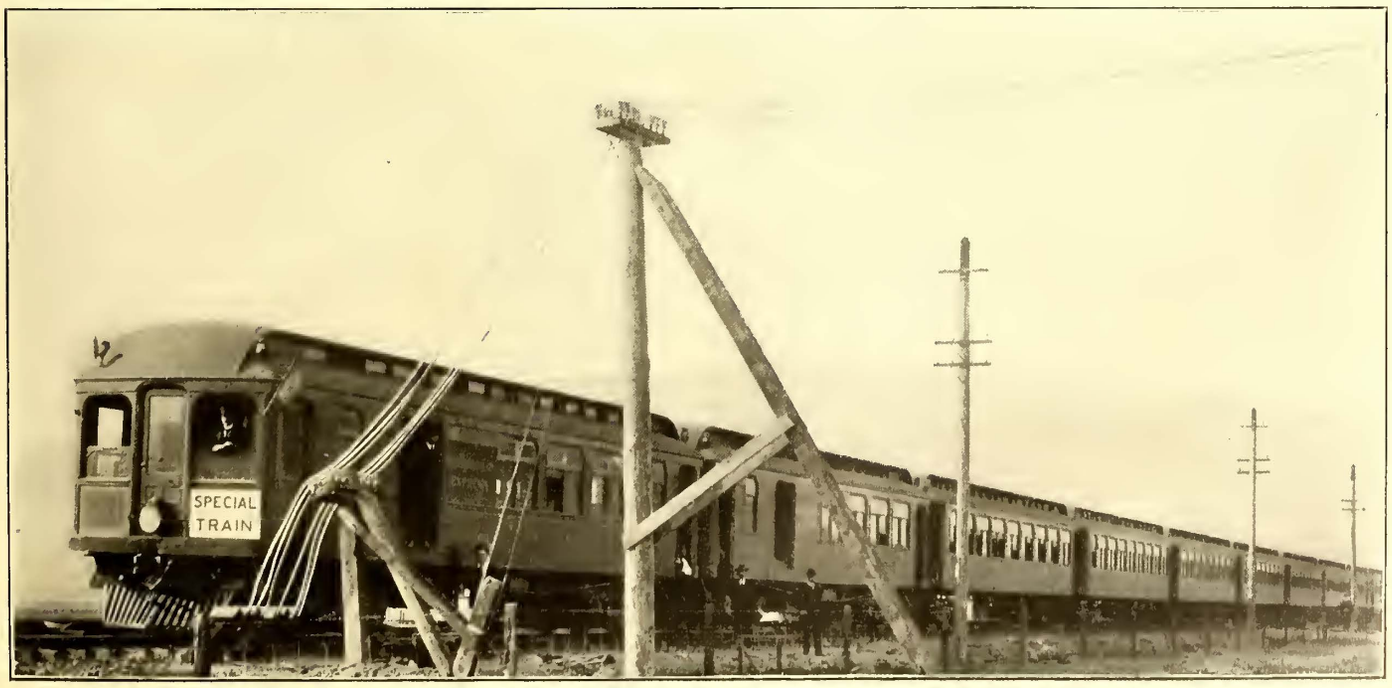
CONTACT-SHOE, MOTORS AND COMPRESSORS ON MOTOR TRUCK

The cars are equipped for train operation with the General Electric Company's type-M multiple-unit control, the only special feature being that a bus line, consisting of No. 0000 copper cable, runs the whole length of the train. This arrangement was made necessary by long road crossings, its function being to supply all the motors with current if only one shoe is in contact with the third rail.

Other furnishings of the cars include Janney couplers, Anderson-Smith arc headlights and interior lights, Westinghouse automatic air brakes on all cars, and Westinghouse motor-driven compressors and governors. The motor cars weigh about 30 tons each, and a five-car train, including two motor cars and three coaches, or trail cars, weighs, equipped, 130 tons.

TRAIN OPERATION

Under usual operating conditions three-car to five-car trains are operated, and four trains is the maximum number on the track at one time. At certain hours of the day three trains leave the Sausalito depot within 1 minute of each other, and this necessarily brings a heavy tax on the power plant, but with the aid of the storage battery the load on the



SPECIAL TRAIN OF TEN CARS OPERATED AT OPENING OF LINE TO SAN RAFAEL

REGULAR PASSENGER TRAIN, CARRYING MAIL, BAGGAGE AND EXPRESS

generators is smoothed out. At other periods of the day, when no trains are moving, there is practically no load on the station, and here again the battery comes into play, as it is charged during such periods, and thus keeps a more even load on the station. Several views of trains are shown.

The list of stations on the electric division of the road, with distances from Sausalito, is as follows:

	MILES
Sausalito	....
Alameda Point	1.24
Waldo Point	1.85
Manzanita	2.67
Mill Valley Junction	3.51
Millwood	4.5
Mill Valley	5.25
Alto	4.46
South Portal	5.05
North Portal	5.67
Corte Madera	6.07
Larkspur	6.87
Escalle	7.42
Kentfield	8.23
Ross	9.
San Anselmo	9.97
West End	11.43
San Rafael	11.95

The trains operate at a schedule speed of about 25 m. p. h. to 30 m. p. h., and have maximum speeds of between 50 m. p. h. and 60 m. p. h. During morning and evening an express service is given between Sausalito and the San Rafael end of the system.

The entire railroad, steam as well as electric, is operated under the American standard railroad rules. The engine drivers of the old steam system are used as motormen, and they go from steam to electric train, or vice versa, as they may be assigned.

SIGNAL SYSTEM

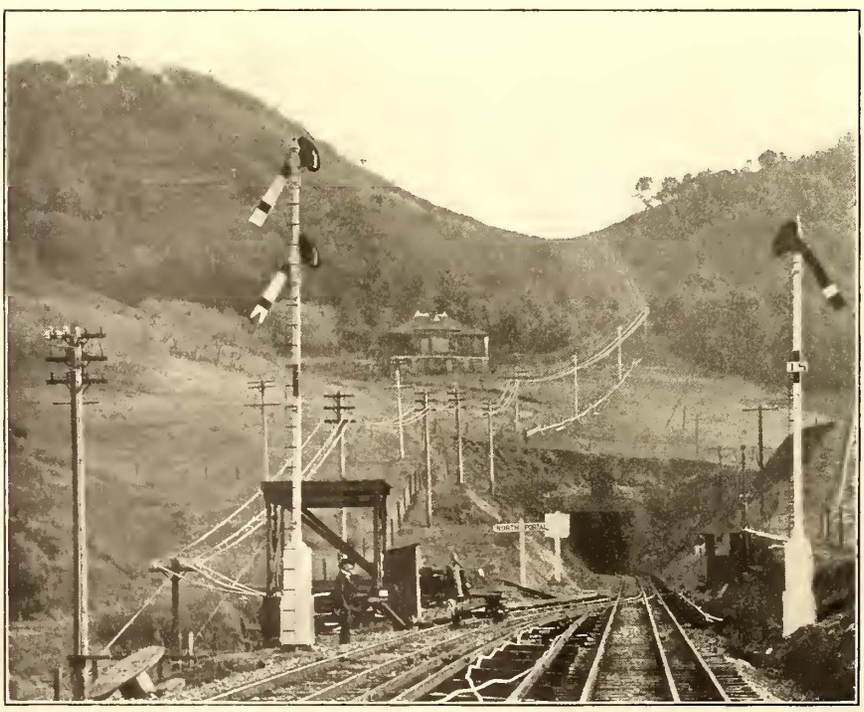
The road is operated by a train despatcher

SIGNALS GOVERNING MILL VALLEY JUNCTION, AND INTERLOCKING TOWER AT RIGHT

located in the depot at Sausalito, all despatching being done by telegraph. For the use of the officers and operating men a telephone system connects the terminal shops, power house and all suburban stations.

An automatic block signal has been installed by the Union Switch & Signal Company for the double track between Sausalito and San Anselmo. This system embodies certain interesting features which are novel in the art of railroad signaling, in that alternating current is used in track circuits, which in turn actuate the motors that operate the signals. Electric transportation having reached the speed and other conditions common to steam practice, it follows that similar protective devices are called for, but the customary track circuit supplied by a primary battery or other source of direct current, is in this case proscribed for the reason that, at least, one of the rails must be used as a return conductor to the power station for the train current.

The general arrangement of the track circuits is similar to that on the Boston Elevated Railway except in the use of an alternating current in the signal circuit. One of the track



NORTH PORTAL OF TUNNEL, SHOWING SIGNALS AND ALUMINUM FEEDERS GOING OVER HILL. SIGNAL WIRE TRANSFORMER POLE AT LEFT

rails is insulated from the other, and is also divided into sections of varying length by the use of track splices or insulated sections, such as used in standard steam railroad signal work. The signals are then operated in the usual way, viz., when a car enters a block its axle furnishes a direct short circuit between

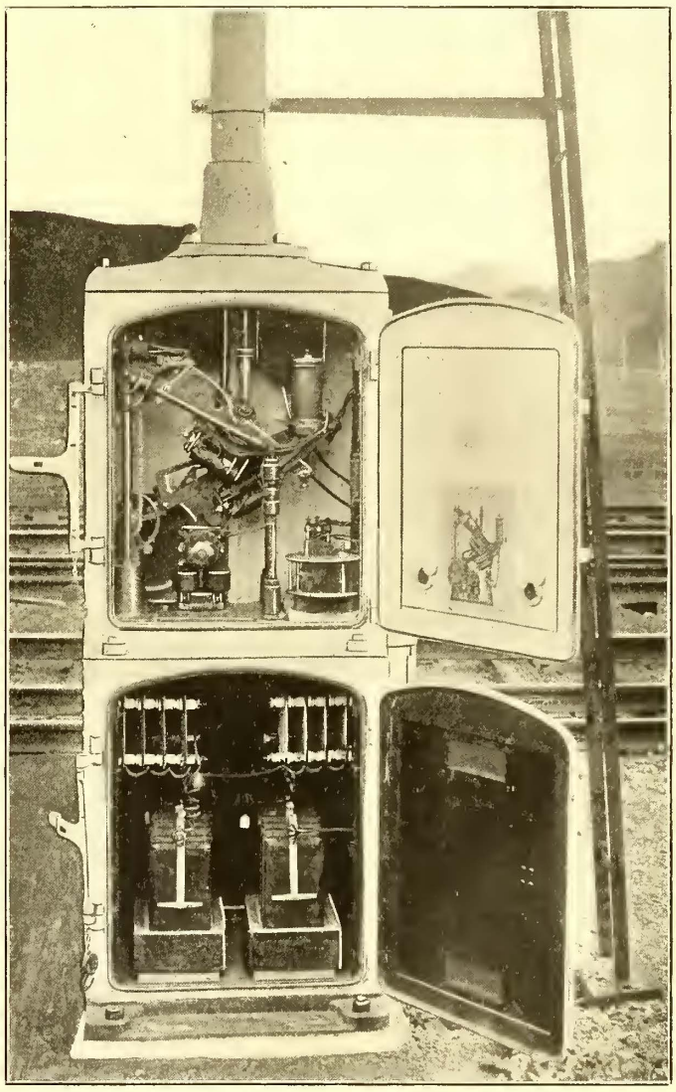
TYPICAL VIEW SHOWING SIGNAL SYSTEM AND METHOD OF LAYING CONTACT-RAIL ON CURVE

the signal track rail, which is kept at an alternating-current potential of from 9 volts to 15 volts, and the other track rail, which is grounded. This short circuit operates a relay controlling the signal, and this relay throws the signal, as will be described later. Alternating current has been adopted for the signal circuit in place of direct current, as used in Boston, because on a long line of this kind the voltage of the return track rail would vary considerably, owing to the fluctuating direct-current drop, and this difference in potential would tend to interfere with the proper operation of the signals. The use of alternating current corrects this, and offers the additional advantages common to high-tension distribution systems.

Alternating current for the signal circuits is taken from the main 4500-volt supply at the power house, making the system quite simple and easily maintained. One phase of a three-phase four-wire system is used, its voltage being 2300. This feeder is tapped off to small transformers, one for each block section, located at the ends of the blocks and enclosed in iron cases mounted on poles.

The alternating-current relay, which is short circuited by the presence of a train within the block, is contained in the upper half of the signal compartment at the base of the signal, and can be seen at the lower right-hand corner of this compartment in the illustration showing the details and mechanism of the signal apparatus. This relay is adjusted to pick up at about one-tenth of an ampere, and opens or closes the circuit breaker of the small 8-volt direct-current motor used to operate the semaphore signals. After the semaphore is raised, the motor, according to the regular system of the Union Switch & Signal Company, is cut out, and the signal is retained in position by current from the storage battery used to operate the motor. The battery consists of four chloride-type P T cells. A duplicate battery is installed so that one battery may be in operation while the other remains fully charged or is being charged. Current for charging the batteries is taken from the contact-rail, the proper resistance being interposed in the circuit. Where two signals are opposite, one battery serves for operating both.

The signals are lighted at night from the mains which supply the track circuits, as are also the way passenger stations. The signal lights are 6-cp 125-volt lamps, burning at 20 volts, so as to prolong their life. The signal itself is of the semaphore type, having both home and distant or caution arms. The semaphores give indication by position in daytime and by color at night, red indicating danger, yellow caution, and green clear. The upper or red semaphore is the home signal, and the lower or yellow arm, with fish-tail end, is the caution signal. There



DETAILS OF COMPARTMENT AT BASE OF SIGNAL TOWER

are thirty signal poles on the line, containing fifty-four signals, twenty-four poles being of the two-arm type and six of the one-arm type. Notwithstanding the fact that this is the first installation of automatic block signals using alternating-current track circuits, the system has given excellent service. Many of the block sections are upwards of a mile in length, which, coupled with the fact that the wet season is now on, constitutes a test which demonstrates the practicability and success of this new system.

In addition to the block-signal system there are three disc signals stationed on the legs of the Y-track at San Anselmo. These signals are controlled by the station agent, who can give right of way to the station to a train on any one of the three legs of the Y. Annunciators operated by trains approaching San Anselmo are located in the station, and give the agent information as to the approach of trains.

At Mill Valley Junction a mechanical interlocking plant is being installed, the main line semaphores of which are semi-automatic, and this feature makes the automatic block signal system in reality continuous. Information of trains approaching the junction is given to the operator in the tower by annunciators. A mechanical interlocking plant of some size is also being installed at Sausalito to control the switching in the terminal yards.

Throughout the tunnel, near Corte Madera, incandescent lamps have been placed 10 ft. apart and the height of a car window. Signal No. 18 at North Portal is always red whenever a train is in the tunnel block. In this position it closes a small switch that supplies current to the primary coil of a General Electric contactor, which in turn closes the circuit from the power rail to the tunnel lamps, these being connected in the usual multiple-series arrangement for 500-volt lighting. The operation of the lights is thus entirely automatic.

SAUSALITO LIGHT AND POWER

The 4500-volt three-phase power circuit from San Rafael and the Alto power house terminates at the pump house in the Sausalito terminal yards, where it is transformed for motor work at the ferry, and for incandescent and series arc lighting. The machinery at the shops is driven by a 30-hp induction motor. In the pump house is a vertical triplex 9-in. x 10-in. Allentown fire pump with 8-in. discharge and 8-in. suction. This pump is driven by a 50-hp General Electric induction motor. A 5-hp induction motor drives a 3-in. x 3-in. Dow triplex pump for filling the accumulator at the ferry apron.

CONCLUSION

The officers of the North Shore Railroad Company, who were in charge during construction, are: President, John Martin; vice-president, E. J. de Sabla; secretary and treasurer, F. B. Latham; auditor, O. F. Giffin; general manager, W. M. Rank; superintendent, E. L. Braswell; purchasing agent, S. F. Alden; general freight and passenger agent, George W. Heintz; electrical engineer, A. H. Babcock; engineer of maintenance of way and structures, B. H. Fisher; engineer of power station and steamers, George S. Ames; master mechanic, F. A. Stevens; car house foreman, W. W. Mason, Jr. Credit for the design and installation of the electrical equipment of the road is due Mr. Babcock. Mr. Mason, who came to Sausalito from the Boston Elevated Railway Company, has supervised equipping the cars with the type-M control system.

The entire steam power plant was designed and installed by Charles C. Moore & Company, of San Francisco, the details of design being approved by Mr. Ames. John Martin & Company, of San Francisco, supplied the electric generators, transformers, switches and switchboards, most of that equipment being of the Stanley Electric Manufacturing Company's construction. The aluminum rod used as feeders was furnished by the Pittsburg Reduction Works, through its agents, John Martin & Company.

Since this article was written the control of the property has passed to the Santa Fe, although that company has not taken possession as yet.

ROTARY CONVERTER RUNAWAY AT JANESVILLE, WIS.

One of the rotary converters in the sub-station of the Rockford, Beloit & Janesville Railroad Company, between Beloit and Janesville, recently ran away and wrecked itself, the runaway, of course, being due to the opening of high-tension lines and the turning of the motor into a generator with the compound winding of the fields, reducing the fields' strength so that the speed of the armature became very high.

THE INSPECTION OF CONDUCTORS FOR FAILING TO REGISTER CASH FARES

BY H. N. BROWN

The methods pursued by conductors for collecting fares and failing to register them are various. Perhaps the most popular is to collect a number of fares at one time and then register one or two less than the proper number. Many conductors believe that an ordinary passenger cannot detect this trick, and properly, because it requires close watching by a practised inspector. Another way to defraud the company is for the conductor to wait until the car is in the middle of a block, then to collect two or three fares just before the car reaches the next corner. If a passenger should be at this point ready to board the car, the motorman will stop to take him on, and the conductor will hurry to the rear platform to ring his car ahead, and thereby fail to register the fares just collected. He will leave the passengers in the car under the impression, however, that he had forgotten to ring the register, simply because his mind was attracted from his work to see that the passengers boarded the car before starting. Other conductors will collect and register every fare inside of the car, but will register one or two short from those collected on the rear platform, if there is any considerable number of platform passengers.

The most dangerous man among this class, however, is the one who will doctor his manifest or trip card. In other words, he will start out on his trip with thirty passengers on the car, collect all fares and register twenty-six of them, making four fares that he collects and does not register. Should he be suspicious of any passenger on the car he will report on his manifest that he carried thirty passengers on this trip, when, as a matter of fact, the inspector will report the trip as twenty-six on the register and four fares collected and not registered. When the manager checks up the inspector's report with that of this particular conductor he will naturally give the conductor the benefit of the doubt, and believe that when he arrived at the end of the line and found that he had four more fares in his pocket than accounted for, he rang them up on the indicator, which would make his report agree with the inspector's as to the number of passengers on the car. On the next trip this conductor will collect and register every fare in the car, but upon arriving at the terminus of the half trip instead of reporting on his manifest the full number of passengers carried on this trip he will deduct the four fares from proper amount. Should an inspector be on the second trip with this conductor his report will show four over the conductor's trip slips, and, naturally, when checking up the inspector's reports the manager will think that the inspector made a mistake in putting down his figures and give the conductor the benefit of the doubt on this occasion. In a case of this kind it is well for the manager, upon finding that an inspector's reports do not agree with the conductor's, to place this particular report aside and watch the balance of the reports sent in by the inspector on this conductor. Should he find that they do not agree with one another it is well to take the inspector's word in preference to that of the conductor in this case. That is, if the inspector's reports were found correct and checked with accuracy with nine-tenths of the conductors on the line, it stands to reason that they are undoubtedly correct as regards the other tenth.

There are other discrepancies in reports which a manager often does not take into consideration or does not think of at the time he is checking up the reports. Frequently, in a crowded car, a conductor, after collecting all fares and transfers, will return to the rear platform to examine the transfers, and among them will find one, two or three on which the time limit has expired, or which possibly may have been issued the previous day. After discovering his mistake in accepting these

transfers and not knowing from whom he received them, he will tear them up and throw them into the street. Naturally, the inspector will report the number of transfers he saw collected by this conductor, but when the latter's reports are turned in they may show one, two or three less than the inspector. In a case of this kind the conductor is again given the doubt, and confidence is lost in the inspector's reports.

On large roads conductors frequently have an opportunity to collect and fail to register fares before they reach the first transfer point, for at this point a number of passengers will leave the car for some intersecting line, and thereafter the passengers on the car will be way below the amount on the dial.

THE BEST SYSTEMS OF INSPECTING.

On small roads where it only requires a car 30 minutes to make a half-trip it is best to have the inspector ride practically from one end of the run to the other. By this method the management can check up the inspector's reports with the conductors' trip slips, and each should tally with the other, except where discrepancies may occur from a conductor missing fares or failing to register them.

On large roads, where it requires three-quarters of an hour to make a half-trip, this may not be the best method, as the railway company would be compelled to employ an enormous number of inspectors. In this case my suggestion would be for the inspector to make 20-minute rides on the lines, thereby securing for the company about eighteen rides per day from each inspector. Should an inspector find any man collecting and failing to register cash fares, the company could make specials of such conductors, and have one or two inspectors do nothing else but ride specials. In these cases the inspectors should ride from one end of the route to the other with these suspected men so that the inspector's reports can check up accurately with the conductors' trip slips.

In my opinion a street railway employing from ten to twenty conductors should have at least one inspection for one week every two months, those employing from twenty to forty conductors should have one week in every month, those with from forty to sixty conductors should have from ten days to two weeks every month, and those employing sixty conductors or over should continue the inspection every day in the year. The reason for this statement can best be shown by taking an illustration, say a road employing from ten to twenty conductors. If a conductor on such a road fails to register an average of one fare on every half-trip, and makes twenty such half-trips a day, he would be taking $30 per month, or $60 in two months. An inspector's services for one week would not cost the railway company over $35 for that length of time, and during this time he could readily check up twenty conductors. The usual number of rides made by an inspector is from ten to twelve, so that by seventy rides he could check the majority of the conductors four times apiece and the others three times each. Should he find only one conductor dishonest out of the twenty the company would be saving at the lowest estimate $25 through this work. This same reasoning can be applied to larger roads, although they are more liable to suffer from dishonest men than the smaller ones.

DEPORTMENT OF MEN IN THE EMPLOY OF RAILWAY COMPANIES

There are a number of irregularities practiced by conductors and motormen in the employ of street railway companies, which, if allowed to continue, may cost the latter considerable money in the way of accidents, etc. I will endeavor to mention a few of them.

1. Conductors failing to flag railroad crossings.

2. Ringing their car ahead from the inside, tending to throw people from the rear platform.

3. Collecting a number of fares at one time before registering.

4. Smoking on the car while on duty.

5. Talking to motormen for any length of time, thereby distracting his attention from his duty.

6. Failing to report broken seats, car floors or windows on the car he is working.

7. Failing to hold trolley rope when rounding curves, which is liable to jump off and break down the overhead wires.

These faults, in my opinion, should be promptly punished by a severe reprimand for the first offense, suspension for the second offense and dismissal for the third, for if the management allows them to continue many accidents may occur from any one. The chief faults of motormen are: Throwing the controller handle from one point to five when starting, tending to throw passengers in the car; disobeyment of slow and stop signals placed along the line; hitting curves and switches too hard, tending to throw the car off the track; talking to passengers or conductor, thereby diverting his mind from his duty; smoking on the car, abuse of current, etc. These irregularities should be dealt with as in the case of conductors.

EXPLOSION WRECKS POWER PLANT AT ST. LOUIS

The Geyer Avenue power house of the St. Louis Transit Company, at Geyer Avenue and Missouri Avenue, was completely wrecked by an explosion Monday evening, Dec. 21, at 5:13 o'clock. Six men were killed and nearly everyone of the thirty employees in and about the boiler room was injured in some way. Seven of the fourteen boilers exploded so rapidly as to render the reports almost simultaneous. The force of the explosion was exerted in all directions, and brick and iron were scattered about for a radius of three squares. Two boilers were hurled east into Missouri Avenue, as shown in the

SCENE OF THE EXPLOSION

accompanying engraving; three others went south into the car sheds, and parts of others were thrown northward through the building. A boiler shell was carried over a row of houses to a vacant lot in front of the McKinley High School, two blocks away, and a steam drum landed in Allen Avenue, having been hurled entirely over the car houses.

Immediately after the explosion a general alarm of fire was turned in, but there was little for the firemen to do beyond extracting the dead and wounded from the debris. A force of 200 men was put to work the next morning to clear away the wreck. Daylight showed the interior of the power house to be a mass of twisted steel, splintered timbers, bricks and mortar. The fly-wheels of the big engines were the only things that were recognizable as having retained a semblance of their former shape. These stood intact, although the shaft was wrenched loose from one of them. For a distance of 50 ft. the chimney was spattered with mud and scarred by flying bricks.

The boilers which exploded were installed when the power house was built in 1891, and were damaged in the cyclone of May 27, 1896, which wrecked the plant. After undergoing repairs they were put in service again. The new boilers which had been added to the plant in the last few months were separated by a wall from the old battery, and were not damaged to any great extent by the explosion.

In order not to inconvenience its patrons the company called into action as soon as possible after the accident the reserve equipment at each of its other plants. The principal call for extra power, however, fell on the central station at Park Avenue and Vanderventer Avenue. In addition, the two stations in the North End, the northern station at Broadway and Salisbury Streets, and the Cass Avenue station, at Prairie Avenue and North Market Street, put additional machinery in operation.

One of those who personally helped in the wreck was A. B. DuPont, second vice-president of the company.

THE EFFECT OF FREQUENT STOPS IN HIGH-SPEED RAILROADING

BY A. H. ARMSTRONG

The growing tendency for steam lines to adopt electricity as a motive power for their local and suburban service excites much interest in the question of the probable effect upon the extensive suburban electric systems now in operation, many of which parallel steam lines. The electric interurban and suburban road is now operating cars having the same weight and speeds as its steam competitor, but usually its cars operate singly, or at most in trains of two cars, and then only at rush hours. So far as the rolling stock is concerned, the electric road can give higher speed and afford greater convenience to the traveling public. The roadbeds of the two systems, however, present a considerable contrast, and in most cases the advantage is on the side of the steam-operated road.

The electric road owes its rapid development and success partly to the fact that it picks up and discharges a passenger in the neighborhood of his destination, and partly owing to the frequent service afforded. The bulk of the traffic is secured, notwithstanding the fact that the schedule speeds in most cases is lower than that of the steam road which the electric road may parallel. Although the steam trains make fewer stops, and, as a rule, have a better roadbed, the steam railroad schedule speed made is not greatly in excess of that provided by the electric roads, owing to the ability of the electrically-propelled car to get away promptly from the station. Should the steam road operate its trains electrically, however, its better roadbed would prove a factor demanding the most serious attention on the part of the present electric road management.

The installation of an electric road in a new territory is often a very serious financial problem, owing to the undetermined patronage and receipts which the road will enjoy. It often happens that the road is installed at a minimum cost, and the roadbed is not all that it should be, being full of curves, heavy grades and, perhaps, running largely over the public highway. Even if private right of way is obtained, sufficient attention is not given to providing a straight track, adapted to high-speed operation. In order to secure franchises it may be necessary to locate stopping places at very frequent intervals, and these, together with sharp curves, often handicap the road at the start for making any high speed between terminals. It is not the intention here to in any way criticise electric roads, but to point out the necessity of greatly improving their roadbeds should they be brought into competition with steam roads when operated, not with steam locomotives, but with electrically-equipped motor cars.

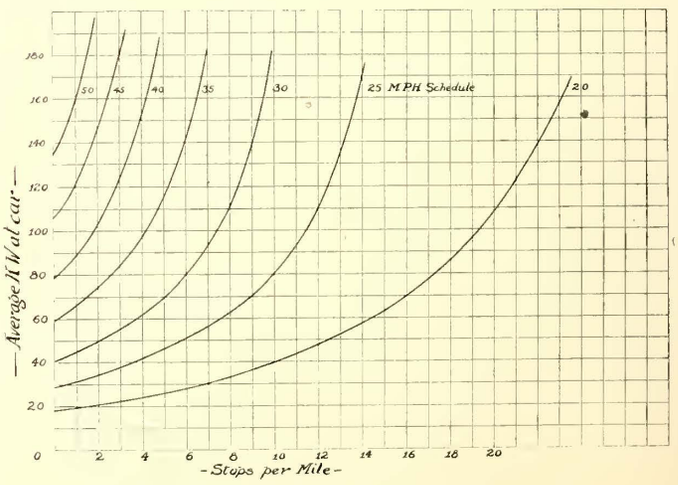
The coal consumption of an electric road is a matter of growing importance and depends largely upon the relation of schedule speed, frequency of stops and alignment of the roadbed. A curve is much more to be avoided in high-speed work than a heavy grade, in fact, a 5 per cent grade of considerable length will not be the source of operating expense that a 12-deg. curve will, unless the latter is placed at a stopping point. In other words, on high-speed passenger roads it is better to go over a hill than around it, if going around it introduces a curve of any considerable degree. Where the road carries freight the grades, of course, will be objectionable, but as dividends of electric roads are earned from passenger receipts rather than freight haulage, the needs of high-speed passenger service must be given first consideration for the present at least.

To take up a specific case, assume a certain road to require a schedule speed of 25 m. p. h., operating 35-ton cars; wanted, the relation between frequency of stops, energy consumption, maximum speed and motor capacity demanded. The following table is made out for an accelerating and braking rate of 1¼ m. p. h. per second, a value sufficiently high for suburban work.

SCHEDULE SPEED 25 MILES PER HOUR

Stops per Mile	KW	Maximum Speed	Total HP Motor Capacity
0	29	25 miles	143
.2	35	29 "	175
.4	44	31 "	186
.6	51	33 "	207
.8	63	37 "	245
1.0	79	43 "	301
1.2	100	51 "	395

This table affords means of very interesting comparisons. The number of stops per mile given is the equivalent number of stops, and includes slow downs required for sharp curves, etc. With .8 of a stop per mile the energy consumption is given as 63 kw per car, while an increase of 50 per cent in the number of stops to 1.2 per mile increases the energy consumption to 100-kw average. A further increase in the number of stops and the maintenance of the same schedule speed would increase the energy consumption of the car at a much greater ratio. This increase in energy for the more frequent stops can be capitalized. The difference in energy consumption between



ENERGY CONSUMPTION FOR 35-TON CAR

.8 stops and 1.2 stops, 37 kw, corresponds to 1.48-kw hours per mile of track per car per day. Assume, 1-hour headway and 18-hour service, there will be thirty-six cars per day operating over this 1-mile section, consuming a total of 53.2-kw hours. At 1 cent per kilowatt-hour this energy amounts to 5 per cent interest on $3,880. In other words, nearly $4,000 per mile of track could be expended to eliminate curves, which would decrease the number of stops per mile 33 per cent.

No consideration has been given to the fact that the motor capacity has increased over 60 per cent, that the generating station has increased a like amount, and the interest on this extra capital investment should be also included in figuring up the cost of making additional slow downs or stops. Also it has been necessary to operate our car at a maximum speed of 50 m. p. h., where 40 sufficed before, and the additional deterioration of rolling stock at the higher speed should also be taken into consideration. Furthermore, a headway of 1 hour only was considered, and many of our suburban roads operate on 30 minutes or even 15 minutes headway during part or whole of the day. When all these influences are considered it becomes evident that any money spent in straightening the track is well invested and will give handsome returns, as shown in reduced operating expenses.

The matter is presented somewhat in detail in order to indicate what the electric road must expect should the steam road, with its straighter track, operate its trains or cars electrically. With the possibilities opened up by single-car operation, frequent service and rapid acceleration provided with electric motors, the steam road will force its electrical competitor to higher schedule speeds in order to retain its share of the traffic. Furthermore, the electric road in nearly all cases has to traverse city streets in order to reach the center of distribution at its terminals, while the steam road has private right of way, thus compelling the electric road still further to better its speed on the suburban sections in order to compete with the electrically-equipped steam road. Any necessity requiring an increase in the schedule speed of many of our suburban roads, especially those having frequent stops and bad alignment, will result in a considerably increased energy demand.

The electric road has built up a residential district in the immediate vicinity of its tracks, calling for additional facilities in the way of more frequent stops. Many of the suburban roads, which, at the time of their installation, made one stop in say, 2 miles, and were able to make a good schedule speed, have, by the very success attending their operation, so built up and developed their traffic that more frequent stops are necessary. As high-speed roads, these systems have defeated their purpose by their own success, in other words, they can no longer be classed as truly high-speed roads, but rather as a high-grade city system. This does not apply to those systems enjoying private right of way, which must constitute a division by themselves. Such roads have more power to regulate their stopping places, but even such systems are being troubled by their inability to make the schedule speed desired, as shown by the rather general adoption of both local and express service over the same lines.

To illustrate the influence of more frequent stops a case has been assumed where a 35-ton car is geared for 45 m. p. h. maximum with an equipment of 300-hp nominal capacity in motors. The following table gives the proper frequency of stops, with varying schedules, for the same temperature rise, approximately 60 degs. C. of the motor power. That is, given an equipment operating at 45 m. p. h. maximum speed, the table will show the reduced schedule speed required with increasing number of stops, such as would result from increased popularity of our suburban systems:

45 MILES PER HOUR MAXIMUM SPEED

Schedule	Watt Hours Per Ton Mile	Car Energy	No. of Stops Per Mile
45	67	106	0
40	72	101	.18
35	79	97	.4
30	89	93	.7
25	100	87.5	1.08
20	120	84	1.8

The table shows that a car capable of making, say, 35 m. p. h., with one stop in 2½ miles, would have its schedule speed reduced to 25 m. p. h., should the traffic demand stopping every mile. It is, of course, possible to make somewhat higher schedule speed with one stop per mile than 25 m. p. h., but the increased acceleration required would demand commutation requirements in excess of the capability of the motor.

It would be a novel sight to see the electric road and the steam road change places, as is possible in many cases should the steam road electrically operate its suburban service. With the better facilities at the terminals, with private right of way through the cities to the center of distribution, and, furthermore, with the better and straighter track and fewer stops on the steam lines, they could give speed facilities to the more outlying districts against which the electric road could not compete with its present tracks. The remedy, of course, would be to increase the investment on the electric roadbed, straighten it, increase the radius of what curves are necessary, and purchase right of way through the city, if possible, provided the electric road caters to the long-haul suburban patronage. There are very few railway problems of such assured success as to warrant the very large initial capital investment demanded in such construction, and many electric roads have been able to create a traffic and place themselves on a dividend-paying basis, largely owing to what may be termed the mental inertia of the steam railroad management. That such a period has passed is being evidenced by the large contracts placed by the steam roads for the electrical equipment and extension of their suburban systems. It is not to be expected that the steam roads will continue to ignore the lucrative business of which they can secure a large share, with their good roadbed and terminal facilities, by the additional investment of a comparatively small capital. It will be necessary, therefore, for the electric suburban road to earnestly consider the high-speed possibilities of its line, and the open competition of the steam lines operated electrically will undoubtedly result in a considerable improvement in the straightening of the suburban electric roadbed, double-tracking it and eliminating superfluous and unnecessary stops. Many electric roads now operating could be put on a paying basis by the expenditure of a reasonable amount in bettering the roadbed and proportioning the maximum speed of the cars and the stops to the local requirements of the traffic.

A stop in high-speed railroading is an expensive luxury, and its results may be far reaching, both in the first cost and cost of operating an electric system. Although the initial success of electric roads depended upon the very frequent stops afforded, the scope of such lines has been so extended that stops and fare are the controlling factors, and frequent stops are not conducive to either high speed or low operating expense.

MILEAGE BOOKS FOR INTERURBANS

With the extension of interurban electric roads the necessity for mileage books has been felt, especially in Ohio, where the principal systems extend over a considerable area, and the people patronize these roads freely. In some parts a working agreement has been effected between the several lines, as in Columbus, where the interurban roads radiating from that city have been selling 500-mile books good on any of the roads. Heretofore, these mileage tickets have been put up in the form of books with perforated pages, thirty small tickets to each page. The tickets were so small and the method of handling them so inconvenient for conductors, especially when cars are crowded, that a new form of book has been adopted. The new books are practically the same as those used by steam roads. The mileage is in one strip, the conductor tearing off the required amount, thus keeping his portion all in one piece, which affords a record for the office, and shows the distance traveled.

FEEDER CONDUIT CONSTRUCTION IN BROOKLYN

The Brooklyn Rapid Transit Company has recently had installed by J. G. White & Company an extensive system of underground conduits for high-tension and low-tension feeders. There are from six to twenty-four ducts per line of conduit. Camp vitrified clay ducts are used, mostly of the single type, 3¼ ins. diameter, although part of the system was built of multiple duct, using from two-duct to six-duct sections. The ducts were laid in Portland cement mortar, with burlap joints, and the entire conduit was surrounded with about 4 ins. of Portland cement concrete.

The manholes are located about every 425 ft. of trench, and are of two standard sizes, viz., 4-ft. x 5-ft. x 6-ft. depth and 6-ft. x 7-ft. x 7-ft. depth. The manholes are oval in form, for convenience of handling cables, but of various dimensions to suit the space available. All manholes are covered by short sections of steel rails embedded in concrete filling, and the manhole castings are provided with single cover each.

The low-tension feeder taps, carried to the bridge or elevated structure, consist of single lengths of 3-in. wrought-iron pipe asphalted with a bend of 3-ft. radius, and are fastened to the pillars by wrought-iron clamps. Fig. 1 shows the method of bringing the terminal pipes from a manhole to the elevated railway structure. Fig. 2 illustrates the nesting of twenty pipes carried up a pillar of the new East River Bridge. The special clamps are composed of angle-irons, and spacing rods are between the pipes.

Many obstructions, such as underground pipes, boulders, etc., were encountered. Some of the latter were removed by drilling and feathering, some hoisted out bodily, while others, weighing as much as 15 tons, were lowered by carefully excavating underneath and sinking them out of the way. It was found in many cases that the cost of lowering the boulders was less than hoisting them out of the trench, as in such cases the pavement did not have to be removed to a width greater than the ordinary trench.

On one street the trench was excavated through a solid mass of boulders ranging from 1 ft. in diameter to 8 ft.; but this trench was put through expeditiously without changing the line.

On completion of the conduits the manholes and each duct were rodded and cleaned by drawing through special scrapers and brushes.

Fig. 3 shows a special three-part manhole built at one of the railway sub-stations especially to accommodate a forty-nine-duct line, and with special duct openings connecting all three manholes. This construction permits of a most convenient placing of the cables, although it was partly necessitated on account of an independent high-tension conduit line intersecting this location and the base of the elevated railroad pillar. Twenty-two feeder pipes were brought out of this three-part manhole and carried up the elevated railway column. The construction at this point was particularly difficult on account of obstructions encountered, including large boulders, independent conduit lines, and the footing of the elevated railway column, which required protection.

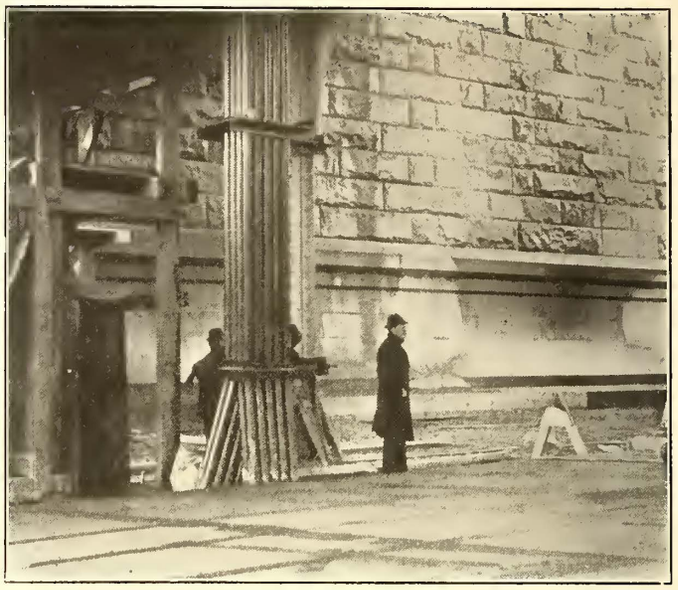


FIG. 2.—TWENTY OUTLET PIPES, RUNNING FROM MANHOLE UP PILLAR OF APPROACH TO NEW EAST RIVER BRIDGE

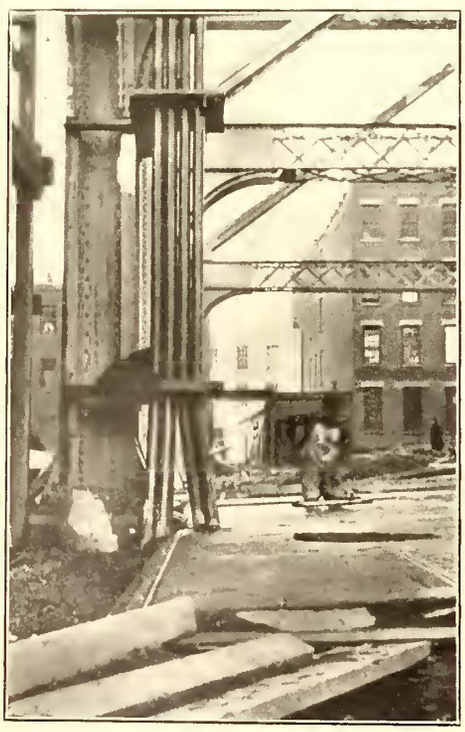


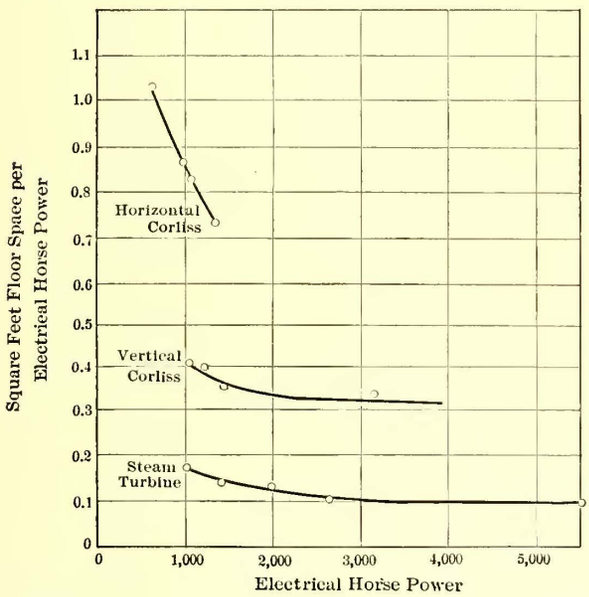
FIG. 1.—OUTLET PIPES, SHOWING METHOD OF ATTACHMENT TO PILLAR

FIG. 3.—TRIPLE MANHOLE FOR DISTRIBUTION OF FORTY-NINE-DUCT LINE AT SUB-STATION

5000-KW WESTINGHOUSE-PARSONS TURBO UNITS

As previously announced in this paper a number of orders have been placed with the Westinghouse Machine Company for 5000 kw units. Among the companies which will use this size of machine are the Pennsylvania Railroad, the Philadelphia Rapid Transit Company, and the Underground Electric Railways Company, Ltd., of London. The work on these machines is now so far completed that detailed particulars of them are available.

The space occupied by the 7500-hp turbine is approximately 27



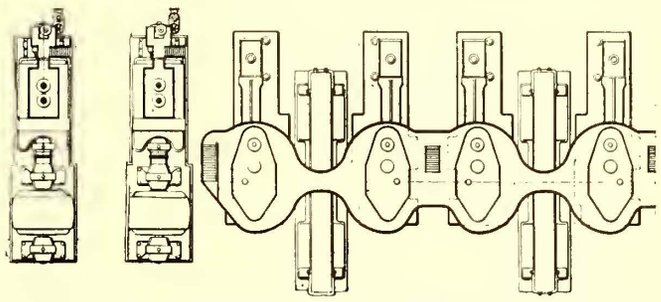
COMPARATIVE FLOOR SPACE OCCUPIED BY 5000-KW TURBINES, VERTICAL AND HORIZONTAL ENGINES

ft. 8 ins. x 13 ft. 3 ins., and the height to the top of the hand railing is 12 ft. This is equivalent to .049 sq. ft. per electric horse-power capacity, or 20.2 hp per square foot of floor area required. For the complete unit a rectangular area of 47 ft. 4 ins. in length and 13 ft. in width is required, which is equivalent to .084 sq. ft. per ehp capacity, or 12 ehp per square foot of floor space. This point of relative economy of space is well illustrated in the cut, which represents the comparative areas occupied by the 5000-kw Manhattan Railway engine-type units and the 5000-kw Westinghouse-Parsons turbine units.

The speeds for the several sizes of turbines manufactured are: For the 5000-kw, 750 r. p. m.; for the 2000-kw unit, 1200 to 1560 r. p. m., and for the 1000-kw unit, 1500 to 1800 r. p. m., depending upon the frequency desired.

The unit rests upon a single bed-plate in two sections, which are secured by shrunk links. To the bed-plate, which is heavily ribbed to secure rigidity, are bolted the pedestals, generator casing and turbine body, but the bed-plate itself is not secured to the foundation by other means than the weight of the unit. Steam and exhaust connections are made beneath the floor level.

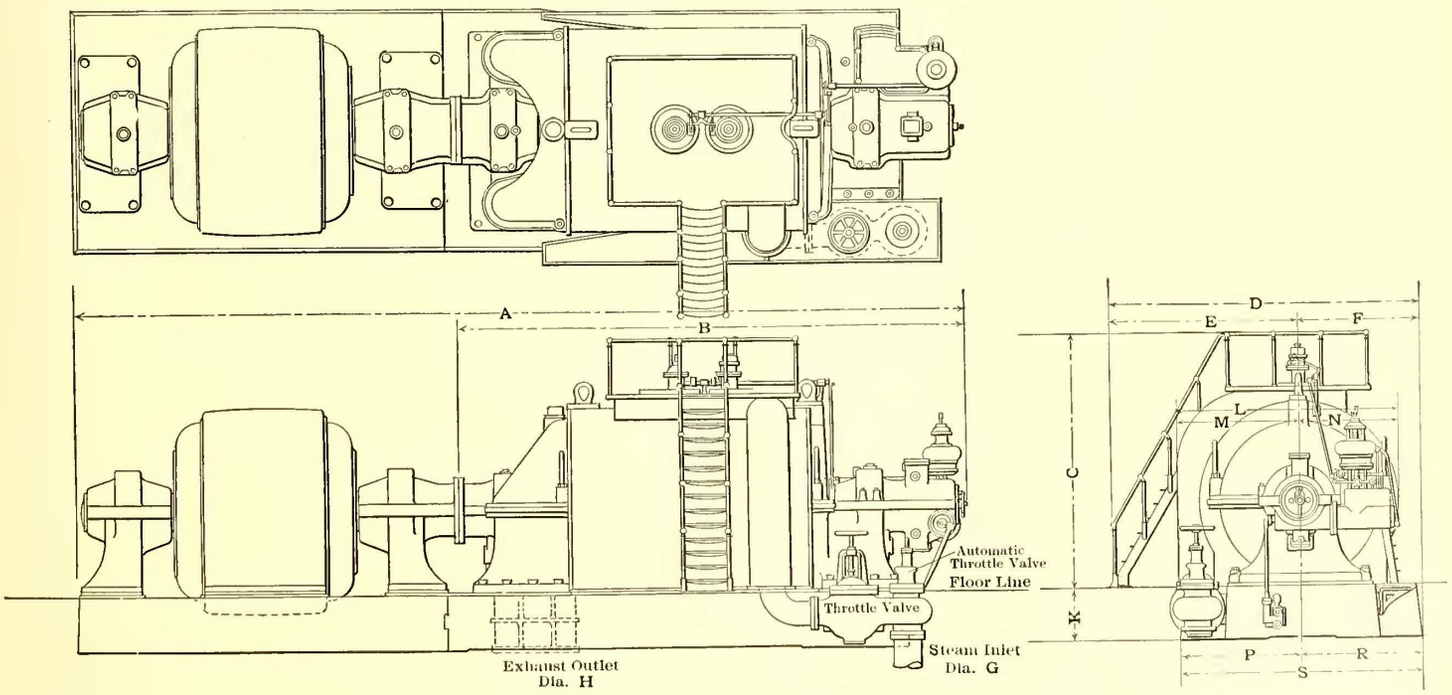
In the smaller machines of this type the cylinder barrel and both journals are cast in a single casting, thus largely minimizing machine work. In the large machine, however, the barrel is cast in two sections, united by links, the outboard



COMPARATIVE SIZES OF TWO TURBINES AND TWO RECIPROCATING ENGINES

section carrying the journal and worm casing, and the inboard section, the journal and exhaust opening, which extends through the bed-plate. As in former types linear expansion and contraction of the turbine are provided for by a sliding foot. The inboard journal pedestal is bolted securely to the bed-plate, but the outboard pedestal is free to slide between parallel machined ways. The main body of the casing is heavily lagged with non-conducting material, secured in place by sheet-steel casings. Leakage of air from the atmosphere into the exhaust spaces of the casing at the entrances of the shaft is prevented by frictionless packing glands.

In shaft construction great rigidity has been secured with minimum use of metal. A central steel quill carries the entire rotating parts, both blades and balance pistons. Hollow forged



PLAN AND ELEVATIONS OF 5000-HP TURBINE

steel ends are forced into the two ends of this quill, under hydraulic pressure, and are in addition secured by arrow-head links. High-pressure steam is conveyed to all parts of this quill structure in such a manner as to eliminate stresses and consequent distortion, due to highly superheated steam.

Power is transmitted to the generator shaft through a flexible coupling, which is housed partly by the turbine and partly by the generator inboard journal. The coupling is split at the junction of the two shafts, so that by removing one bearing cap and the coupling bolts, either section of the unit may be lifted out without disturbing the adjustment of the remaining section. In the smaller sizes, the engagement surfaces of the coupling consist of the squared or hexagonal ends of the shafts, but in the larger machines a crow-foot sleeve is keyed to each shaft, and the power is transmitted by an outside quill engaging the crows-feet.

The journals in the larger machines are of the solid self-aligning type, similar to that employed in generators and cross-compound engines. The departure from the familiar oil-cushioned journal employed in the small machines is occasioned by the speed reduction secured. The journal shells are babbitt lined, and are split horizontally, the two halves being united by bolts with shim adjustment. Oil from a central system is introduced at the center under slight pressure, thoroughly flushing all parts. Axial adjustment is provided by metal shims arranged in quarter-box fashion. The diameter of the shaft at the journal of a 5000-kw machine is 15 ins., strikingly small in comparison to the 34-in. shafts required for a cross-compound reciprocating engine of corresponding capacity.

Longitudinal adjustment to preserve proper side clearance is secured by a thrust bearing, located next to the outboard bearing. The bearing is not subjected to longitudinal thrusts from the action of the steam, and is, consequently, of small size.

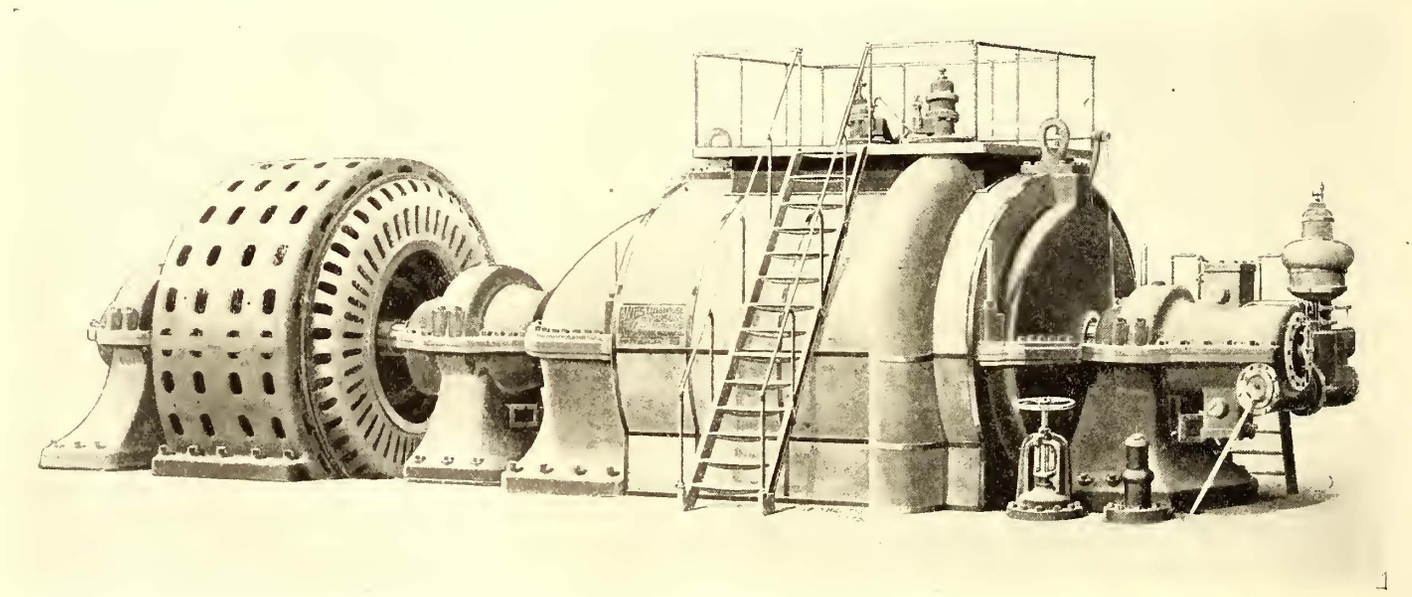
The two half shells are advanced in opposite directions by graduated set screws, so that the actual running clearances are measured in thousandths of an inch. Once set, these adjustments are permanent, and do not require frequent "taking up."

Steam enters the turbine successively through an automatic quick-closing throttle, hand-throttle, strainer and the main admission valve. A circular port surrounding the entrance to the initial stage conveys this steam to all points, so as to avoid stresses incident to more localized admission of highly superheated steam.

An important feature of the steam distribution system is the provision of a by-pass valve. This valve admits high-pressure steam to the second stage of the turbine on overloads, in order to increase its capacity up to 50 per cent in excess of full-rated load. By properly proportioning the by-pass steam to the overload on the turbine, maximum economy may at all times be secured, together with reserve overload capacity. This results in a slight rise in the economy curve on heavy overloads, resesembling, in some respects, the engine economy curve on loads exceeding that of maximum economy. The turbine, however, only suffers in economy at heavy overloads, while the engine economy decreases progressively from 75 per cent to 80 per cent for full-load capacity.

The main admission valve consists of a double-beat poppet valve operated by a small piston, this in turn being controlled by a small pilot-valve directly actuated by the governor mechanism. The valve admits steam to the turbine in puffs, the duration of which are proportioned by the governor to the load upon the turbine. This intermittent method obviates the throttling of steam to accommodate loading and secures the highest economy by using at all loads steam at boiler pressure.

At the extreme outer end of the turbine shaft is mounted a worm driving a short horizontal cross shaft. This shaft drives at one end the oil pump and at the other the governor through bevel gearing. An eccentric provides the reciprocating motion necessary for the valve mechanism.



5000-HP STEAM TURBINE

The governor is of the fly-ball type, with 90-deg. bell crank ball levers mounted on knife edges and fitted with roller contacts. The governor sleeve and spring is mounted on ball bearings, and adjustment of the spring tension may be made while the turbine is running, thus affording a most simple and convenient means for paralleling alternating-current generators and dividing the load proportionately between them.

At the extreme end of the outboard pedestal is mounted an auxiliary speed-limit governor. It is likewise of the centrifugal type and may be set to release, at any predetermined speed, a small plunger valve which controls, with high-pressure steam, the operation of the quick-closing throttle before mentioned. This is normally held open by means of an over-balanced differential piston. At the moment the speed limit operates, the excess pressure is removed and the throttle closes. This device is employed purely for insuring absolute immunity from accident from excess speeds, due to the possible disablement of the governor mechanism.

Copious lubrication is supplied to all journals by means of a plunger pump driven from the worm shaft. The warm oil returning from the bearings passes through a copper coil cooler

in the bed-plate and thence to a reservoir from which the pump draws its supply. The cooled lubricant is circulated at slight pressure, sufficient to ensure positive flow. At no point is oil under high pressure employed for preventing erosion of rubbing parts, bearing areas being sufficient for supporting the weight of the rotating parts.

GENERATORS

In general construction the 5000-kw turbo-generators conform to those now building for smaller machines. The field or revolving element is built from a solid cylinder of steel, slotted for the reception of the bar windings, and provided with ventilating openings corresponding with openings in the laminations of the stationary element. The generators may be wound for high voltage, if desired, in order to avoid the use of step-up transformers in a system of power transmission at voltages ranging up to 15,000.

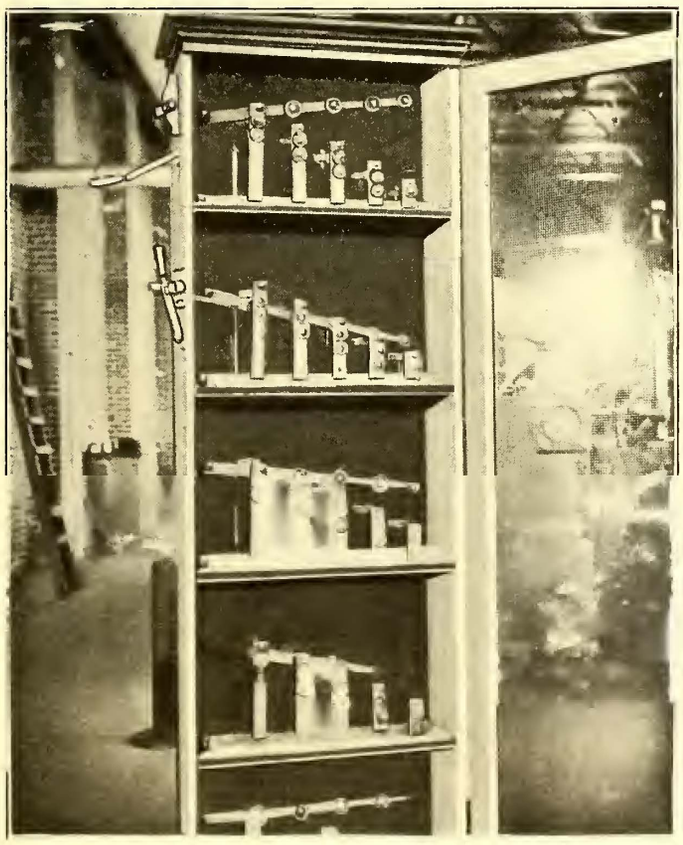
HOME-MADE LIGHTNING ARRESTER

COLORADO SPRINGS AND INTERURBAN RAILWAY COMPANY

Colorado Springs, Col., Dec. 10, 1903.

EDITORS STREET RAILWAY JOURNAL:

The accompanying illustration shows a type of lightning arrester that is doing good service for us here at Colorado Springs. The old street car men will recognize it, as it was used on a great many of the first Sprague roads, but a few changes have been made in the arrangement of fuses. The original arrester consisted of four fuses, which caused a great deal of trouble, as one discharge of lightning would often blow all four fuses, owing to the contact arm dropping from one fuse to the other so quickly that the fumes and gases from the



the trouble of blowing all four fuses upon one discharge. We find that frequently after lightning storms all fuses in these arresters have been blown.

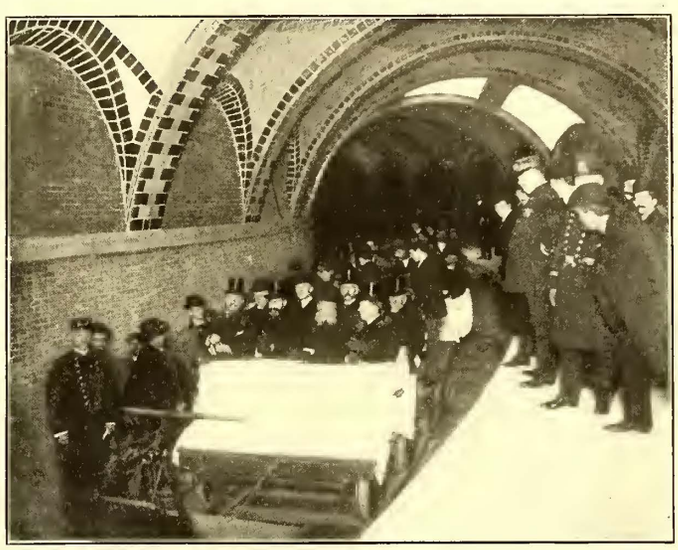
We have, all told, about twenty-six arresters of this type on the line and at places such as the power house and machine shops, where these arresters can be observed, we have never had but one fuse blow at one time on discharge of lightning.

We also use about six Garton arresters to the mile, and all cars are equipped with General Electric type M. D. arresters.

The illustration shows a bank of five of these arresters that has been used at the power house. On the line only single boxes are used. D. L. MACAFFREE, General Manager.

THROUGH THE NEW YORK SUBWAY ON HAND-CARS

Mayor George B. McClellan, of New York, and a party of city officials and invited guests of the Rapid Transit Subway Construction Company made a trip on hand-cars in the New York subway from City Hall up to Manhattan Valley, a distance of more than 6 miles, on the afternoon of Jan. 1. The party met at the City Hall, and started from the loop station at that place at 2 o'clock. Six cars were used, all of which were worked by Italian laborers. Among those who made up the party were Mayor McClellan, John B. McDonald, Comptroller Grout, Rapid Transit Commissioner Alexander E. Orr, Vice-President Walter B. Oakman, of the Rapid Transit Construction Company; William Barclay Parsons, President



NEW YEAR'S INSPECTION PARTY STARTING FROM CITY HALL STATION FOR TRIP THROUGH SUBWAY

COMBINATION SNOW-PLOW AND FREIGHT CAR

The J. G. Brill Company has delivered the heavy type combination double-end nose snow-plow and freight car, shown in the illustration, to the Olean Street Railway Company, of Olean, N. Y. The car without motors weighs about 25,000 lbs., and is probably the heaviest snow-fighting machine ever put on an electric railway. The builders have furnished com-

COMBINATION SNOW-PLOW AND FREIGHT CAR

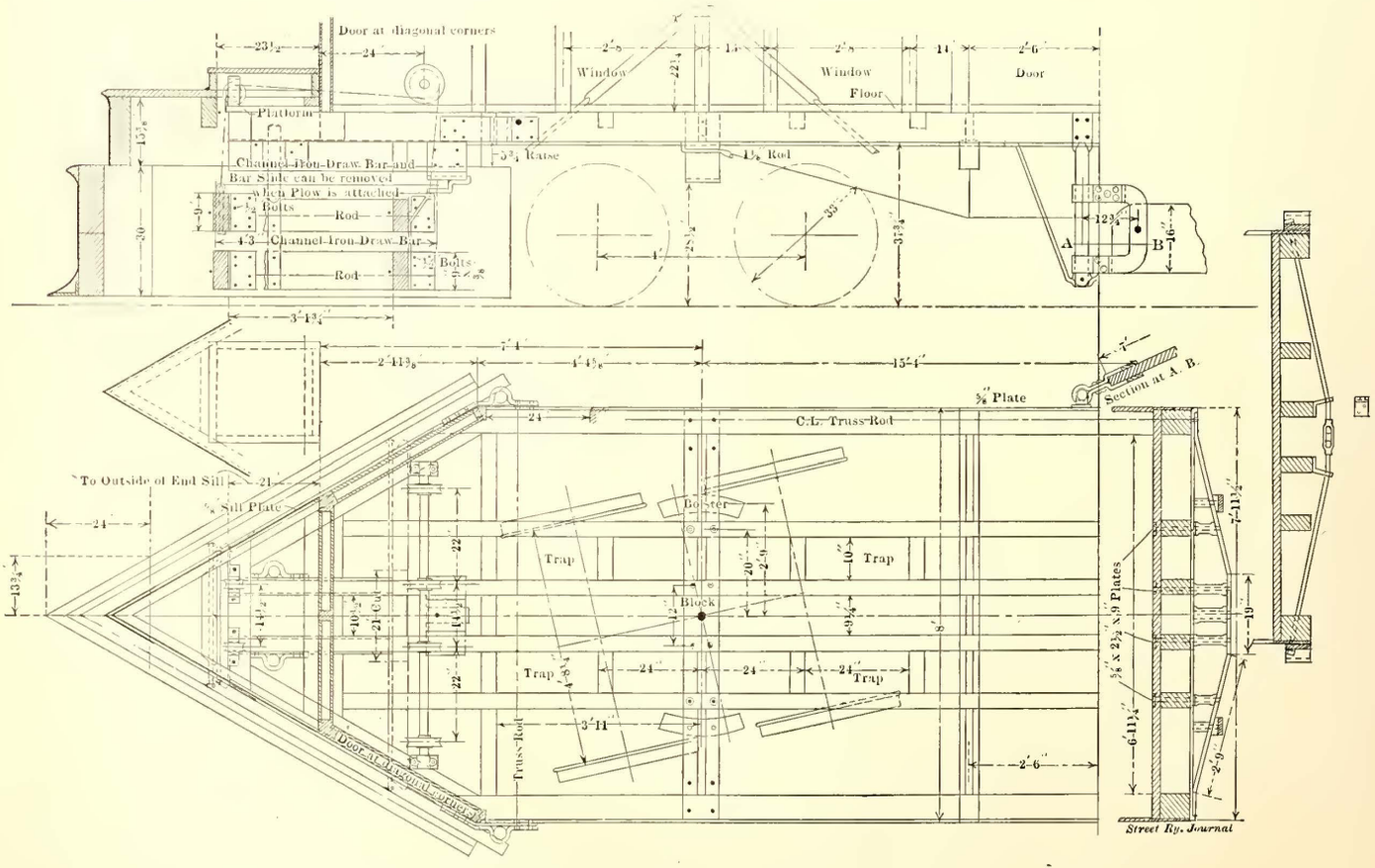
binations of snow-plows and freight cars to several roads, but this is said to be the first car of the kind to have a completely enclosed body. The plow is intended for use on the recently-constructed 5-mile extension to Shingle House, Pa., which is over private right of way, and the nature of the ground tends to render the lines liable to deep snow drifts.

The plows, shear boards and wings are readily removable and the car made ready for freight and locomotive service. To enable long pieces of freight to be handled advantageously, 38-in. doors are provided at diagonally opposite corners, which swing outwardly, and 5-ft. double-sliding doors at the sides. Besides these doors are sliding doors at the corners opposite the swinging doors. The adjustable plows are 9 ft. 4 ins. from point to side, and are 30 ins. wide. They have a heavy backing of oak, and are attached to the body by four heavy guide posts, upon which they are raised vertically by means of stout chains passing over sheaves upon shafts, which are revolved by large horizontal hand wheels geared to the shafts. When the plows are removed, heavy channel-iron draw-bars are installed with bar slides.

The body framing is unusually strong, as reference to the diagram will show. The side sills are 5¾-in. x 7⅞-in. long-leaf yellow pine, plated on the outside with 7-in. x ⅝-in. steel. Tie-rods extend across the car and through the guide plates at the corners to give extra strength at these points. The center and intermediate sills are 3½ ins. x 7⅝ ins., and the end sills 3½ ins. x 7 ins. Besides under truss rods, short upper truss rods are introduced, as shown in the diagram. The wings or levellers are attached to the body by heavy center posts at center of car, securely braced, and are raised vertically instead of at an angle, as in the old style, so that obstacles close to the track may be avoided. These levellers are 7 ft. long. The length of the car over body is 30 ft., and the width over sheathing 8 ft. The car is equipped with sand-boxes, bumpers, draw-bars and roof gongs of the builder's make.

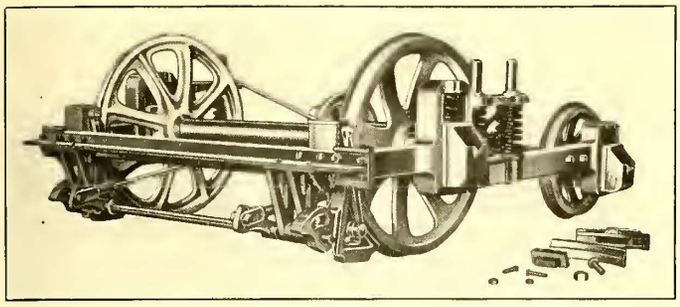
COMBINED WHEEL AND RAIL-BRAKE

The accompanying illustration shows a new combined wheel and rail brake, as applied to a Brill "Eureka" maximum traction truck. The brake has been placed on the market by John W. Fowler, of Brooklyn, N. Y. The brake-shoes are normally supported by spiral springs, in such a way as to permit the free movement of the shoes, both toward and away from the wheels, and toward and away from the rails. The first movement by the motorman of the brake spindle brings the brake-applying cams into contact with inclines on the shoe backs and presses the brake-shoes hard against the wheels. This single move-



CONSTRUCTION DETAILS OF COMBINATION SNOW-PLOW AND FREIGHT CAR

ment will stop a car under ordinary conditions. If, by reason of slippery rails, this initial pressure is not sufficient to overcome the momentum, stop the car and prevent skidding on the rails, or to control the car on a grade, an extra pressure on the brake spindle by the motorman will force the rail-brake at the bottom of shoes into contact with the rails (the wheel-brake still retaining its hold on the wheels), and will bring the car under control. In case of an emergency the wheel-brake and the rail-brake can be brought into contact with the wheels and rail immediately. No alterations to standard truck frame are required in adopting this brake. It is only necessary to remove the ordinary brake and attach the new one to operate on the two large wheels.

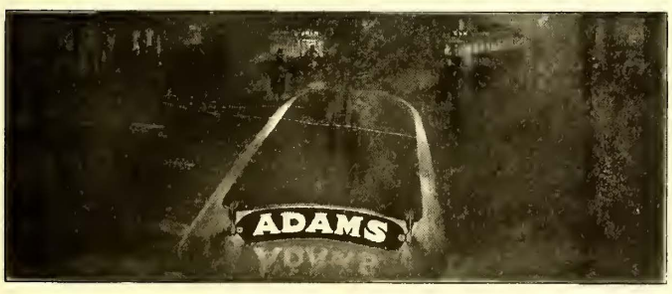


COMBINED WHEEL AND RAIL-BRAKE

The wearing parts are easily replaced. The shoe is constructed in sections (shown at right of cut), with chilled face, soft cast-iron or cast-steel shoes, as may be desired.

VISIBLE CAR SIGNS

A frequent source of annoyance to the public is that caused by motormen who fail to stop their cars if hailed within too short a distance. This often occurs on streets over which more than one line is operated, as many people hestitate to signal a car until they are sure that it is the right one. If the car signs are illegible within reasonable stopping distance dissatisfaction with the railway is sure to result. The rapidly-growing custom of street railways to paint their cars a uniform color has also emphasized the demand for a more effective car sign than has heretofore been considered necessary.



ILLUMINATED CAR SIGN

To meet this need for a car sign that can be read day and night at a considerable distance, the W. R. Garton Company, of Chicago, is making a specialty of the "Visible" car and sub-signs, two types of which are shown in the accompanying illustrations.

These car signs are of the single type. They are made of clear white poplar, the letters being cut out through the wood in a standard bold design. The ends are reinforced with malleable iron straps, forming the hanger catches. Intermediately the boards are braced and prevented from warping by steel straps. The letters are covered with a transparent backing, allowing the light to pass through without glare and showing the lettering plainly at from 200 yds. to 300 yds., corresponding to about two blocks. The signs are thoroughly painted with pure white lead and linseed oil paint, with a black face, showing, day and night, a white letter on a black ground. The hangers on the cars, by which the signs are held, are properly pitched for bolting to the transom roof.

All the signs for a system are made to one standard size, hence any sign may be employed on any car, requiring less than a minute to make the entire change. To attach the sign to the car it is merely dropped into the hangers. To remove, it is simply lifted out. No fastening device of any sort is employed other than the special shape of the hanger and catch, which does not interfere with their ready placing or removal, but prevents rattling or dislodgement. The signs being strongly made, with nothing fragile in their construction, will stand a great deal of handling and wear indefinitely. They may be washed or repainted as easily as the car itself.

INTERCHANGEABLE SUB-SIGN

The advantages claimed over signs of the roll, box or curtain types, include: a much smaller number of signs required and no mechanism to constantly give trouble; flexibility when new routes are added or old ones changed; require but one-half to one-fifth of the time to change the route; greatly reduce the possibility of running the route with the wrong sign set, and at all times show a strong, bold letter, not possible with the other types. Additionally, in signs in which glass in any form is employed, the item of breakage is a serious one in the operating expense.

Economy and effectiveness in operation are secured through the illumination being entirely furnished from the ordinary interior lighting of the cars. These lights shine through the end and side transom sash, and thence through the sign letters, producing an even diffusion and illumination at no extra expense.

In some cities municipal regulations require the showing of a colored light for different routes. This is provided for in the sign itself by a bulls-eye of glass or translucent material.

Interchangeable sub-signs are also used in addition for indicating special routes and terminals, such as "Through," "Depot," "Parks," etc. These are made of malleable iron, transparently backed, and are readable with facility at about one block distance.

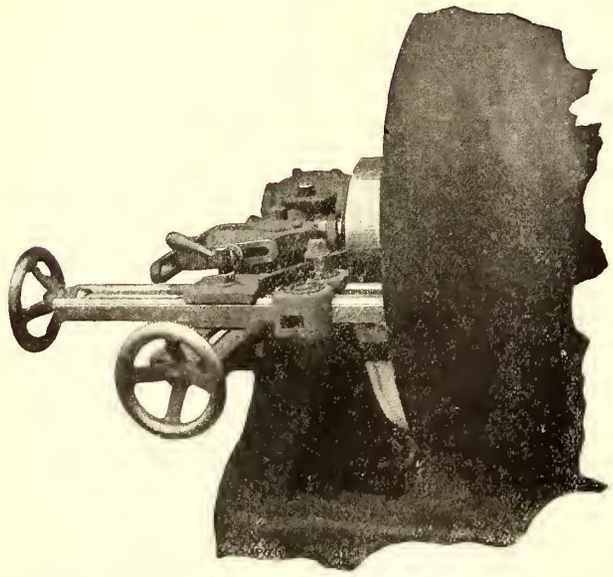
COMMUTATOR TRUING DEVICE

To meet the constantly growing demand for a reliable tool for truing up the commutator of a generator without removing the armature from its bearing, the Akron Electrical Manufacturing Company brought out some time ago the Carr Commutator truing device. This tool is directly attachable to any machine having a removable bearing cap, and it is claimed that it will do work that will compare favorably with that done in a lathe, with the great additional advantage that the armature need not be removed from the machine. The work is done while the shaft is running in its bearings, and, consequently, the face of the commutator runs absolutely true.

In the design of this tool the utmost care has been taken to so distribute the metal as to obtain the utmost rigidity, the stiffest possible sections being employed throughout, with the

result that the fault so common in other devices of this character—namely, lack of rigidity and consequent chattering and gouging in of the tool—has been entirely obviated. So far has this difficulty been overcome, that when the commutator is dressed off, a slight application of No. 00 sandpaper will give a perfectly finished commutator.

As shown in the accompanying illustration a T-shaped clamp is bolted to the machine in place of the bearing cap, set screws



COMMUTATOR TRUING DEVICE ATTACHED TO GENERATOR

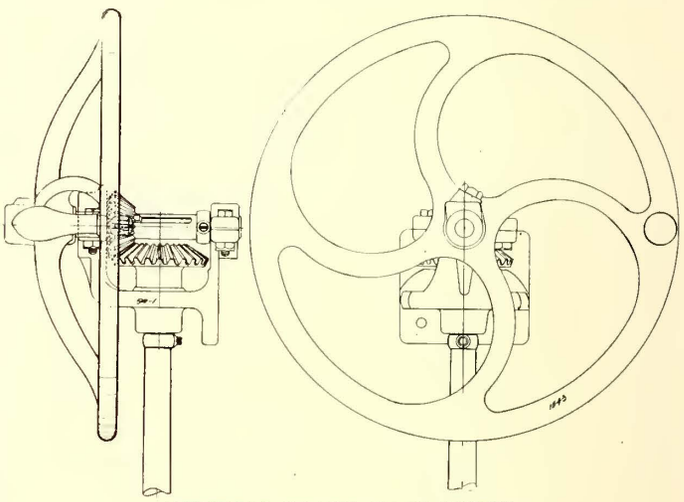
being provided in its lower end to rest against the pedestal and steady the tool. On this piece the tool bar is clamped by means of an ingenious saddle, which allows the bar to move both perpendicular and parallel to the face of the commutator and instantly clamps the two pieces by drawing a lever nut. The bar carries a slide, which in turn carries the tool post; this slide is driven relative to the bar by means of a screw and hand wheel, thus giving the feed. The tool bar is also easily adjusted to any width of commutator up to 12 ins. in this company's type A and to 18 ins. in type B, this adjustment being accomplished by slacking the lever nut and sliding the bar in or out the necessary distance parallel to the commutator. The bar may also be reversed by slacking the lever nut and removing the top half of the saddle. This, with the double tool post socket, makes it possible to use the device on either side of the machine, depending on the more convenient direction of commutator rotation. The adjustment of the tool at right angles to the face of the commutator is also accomplished by hand wheel and screw operation on the saddle, it being first necessary to slacken the lever nut slightly. In operating the device this nut should always be drawn tight, but when it is desired to face the end or leads of a commutator, this nut may be slackened enough to allow the requisite movement. At the extreme outer end of the tool bar a threaded rod is screwed in, and intended to be screwed down to a solid support, acting as a jack to steady the tool at the extreme limit of its cut. A center is attached to the device by means of adjustable brackets, to prevent end motion in the commutator while being turned.

The tool is adjusted to the desired cut by means of the cross-feed. This cut should invariably be light, several light cuts being taken in preference to one heavy one. The feed should also be slow, as a smoother job is thus obtained. For the best work a commutator speed of from 200 ft. to 250 ft. per minute is recommended, and in case of large machines this can generally be obtained by slowing the source of power, and also often with small sizes. A crank for attachment to the pulley is provided, so the machine can be operated by hand if necessary, but it is desirable to use the power drive owing to its more uniform speed.

This device is built in two sizes: Type A, operative on commutators up to and including 20 ins. in diameter and 12-in. face; type B, adapted to commutators up to and including 48 ins. in diameter and 18-in. face. However, the design of the generator enters largely into the range of the tool, and in some cases it will be considerably in excess of the above figures.

VERTICAL BRAKE HAND WHEEL

A vertical hand wheel for hand brakes, bevel geared to the regular brake staff, is one of the regular features of the vestibule cars supplied by the St. Louis Car Company, unless otherwise specified. This hand wheel is of such shape that it takes up very little room in the vestibule, and the handle extends no farther than the hub of the wheel, owing to a dish in the latter. Of course, on heavy cars where air brakes are used, the hand brake is only used in an emergency, and for this reason it is



VERTICAL BRAKE HAND-WHEEL

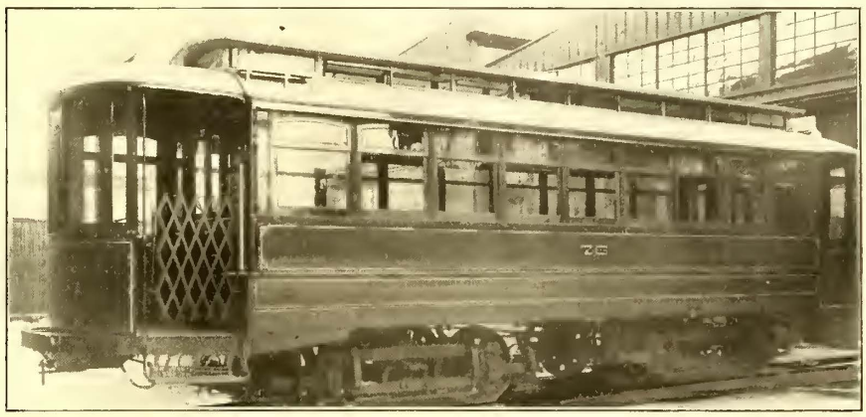
especially desirable that it should not permanently take up much space on the platform. In this case, there is no sacrifice of efficiency by adopting a form of brake occupying but little room, because the vertical wheel brake is practically as easy to operate as the ordinary horizontal brake staff used on open cars. Indeed, in some respects, it is more effective in action than the ordinary brake handle. It can be rapidly revolved to take up brake slack, and after the slack is taken up, the motorman can pull up on the rim of the wheel next to him and get a very effective purchase, as he has only to brace against the floor without altering his usual position. There is also less likelihood of passengers or motormen being injured with a flying brake handle where this type is used in place of the horizontal style.

COMPETITION BETWEEN STEAM AND ELECTRIC LINES IN OHIO

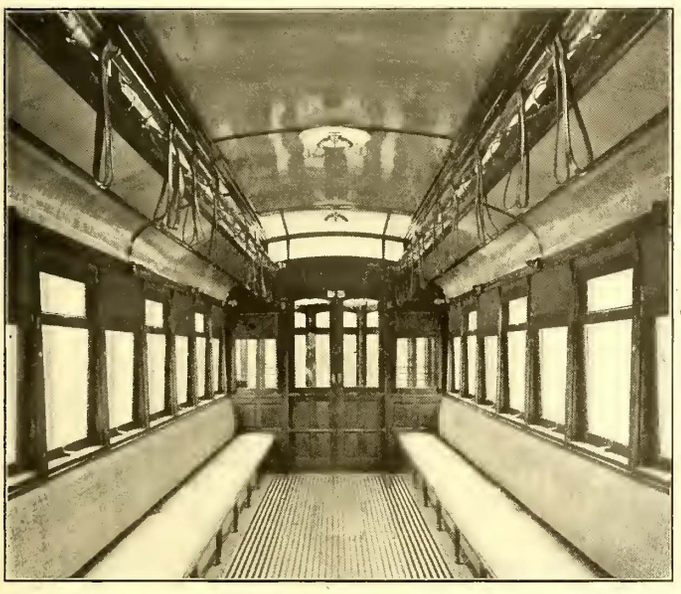
The Cincinnati, Hamilton & Dayton Railway (steam) has started a rate war against the Western Ohio Railway, the Dayton & Troy Electric Railway, and the Cincinnati, Dayton & Toledo Traction Company, which parallel its line between Lima and Cincinnati, Ohio. The steam railroad has cut its round-trip rates to all of the towns in this district, and is also selling round-trip tickets, good for two persons, going one way. The electric railways more than held their own during the recent holiday excursion business, despite the fact that in some cases the steam rates were lower.

NEW CARS FOR THE EAST ST. LOUIS & SUBURBAN RAILWAY

The East St. Louis & Suburban Railway Company has lately received from the American Car Company, St. Louis, six fine cars, which have some interesting features. The platforms have an entrance from one side only, and the steel dashers are brought around to the corner posts. Substantial portable vestibules enclose the platforms except at the entrances, and gates hinged to the car bodies close the entrances. The platform steps are 17⅝ ins. from the rail heads, and from step to platform is 14 ins. The platforms are 4 ft. 6 ins. from the end panel over the crown pieces. The seats are upholstered in spring cane, and are placed longitudinally. The interiors are finished in cherry with ceilings of birch. Besides electroliers at intervals along the center of the monitor deck, single lights are placed along the upper window rails. The upper window sashes are stationary, and the lower arranged to drop into pockets, which are covered with flaps. The length of the cars over the end panels is 26 ft., and over the crown pieces, 35 ft.; width over sills, 7 ft. 9 ins., and over the posts at belt, 8 ft. 2½ ins.; from center to center of posts, 2 ft. 9 ins. The side posts are 2¼ ins. thick, and the corner posts 3¾ ins.; sweep of posts, 2½ ins.; size of side sill, 4¾ ins. x 7 ins.; end sills, 3¾ ins. x 7 ins. The cars are equipped with brake handles, folding gates, sand-boxes, alarm gongs, angle-iron bumpers and other specialties of Brill manufacture. The cars are mounted on Brill 27-G trucks, having 4-ft. wheel base, 33-in. wheels, and equipped with 38-hp motors.



ONE OF THE NEW CARS FOR THE EAST ST. LOUIS & SUBURBAN RAILWAY



INTERIOR OF EAST ST. LOUIS & SUBURBAN RAILWAY CAR

CREOSOTED TIMBER

In the STREET RAILWAY JOURNAL of May 30, 1903, an abstract was published of a paper by Dr. Herman von Schrenk on "The Use of Timber by Railroads and Its Relation to Forestry." After citing numerous foreign experiments in timber preservation, he concluded that short-lived, porous timber well repaid the cost of proper preservative treatment, and that creosoting usually gave the best results.

It is interesting to note in connection with this well-known government expert's opinion of creosoting, that that method has been for a long time extensively applied by the Wyckoff Pipe & Creosoting Company, Inc., whose offices are at Stamford, Conn., and works at Portsmouth, Va. This company has been creosoting timber since 1881, and as many of its installations have been in successful use for fifteen years to twenty years, it has had every opportunity to study and apply the best methods for each kind of timber as used for wire and cable conduits, poles, cross-arms, railroad ties, wharf and bridge timbers, etc. Among the company's important customers are the Bell Telephone Companies, who purchase from it millions of feet of conduit every year. Only recently several carloads of creosoted timber were shipped to one of the largest railroad systems in the United States.

The method applied by this company in preserving wood is to first subject the timber to superheated system to draw out the sap, after which creosote is forced into the wood under high pressure. This method has proven so satisfactory that the company is prepared to guarantee that its creosoted timber will never rot. It should be noted that as creosoted timber is an excellent insulator it is doubly valuable on third-rail systems and other electrical installations.

Several weeks ago the company received a number of pieces of conduit from the Bell Telephone Company, of Philadelphia, with the statement that it was obliged to take up some of the Wyckoff conduit, laid fifteen years ago, on account of the subway now being built by the Philadelphia Rapid Transit Company. The Bell Company wrote that every piece was found to be in a perfect state of preservation, and that even the small tenons were as sound as the day they were laid. The United States Department of Agriculture has asked for a piece of this conduit, to be placed on exhibition in Washington, and has also made a request for two pieces to be sent to St. Louis.

A UNIQUE CAR HOUSE AND SHOP

The Columbus, Delaware & Marion Railway Company has completed a unique car house and shop at Stratford. The building has been erected as an addition to the power house at that point, and is constructed of blue sandstone, which was quarried on the company's own property. The building has nine tracks, each with a capacity of two cars. The first and second tracks are for repair work and contain pits. The third track is the paint track, while the remaining tracks are used for storage. In the rear, on the left, is the machine shop, and on the right, the carpenter shop. The second floor is utilized for the store room and the electrical repair department. A crane has been arranged to lift motors, armatures and other heavy parts from the first floor below, and convey them to any point in the electrical repair room. The equipment of the shop is the same as was used in the old shop, which was described in the article on the Columbus, Delaware & Marion Railway in the STREET RAILWAY JOURNAL last year.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 6, 1904.

The Money Market

The three principal features in the money market during the last fortnight have been a heavy expansion in bank loans, a recovery in foreign exchange and continued arrivals of currency from the interior. The bank loan increase, amounting to $30,000,000, is explained principally by the shifting of loans from the trust companies to the banks, consequent upon the desire of the former to strengthen their position as far as is possible at the end of the year. A further cause is the large investment in exchange drafts by local bankers, which means essentially that we are lending Europe a part of the sums due to American merchants in the foreign trade. Purchases of these drafts on a large scale account in large measure also for the rise in sterling rates. It still seems doubtful, however, whether exchange has recovered sufficiently to shut off gold imports, and at this writing there are reports that more of the precious metal has been engaged in London for shipment to this country. In spite of a decline of nearly $5,000,000 during the last two weeks in the surplus reserve, the banking condition is considerably stronger than the average for this period in former years. This fact is reflected in the comparatively low rates for money which have prevailed in face of the usual extremely large requirements at the outset of the new year. In the first week of January, a year ago, call money on the Stock Exchange averaged somewhat above 11 per cent, while 15 per cent was occasionally reached. During the past week the highest figure touched was 9 per cent, and the great bulk of the loans made were at 6 per cent and under. Time money, which commanded 6 per cent last year, is now ruling at from 5 to 5½, and mercantile discounts are accepted on a correspondingly lower basis. Altogether, the new year starts with a pleasing prospect of an easy money market for some time to come. Leaving aside the possibility of additional gold importations, the movement of domestic currency inward from the interior promises to continue in volume sufficient to add heavily to local resources during the next six weeks. The treasury will have its usual large disbursements to make in the course of this month, for pensions and other extraordinary purposes, and a steady credit is thereby assured the banks from this quarter. One single possibility to interfere with this satisfactory outlook, is, that the railroads and industrial corporations, which have new capital to raise, may feel that the time has arrived to make applications at the loan counter. These corporate borrowings, it will be remembered, bore very severely upon surplus bank resources, both in 1901 and 1902, and the suggestion that they may be repeated now cannot but be viewed with some uneasiness. On the other hand, it may be said that demands for ordinarily speculative purposes are comparatively light, and that less money is required in general trade than in any of the previous seasons.

The Stock Market

There have been few features in the general stock market of the last two weeks. Trading has been active enough, considering the holidays, but it has been confined entirely to professional operators, who have manipulated the market to suit themselves. Speculative operations, on the whole, have favored the side of rising prices first, because outside conditions are generally favorable, and second, because the course of events on the Stock Exchange itself has shown that there is very little desire among real holders of stocks to sell. The most important influence working against the market has been the fear of hostilities between Russia and Japan, which has depressed financial sentiment abroad, and caused some rather heavy selling for foreign account on this side of the water. With the exception of the war possibilities, outside developments have been generally encouraging to owners of securities. The steady tendency toward relaxation in the money market, and the exceedingly favorable position of foreign exchange have been related already. Railroad earnings, except in the case of the anthracite coal roads, have held up extremely well, and in many cases are, in fact, showing a larger proportion of net earnings increases than they were a year, or two years ago. What between easy money and heavy earnings expansion it is hard to see how the feeling can be anything but optimistic so far as the Western railroad shares are concerned, and this, indeed, is the general view now taken on the Stock Exchange. In the industrial shares, and in some of the railroads, where traffic receipts are falling behind, there may be room for more misgivings. Yesterday's very poor showing of the Steel Corporation illustrates the vicissitudes which holders of industrial companies' shares must expect. But for the market as a whole, the present position is distinctly sound, and while there may be no good reason to expect much advance in prices, there is even less ground to look for much of a decline.

The publication yesterday of the Brooklyn Rapid Transit earnings, showing a heavy increase for the half year, brings out one reason, at least, for the recent advance in the stock. Professional opinion otherwise is rather mixed as to the speculative position in the stock. One set of observers think they see evidence of quiet unloading by the "political pool," which took such an active part in the recent advance; another set insist that the stock is being firmly held by the larger interests, for higher prices. Manhattan Elevated and Metropolitan Street Railway shares have both shown considerable independent strength during the past fortnight. Earnings of the Manhattan for the December quarter are said, by people likely to know, to break all records.

Philadelphia

The principal movement in the recent dealings in the Philadelphia traction group has been the advance on heavy trading in the Philadelphia Company issues. The common moved up from 39 to 42; then, with the dividend off, sold from 41½ down to 40⅜. The preferred meanwhile, which for some time has kept inactive around 43, rose to 46. There is no explanation for this advance, except that the recent earnings of the company's properties have been favorable. It has looked simply as if a pool had been formed, taking advantage of general market conditions, to bid up the stock. Philadelphia Rapid Transit, a week ago, fell to 7¾—the lowest ever reached. Since then, however, it has recovered, selling yesterday at 8½, after going as high as 9. Union Traction has been steady between 45⅝ and 46, and Philadelphia Traction has also held firm between 97 and 97⅞. American Railways, on light transactions, rose from 43⅛ to 44½, and then reacted to 44. Philadelphia Electric advanced from 5¾ to 6 3-16, but later lost nearly all its gain. Purchase of a hundred shares of Consolidated Traction of New Jersey raised the stock from 64½ to 66½, but an odd lot sold afterwards at 65½. Union Traction of Indiana sold at 35; this completes the list of the two week's trading.

Chicago

Two stocks only have shown any semblance of activity in the Chicago market, during the period under review. These are South Side Elevated, which sold down from 95 to 94, and Lake Street Elevated receipts, which advanced from 1⅞ to 2¼. It is understood that the South Side management in issuing its $7,000,000 new stock, to pay for its extensions, will arrange to have the new shares paid for in three equal installments, running over, perhaps, two years. In that event the stock would not be issued until it had all been paid for, and the new lines built. No interference with present dividends would be necessary under this plan, because the new extensions would be earning a revenue before dividends would be called for on the new stock. The motive for the buying of Lake Street securities probably lies in the fact that the reorganization scheme has now become operative, and the worst that can happen is known. Other sales in the Chicago traction group comprise Union Traction common from 6 up to 7, then down to 6⅝ (the stock sold as high as 7⅝ in New York), Union Traction preferred from 27 to 30, City Railway from 166 to 162, Lake Street stock at 2, Metropolitan common at 17, and Metropolitan preferred at 52.

Other Traction Securities

Rumors of a dividend increase—which, however, are wholly unconfirmed—have been used as an excuse to bid up North American shares rather sharply, on the New York Stock Exchange. A professional speculative party announces privately that it is very bullish on the stock. The local curb dealings, so far as the traction specialties are concerned, hardly deserve much notice. Interborough Rapid Transit, which a fortnight ago sold as low as 90⅜, advanced to 93, and then dropped back to 92½. The only other trades recorded are a hundred shares of St. Louis Transit at 11¾, Washington Traction preferred at 46 and Chesapeake Traction 5s at 90½. In Boston the market has been extremely dull. Elevated shares ranged between 140 and 140¾. Massachusetts Electric common was bid up from 18 to 20¼, but transactions in the stock were

too small to be of any significance, and the quotation yielded subsequently to 19. Massachusetts Electric preferred sold at 75¾ and 76, West End common between 89 and 89½, and the preferred between 110 and 108. The regularly active Baltimore securities have varied but little. United Railways stock is a trifle lower at 8½. The income bonds have not gone above 56¾, nor below 56½, while the general mortgage 4s, after selling at 91⅝, weakened to 91¼. Other sales for the two weeks' period comprise Atlanta Consolidated Street Railway 5s at 105½, Anacostia & Potomac 5s at 90, Norfolk Street Railway 5s at 107¾, Newport News & Old Point Comfort 5s at 97¼, Central Street Railway 5s at 112¼ and Charleston Consolidated Street Railway 5s at 102.

There was practically nothing doing in tractions in the Ohio financial centers last week. At Cincinnati, the Cincinnati Street Railway stock advanced to 134 on sales of about 300 shares. A small lot of Detroit United sold at 69. A block of Miami & Erie canal bonds changed hands at 40, which is purely a gamble, as the company is in bad shape financially, and its future depends wholly upon the action of the Legislature in granting the canal company additional privileges. A block of Northern Ohio consolidated 5s sold at par, an advance over previous figures. At Columbus, Columbus Railway & Light common continued in demand, and several hundred shares sold from 33 to 34⅛, which is a high mark. The old Columbus Railway common sold at 85⅜, also an advance. At Cleveland, the only transaction during the week was a lot of Northern Ohio Traction & Light at 13¼, a slight decline.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid	
	Dec. 21	Jan. 5
American Railways	43	43½
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	50⅞	49⅛
Chicago City	160	160
Chicago Union Traction (common)	5½	6½
Chicago Union Traction (preferred)	25½	28
Cleveland Electric	65½	65
Consolidated Traction of New Jersey	64	..
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	68	66½
Elgin, Aurora & Southern	a38	a32
Lake Shore Electric	—	—
Lake Street Elevated	2	1¾
Manhattan Railway	141¼	142½
Massachusetts Electric Cos. (common)	18½	19½
Massachusetts Electric Cos. (preferred)	75	75¼
Metropolitan Elevated, Chicago (common)	16	17
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	122¼	122¼
Metropolitan Securities	—	88
New Orleans Railways (common)	10⅛	10
New Orleans Railways (preferred)	30½	30½
New Orleans Railways 4½s	80	80
North American	75½	83½
Northern Ohio Traction & Light	13¼	13¼
Philadelphia Company (common)	39	40¾
Philadelphia Rapid Transit	8½	8¼
Philadelphia Traction	96	97
St. Louis Transit (common)	11½	13
South Side Elevated (Chicago)	90¼	92¼
Third Avenue	112	119
Twin City, Minneapolis (common)	91½	91
Union Traction (Philadelphia)	45½	45
United Railways, St. Louis (preferred)	55	55
West End (common)	89	89½
West End (preferred)	110	109½

a Asked.

Iron and Steel

It cannot be said that a decrease in the Steel Corporation's earnings, even as large as the one reported yesterday, had not been expected, both by Wall Street men and by authorities in the iron trade. How much of a shock it will be to the outside public remains to be seen. The optimistic reading of the situation is that the "pauper period" in the iron industry was witnessed at its extreme in the four months ending with December, and that a gradual improvement, both in earnings and in profits, will be witnessed from now on. The important question to be answered in the immediate future is whether the recent price reductions have been sufficient to induce liberal buying for long-term requirements, or whether consumers, not feeling entirely satisfied that the reaction is over, will content theselves with buying from hand to mouth. Quotations are as follows: Bessemer pig iron $14.50, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper, 12½ cents, tin 28¾ cents, lead 4¼ cents, and spelter 5 cents.

POWER IN BALTIMORE

It is stated from Baltimore, Md., that the completion of the great project for the electrical development of the falls of the Susquehanna River, on the Niagara plan, is now assured by the fact that Anthony N. Brady, of New York, and associates have taken over $1,000,000 stock in the United Electric & Power Company, of Baltimore, controlling the lighting of that city. Plans for the power plant at Conowingo, on the Susquehanna, have been completed, and routes for the cables to Baltimore, Havre de Grace, Elkton and other towns in Maryland, Southern Pennsylvania and Delaware have been laid out. There will soon be a number of changes in the directorate of the United Electric Light & Power Company. The new interests in the company have tendered the presidency to S. Davies Warfield, president of the Continental Trust Company, who conducted the negotiations with Mr. Brady. There are now five vacancies in the board of directors, and Mr. Brady, with three of his associates, will fill four of these. Mr. Brady will also become a member of the executive committee of the company, which will be increased from five to seven members. The present executive committee is composed of S. Davies Warfield, William T. Dixon, Thomas J. Hayward and Francis E. Waters. The dissolution of the syndicate holding the $2,000,000 common stock of the United Electric Light & Power Company, and owning the Mount Washington Electric Light & Power Company, will mean a distribution of these securities to the new owners. The investment of the New York interests in the Susquehanna project will probably be $10,000,000. It is proposed the works can be completed in 1905 to supply 40,000 hp to Baltimore.

ELECTRIC RAILWAY PLANS FOR THE NEW EAST RIVER BRIDGE

With the completion of the Williamsburg bridge the question of granting concessions for street railway lines comes up, and many plans are now under consideration for the utilization of this new means of relief for Brooklyn Bridge. It has been proposed to give the surface railroad companies of both the great boroughs right of way over the new bridge, one on the north and the other on the south roadway. The plan is to give to the Brooklyn Rapid Transit Company the right of way over the south roadway and let its cars run over the bridge to a terminal station and loop at the Manhattan end, thence back to Brooklyn; and to give to the Interurban Street Railway Company a similar franchise over the north roadway, with the condition of a terminal station and loop at the Brooklyn end of the bridge.

The advantages claimed for this plan are set forth under five heads.

1. The evening crowds would enjoy the same advantages as the morning crowds. In the morning riders from remote points in Brooklyn would remain on the Brooklyn Rapid Transit cars and diverge in Manhattan, as they do now on the Brooklyn Bridge. In the evening the riders could cross the bridge on the Interurban cars and diverge in Brooklyn. This, it is claimed, would greatly decrease the crowding at the terminals.

2. By reason of the Interurban lines reaching Brooklyn persons who live within walking distance of the Brooklyn terminal, and there are many thousands, would have to pay but one fare and would save 10 cents a day in carfare.

3. Commissioner Lindenthal has stated that 450 cars an hour can be operated on tracks which are not blocked by trucks and wagons. The maximum for Brooklyn Bridge is 275 an hour. There would be no deprivation to Brooklynites to have two of the four trolley tracks given to the Interurban Street Railway Company.

4. In case of a serious breakdown, blockade or strike on either line the other line would maintain the steady service so essential to the welfare of both boroughs.

5. All the advantages of a railroad monopoly of the bridge would still obtain. The advantages mentioned would be supplementary and additional.

NEW RULES OF THE ROAD FOR NEW YORK CITY

On Dec. 8, 1903, the committee on law and legislation of the Board of Aldermen of the city of New York presented for the consideration of that body an ordinance entitled "Rules of the Road," the said ordinance being a substitute for the one referred to the committee on April 28, 1903. The revised ordinance was passed by the Board of Aldermen on Dec. 8, and approved by the mayor on Dec. 14, after section 15, article 1, had been amended at his suggestion by the Board, namely, to continue giving north and southbound travel the right of way. The most important feature of the new ordinance is that requiring cars to stop on the near side of the street, before reaching crosswalk, when discharging or taking passengers. This rule has been in force on the lines of the Brooklyn Rapid Transit Company (Brooklyn Borough) since Jan. 1, 1904, and will become effective on the lines of the Interurban Railway Company (Manhattan Borough) beginning Jan. 17, 1904.

The Police Department has published and distributed an abstract of the new ordinance, covering the rules for driving, and guide signs have been placed at all important crossings.

The new ordinance as approved on Dec. 14 is given herewith:

An Ordinance in Relation to the Rules of the Road.

Be it Ordained by the Board of Aldermen of The City of New York as follows:

Article I.—Rules of the Road.

Section 1. Vehicles Keeping to the Right—Vehicles shall keep to the right, and as near the right hand curb as possible.

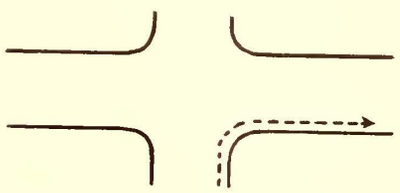
Sec. 2. Vehicles Meeting—Vehicles meeting shall pass each other to the right.

Sec. 3. Vehicles Overtaking Others—Vehicles overtaking others shall, in passing, keep to the left.

Sec. 4. Turning and Starting—The driver or person having charge of any vehicle, before turning the corner of any street, or turning out or starting from or stopping at the curb line of any street, shall first see that there is sufficient space free from other vehicles, so that such turn, stop or start may be safely made, and shall then give a plainly visible or audible signal.

Sec. 5. Turning to the Right Into Another Street—A vehicle turning to the right into another street shall turn the corner as near to the curb as practicable.

THUS:



Sec. 6. Turning to the Left Into Another Street—A vehicle turning to the left into another street shall pass to the right of and beyond the center of the street intersection before turning.

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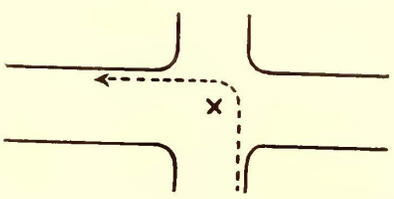

Sec. 7. Crossing Streets—A vehicle crossing from one side of the street to the other shall do so by turning to the left so as to head in the same direction as the traffic on that side of the street.

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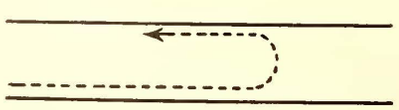


Sec. 8. Stopping at Curb—No vehicle shall stop with its left side to the curb.

Sec. 9. Driving, Backing, etc., on Sidewalks—It shall not be lawful for any public cartman, or for any person driving or having charge of any public cart, wagon or other vehicle, to drive or back any such public cart or any other cart, wagon or other vehicle, onto the sidewalk of any of the streets of said city, except as hereinafter provided, or to stop any such cart, or any other vehicle, on any of the crosswalks or intersection of streets so as to obstruct or hinder the travel along such crosswalks or intersection of streets, or to place any such carts or other vehicles crosswise of any streets of said city, except to load thereon or unload therefrom; but in no case shall it be lawful for any person to permit such cart or other vehicle to remain so crosswise of any street for a longer period than may be actually necessary for such purpose; but it shall be lawful for the owner or occupant of any store, warehouse or building in any street or avenue in which the rails of any railroad company are laid so close to the curbstones as to prevent the owners or occupants from keeping any such cart or other vehicle in the carriageway in front of his place of business without interference with the passing cars of any such railroad company to occupy with such cart or other vehicle during business hours so much of the sidewalk as may be necessary for such cart or other vehicle; provided that sufficient space be retained for the passage of pedestrians between the cart or other vehicle so permitted to occupy such portion of the sidewalk and the stoop or front of every such store, warehouse or other building. In no case shall it be lawful to place any such carts, wagons, or other vehicles, crosswise of the carriageway on Broadway or Fifth Avenue, south of Fifty-Ninth Street, or on Park Row, nor shall any such cart, wagon or other vehicle be permitted to remain in front of any premises on said Broadway or Fifth Avenue, south of Fifty-Ninth Street, or on Park Row, unless placed in close proximity to the curb, with the side of such cart, wagon or other vehicle parallel therewith.

Sec. 10. In no case shall a vehicle remain backed up to the curb, excepting when actually loading or unloading.

Sec. 11. Stopping Close to the Curb Line—Unless in an emergency or to allow another vehicle (as provided in sections 16, 17 and 18) or pedestrian to cross its path, no vehicle shall stop in any public street or highway of this city, except close to the curb line.

Sec. 12. Obstructing Crossings—No vehicle shall stop, for the purpose of taking or setting down a passenger or loading or unloading freight, or for any other purpose except in case of accident or other emergency, or when directed to stop by the police, in such a way as to obstruct any street or crossing.

Sec. 13. Stopping Near Corners—No vehicles shall stop or stand within the intersection of any street, nor within ten feet of a street corner.

Sec. 14. Surface Cars Taking On or Discharging Passengers—Surface cars shall stop only on the near side of the street, and before reaching crosswalk, to discharge or take on passengers.

Sec. 15. Right of Way—On all public streets and highways of the city, all vehicles in (an easterly) a northerly or (westerly) southern direction, shall have the right of way over any vehicle going in (a northerly) an easterly or (southerly) westerly direction.

Sec. 16. Right of Way of Certain Vehicles—The officers and men of the Fire Department and Fire Patrol, with their fire apparatus of all kinds, when going to, or on duty, at or returning from a fire, and all ambulances, and the officers and men and vehicles of the Police Department, and all physicians who have a police permit (as hereinafter provided) shall have the right of way in any street and through any procession, except over vehicles carrying the United States mail. The Police Department is hereby empowered to issue, upon application therefor, a permit for such right of way to any duly registered physician, which permit shall not be transferable.

Sec. 17. Right of Way of Cars—Subject to the preceding section of this article, surface cars running on tracks laid in the streets especially for their use shall have the right of way along such tracks, between cross streets, over all vehicles moving in the same direction at a less rate of speed than ten miles an hour; and the driver of any vehicle proceeding upon the track in front of a surface car shall turn out as soon as possible upon signal by the motorman or driver of the car.

Sec. 18. Signal in Slowing Up or Stopping—In slowing up or stopping, a signal shall always be given to those behind by raising the whip or hand vertically.

Sec. 19. Signal for Automobile—Every person driving an automobile or motor vehicle shall, at the request or signal by putting up the hand, from a person driving or riding a restive horse or horses, or driving domestic animals, cause the automobile to immediately stop, and to remain stationary as long as may be necessary to allow said horses or domestic animals to pass.

Sec. 20. Slowly Moving Vehicles—Vehicles moving slowly shall keep as close as possible to the curb line on the right, so as to allow faster moving vehicles free passage on the left.

Article II.—Speed.

Section 1. Speed of Vehicles—The following rates of speed through the streets of the city shall not be exceeded, that is:

Eight miles an hour by bicycles, tricycles, velocipedes and motor vehicles, however propelled, or by passenger and other vehicles drawn by horses or other animals, except that in portions of the city not built up, where the buildings are at least one hundred feet apart, a speed of fifteen mile an hour may be maintained.

Sec. 2. Exceptions—Nothing in this article shall apply to the apparatus and wagons of the Fire and Police Departments, the Fire Patrol, ambulances, emergency repair wagons of street railroads, and vehicles carrying the United States mail.

Sec. 3. Excessive Speed Prohibited—No person riding, driving or in charge of any vehicle on any street, avenue, pathway, or driveway in the city shall drive the same at a speed greater than reasonable and proper, having regard to the traffic and use of the highways, or so as to endanger the life or limb or any person.

Sec. 4. Speed in Crossing Streets and Turning—No vehicle shall cross any street or avenue running north and south, or make any turn at a speed rate exceeding one-half its legal speed limit.

Article III.—Lights.

Section 1. Lights—Each and every vehicle using the public streets or highways of this city, except vehicles of licensed truckmen, shall show, between one hour after sunset and one hour before sunrise, a light or lights, so placed as to be seen from the front and each side; if dash lantern is carried, it shall be placed on the left-hand side; such light or lights to be of sufficient illuminating power to be visible at a distance of two hundred feet; said light or lights shall show white in front, but may be colored on the sides, excepting licensed truckmen. Every automobile shall exhibit during the same period two lamps showing white lights visible at a distance of three hundred feet in the direction toward which the automobile is proceeding, and shall also exhibit a red light, visible in the reverse direction. The lamps shall be so placed as to be free from obstruction to light from other parts of said automobile. In the Borough of The Bronx, excepting south of Tremont Avenue and One Hunderd and Seventy-Seventh Street east of Jerome Avenue and west of the Bronx River, and in the Boroughs of Richmond and Queens, and in the Twenty-sixth, Thirtieth, Thirty-first and Thirty-second Wards of the Borough of Brooklyn, every car or other vehicle between said hours, while moving on, along or standing upon the portion of streets in said boroughs or parts of boroughs, shall also carry a light or lights of such illuminating power as to be plainly visible two hundred feet, both ahead and behind said car or vehicle.

Sec. 2. Exceptions—But this section shall not apply to any equestrian, or to any animal led or driven, not attached to any vehicle, nor to the rider of a bicycle, tricycle or similar vehicle, whose light has become extinguished, or who is necessarily absent from his home without a light, when going at a pace not exceeding six miles an hour, when a clearly audible signal is given as often as thirty feet are passed over.

Article IV.—Improper Use of Streets.

Section 1. Coasting Forbidden to Bicyclists—No bicycle shall be allowed to proceed in any street of the city by inertia or momentum, with the feet of the rider removed from the pedals.

Sec. 2. Trick Riding Forbidden—No rider of a bicycle shall remove both hands from the handle-bars, or practice any trick or fancy riding in any street.

Sec. 3. Carrying Children on Bicycles—No bicyclist in the city of New York shall carry upon his bicycle any child under the age of five years.

Sec. 4. Ages of Drivers—Drivers or persons in charge of vehicles other than licensed vehicles shall not be less than sixteen years of age, unless provided with a permit from the Police Department.

Sec. 5. Riding on Backs of Vehicles—No person shall ride upon the back of any vehicle without the consent of the driver, and when so riding no part of the person's body must protrude beyond the limits of the vehicle.

Sec. 6. "Cruising" by Hacks, Etc., Forbidden—No public or private hack while awaiting employment by passengers, shall stand in or upon any public street or place other than at or upon public or private hackstands, respectively, designated by the Board of Aldermen; nor shall any hackman seek employment by repeatedly and persistently driving his hack to and fro in a short space before, or by otherwise interfering with proper and orderly access to, or egress from, any theatre, hall, hotel, public resort, railway or ferry station, or other place of public gathering, but any hackman may solicit employment by driving through any public street or place without stops other than those due to obstruction of traffic, and at such speed as not to interrupt or impede traffic, and may pass and repass before any theatre, hall, hotel, public resort, railway or ferry station or other place of public gathering, provided that after passing such public place he shall not turn and repass until he shall have gone a distance of two blocks beyond such place.

Article V.—Use of Sidewalks.

Section 1. Driving on Sidewalks—Except as provided in this article, no horse or vehicle shall be driven, backed, led or allowed to stand on any sidewalk which has been curbed, except that wares or merchandise in process of loading and unloading, shipment, or being received from shipment, may be transferred from trucks or other vehicles over the sidewalk by the use of skids, or by backing up trucks on the sidewalks in so doing, provided a passageway be kept open within the stoop line of buildings for the free passage of pedestrians.

Sec. 2. Leading Bicycles—Riders of bicycles, when dismounted, may lead their bicycles along the sidewalk in single file, and bicycles may be allowed to stand on the sidewalk, provided they are within the stoop line and cause no obstruction.

Sec. 3. Riding on Sidewalks—Bicycles may be ridden on the sidewalks of any street in the suburbs of the city, the roadway of which is not reasonably rideable for such vehicles.

Sec. 4. Driving Across Sidewalks—Nothing contained in this article shall prevent the riding or driving of horse or vehicles from private property directly across the sidewalks of any street to the roadway, or from the roadway back to such private property.

Article VI.—General Rule Covering the Use of Streets.

Section 1. Reasonable Care to be Used—Nothing contained herein or omitted herefrom shall be construed or held to relieve any person using, or traveling, or being upon any street, for any purpose whatever, from exercising all reasonable care to avoid or prevent injury through collision with all other persons and vehicles.

Sec. 2. Traffic Not to be Obstructed—No vehicle shall be allowed to remain upon or be driven through any street of the city of New York so as wilfully to blockade or obstruct the traffic of that street.

No vehicle shall be so overloaded that the horse or horses are unable to draw it.

Article VII.—Powers of Police Department.

Section 1. Police Department to Regulate Traffic—The Police Department shall have all powers and duties in relation to the management of the vehicular traffic.

Sec. 2. Police Department to See That Ordinances Are Posted—The Police Department shall see that these ordinances are posted in all public stables and at the hacks, cab and truck stands, and shall keep copies of them at all of its stations and issue them on application.

Article VIII.—Definitions.

Section 1. Definitions of Terms Used Herein—The following terms, whenever used herein, except as otherwise specifically indicated, shall be defined to have, and shall be held to include each of the meanings herein below respectively set forth, and any such term used in the singular number shall be held to include the plural.

Street—Every avenue, boulevard, highway, roadway, cartway, lane, alley, strip, path, square and place used by or laid out for the use of vehicles.

Roadway—That portion of any street which is included between the curbs or curb-lines thereof and is designed for the use of vehicles.

Curb—The lateral boundaries of that portion of a street designed for the use of vehicles, whether marked by curbstones or not so marked.

Vehicles—Every wagon, carriage, omnibus, sleigh, push-cart, bicycle, tricycle and other conveyance (except baby carriages), in whatever manner or by whatever force or power the same may be driven, ridden or propelled, which is or may be used for or adapted to pleasure riding or the transportation of passengers, baggage or merchandise upon the street; and every draught and riding animal, whether driven, ridden or led, excepting that an animal or animals attached to any vehicle shall, with such vehicle, constitute one vehicle.

Article IX.—Penalties for Violations.

Section 1. Penalties for Violations—Any person violating any provision or regulation hereof shall be deemed guilty of a misdemeanor, and upon conviction thereof by any Magistrate, either upon confession of the party or by competent testimony, may be fined for such offense any sum not less than one dollar and not exceeding ten dollars, and in default of payment of such fine may be committed to prison by such Magistrate until the same be paid; but such imprisonment shall not exceed ten days.

FIRE DELAYS ACCOUNTANTS' REPORT

Secretary W. B. Brockway, of the Street Railway Accountants' Association, recently prepared for publication a pamphlet containing the standard classification of accounts and standard form of operating report of the association, and to add to its practical usefulness appended to the pamphlet a number of blank pages for notes. Unfortunately the pamphlet was being made ready for the press last week at the composing rooms of McIlroy & Emmet, 106 Liberty Street, New York, which were destroyed by fire, and the type, plates and original copy of the pamphlet were completely destroyed. Mr. Brockway has companions in his misery, however, as the same fire destroyed a considerable part of the current transactions of the American Institute of Electrical Engineers. He has, however, started anew on his work, and expects to issue the pamphlet soon, but its publication will be delayed some time by the untoward accident.

99-YEAR ACT ARGUMENTS IN CHICAGO

Jan. 16 has been set as the date when arguments before Judge Grosscup on the validity of the 99-year act in extending Chicago Street Railway franchises will be heard before Judge Grosscup. David T. Watson, of Pittsburg, has been retained as special attorney for the city of Chicago.

THE THREE-CENT FARE SITUATION IN CLEVELAND

Mayor Tom L. Johnson and the advocates of 3-cent fare street railways have had their inning in Cleveland during the past two weeks. Apparently every effort is being made to rush through franchise grants before the talked-of legislation placing the granting of all street railway franchises and similar matters in the hands of a State railway commission can be enacted in the State Legislature, which is now in session. While the mayor and his cohorts seem to have things their own way just at present, there is every indication that the legislation mentioned will be put through by the present Legislature, thus taking out of the hands of biased City Councils the right to pass ordinances calculated to injure the business and credit of established and reputable street railway companies.

The Rhodes Avenue franchise extension ordinance for an extension of the Forest City Street Railway, the 3-cent fare line, through Rhode Avenue to Detroit Street, thus enabling it to use the so-called free territory and reach the Public Square, was put through the Council a few nights ago in a manner which was questionable, to say the least. The old company has been fighting this grant for many months, and at each session of the Council it was enabled to present revocations of a sufficient number of consents of property owners to render it necessary for the 3-cent fare company to go over the ground again and secure more consents before it could secure the franchise legally. Before the last meeting the Johnson Councilmen held a caucus, with the result that when the meeting was called, the regular order of business was suspended and the franchise matter was acted upon at once and the ordinance passed without a dissenting vote. The revocations, which were in the form of a communication to the Council, were read later, but were without force as the franchise had already been granted.

An ordinance has been introduced in the Council to fix the rate of fare on street railways operating within a certain area of the city at three cents. This ordinance will affect several companies whose rate of fare is not stipulated in the old grants, thus fixing a low fare zone in the central portion of the city.

The question of the expiration of certain franchises held by the Cleveland Electric Railway will be brought to an issue by another ordinance introduced before the City Council. The proposed ordinance grants to the Forest City Railway Company, the 3-cent fare company, the right to operate on Central Avenue and Quincy Street, which constitute two of the leading lines to the East End now operated by the old company. The city claims the franchises for these lines expire March 22, 1905. Another ordinance provides for a belt line traversing portions of Broadway, Woodland, Wilson and Kinsman Streets, all of which are occupied and operated by the old company. The city claims that these grants expire Sept. 20, 1904. The ordinances provide for three-cent fares with transfers, and provide that the city may purchase the property at any time, the price to be fixed by a board of arbitration. There has long been a controversy between the city and the company over the expiration of the above mentioned franchises. The company claims that some of them do not expire until 1913, and that none of them expire before 1908; certain extensions having been secured, it is claimed, at the time the company secured the right to substitute electricity for horse power.

IMPORTANT FRANCHISE GRANTS IN NEW YORK

The Aldermen of New York have approved the report of the railroad committee granting a franchise to the Hudson & Manhattan Railroad Company, and the application of the Long Island Traction Company for a franchise for twenty-five years to operate various electric railways, aggregating about 16 miles, in Queens.

The Hudson & Manhattan Railroad Company is the company of which W. G. McAdoo is president, and which is tunneling the North River between Jersey City and Cortlandt Street, New York. The Rapid Transit Commission approved the scheme several weeks ago. There was no opposition to the committee's report.

The franchise granted to the Long Island Traction Company means the construction in the spring of a comprehensive extension of that company's system in Queens and Nassau, connecting the outlying sections with Brooklyn. For the franchise during the first five years the company must pay an annual rental equal to 3 per cent of its annual gross receipts, and during the remaining twenty years a sum equal to 5 per cent of its annual gross receipts. The Board of Estimate and Apportionment may, by giving a year's notice, require the company to change its system from an overhead to an underground system. The rate of fare is not to be more than 5 cents. The company must build 10 miles by July 1, 1904, and all unbuilt parts on July 1, 1905, are to be forfeited.

NEW LINES BETWEEN MINNEAPOLIS AND ST. PAUL

Vice-President C. G. Goodrich, of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, announces that arrangements have been made to build a line from Minneapolis to Fort Snelling, which is southeast of Minneapolis, on the south side of the Mississippi River. This will be an extension of the present line to Minnehaha. Nothing remains but to secure the approval of the government officers to the plans which have been submitted. When a bridge has been completed across the Mississippi River near Fort Snelling, this line will be joined to the line from St. Paul, making another interurban line between Minneapolis and St. Paul by way of Fort Snelling. Another new interurban line is planned between Minneapolis and St. Paul, which will join the Selby Avenue line in St. Paul, crossing the Lake Street bridge, following Lake Street to Cedar Avenue in Minneapolis, Cedar Avenue to Thirty-first Street, and connecting with the present Thirty-first Street line. This will give St. Paul people a chance to go direct to the lakes without going through the down town district of Minneapolis. The building of this line is dependent upon the granting of the right of way by the Councils of Minneapolis and St. Paul. The company has in operation already two interurban lines between the two cities. Fifty new cars are being constructed, and these, with the new power plant which is to be put in operation soon will enable the company to give greatly improved service.

IMPROVEMENTS ON THE LACKAWANNA & WYOMING VALLEY RAILWAY

Work will be commenced before long on the cutting of a tunnel three-fourths of a mile long in South Scranton, Pa., by the Lackawanna & Wyoming Valley Electric Railway Company, which will remove a grade of 200 ft. to the mile and shorten the distance between Scranton and Wilkesbarre from 19½ to 18½ miles, and enable better time to be made. A roadbed has been graded to the tunnel entrance on either side and some track laid and ballasted. When all these improvements are completed the company expects to cover the distance between the two cities in 20 minutes. About 100,000 tons of broken stone ballast have been used on the new line and the 40 bridges over roadways, railroad track, etc., are all of steel. With the completion of the tunnel, four of the eight grade crossings between Scranton and Pittston will have been eliminated. New cars have been ordered for the road, to be used after the tunnel is completed, which will have a speed of sixty-five miles an hour. They are to be equipped with the multiple-unit system of control. The cost of the road, equipment and right of way between Wilkesbarre and Scranton, is much greater than has been stated, the total cost being nearly $5,000,000. There is some speculation as to whether the improvements will end with the present work. The Carbondale branch will be built during the present summer and will cost nearly $2,000,000. Work will be commenced on this line shortly. It is said that the road will be extended to Nanticoke.

THE PUBLIC WAITING STATION IN CLEVELAND

It seems quite probable that the project of erecting a waiting station on the Public Square, in Cleveland, for the use of the interurban roads, will miscarry. As outlined in a recent issue of STREET RAILWAY JOURNAL, the city company and the interurbans secured permission from the Board of Public Service to erect the stations, and plans were completed for the building. Later certain Councilmen demanded that an ordinance granting such a franchise be put through the City Council. The companies had agreed to install public toilet rooms in the station, and maintain their portion of the building, but when the Council Committee insisted on amending the plans to the extent that the railroads must maintain the toilet rooms and supply towels, soap and other accessories, the railway companies felt justified in making objections. Now certain Councilmen who are advocating 3-cent fare lines, have started an agitation to defeat the measure on the ground that the city should not grant any further rights of any kind to the old company. As a result, the city is likely to lose a handsome shelter house for the Public Square, which the railways offered to turn over without cost. The railroads, however, will not drop the plan of building a downtown station, and it is quite probable that the different roads will be asked slightly to increase the amount they have already guaranteed, which will enable them to build a very creditable station of their own on some downtown street. There would be considerable advantage in this plan, for, while it would be necessary to buy real estate, the building would be owned by the companies, and certain privileges could be let out, from which an income could be derived, an advantage which would have been impossible under the other plan.

RAIL WELDING BY THE THERMIT PROCESS

E. Stütz has been appointed American representative of the Goldschmidt Thermit rail-welding process which has been exploited in Germany to a considerable extent, and hopes before long to be able to supply apparatus and material for rail-welding. This can be done now for small pipe and other repairs for which thermit is used. Mr. Stütz will deliver a lecture on the process at the Franklin Institute, in Philadelphia, on Jan. 20, and at the Massachusetts Institute of Technology, in Boston, Feb. 26.

TRACTION COMPETITION IN INDIANA

At points along the Big Four Railroad in Indiana where there is competition with the traction companies, General Passenger Agent Lynch says that all loss of revenue through local traction competition is being more than made up by the increased revenue derived from through business. "In many ways," says Mr. Lynch, "the traction companies are proving excellent feeders."

A vigorous protest is being entered against the rates charged by the Indianapolis Northern Traction Company on its line between Kokomo and Tipton, which has just been opened for business. In the original franchise it was stipulated the rate should not exceed 1½ cents per mile, but the company is now collecting 2 cents and 3 cents per mile for short distances. A flaw is said to have developed in the franchise of the company, and while the commissioners are willing to pass a new grant, they stoutly maintain that no privileges will be given the company until a rate of not more than 1½ cents per mile is agreed to.

A rate war between the steam railroad and the Evansville & Princeton Traction Company, operating between Princeton and Evansville, is now on.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED DEC. 22, 1903

747,343. Elastic Wheel; Karl O. Ahlquist, Rugby, England. App. filed June 19, 1903. Comprises a hub having a central annular flange, a rim and annular spring side-plates, by which the rim and hub are connected, the connection between the hub and side-plates being made by means of ball and socket bearings.

747,370. Railway Car Appliance; Andrew J. Brislin, Brooklyn, N. Y. App. filed April 20, 1903. A belt adapted to be buckled about the motorman is attached to an alarm circuit, so that in case he becomes disabled and falls, an alarm will be given.

747,371. Trolley Wheel; Herbert W. Brockett, Hamden, Conn. App. filed June 23, 1903. The wheel is flanked by two discs of greater diameter than the wheel, whereby the wheel is retained upon the wire.

747,378. Brake Apparatus; Philip J. Conboy, Hamilton, Ohio. App. filed Aug. 17, 1903. Details of mechanism for winding up the brake chain.

747,410. Brake; Josiah B. Gaston, Rock Springs, Wyom. App. filed April 14, 1903. The brake has two leverages, and is adapted to be changed from one to the other by raising or lowering the staff.

747,470. Support for Electrical Conductors; Robert Orr and John Morrison, New York, N. Y. App. filed Jan. 9, 1903. A trolley clip, consisting of two connected members, each member being provided with a wedge-shape groove and a wedge-shaped, wire-gripping clip or clamp, adapted to be secured in the groove.

747,477. Rail Insulator; Leonard M. Randolph, Newark, N. J. App. filed May 4, 1903. A non-porous insulating covering for rails, consisting of varnish residue, and an absorbent substance laid around the rail and pressed into intimate contact therewith.

747,489. Electric Car; Myron Rounds, Boston, Mass. App. filed June 13, 1903. A car having raised floor-sections over the trucks and vertically adjustable seats at each end of each of the raised sections.

747,501. Automatic Railway Switch; Horace W. Summers, Elyria, and Charles R. Summers, Norwalk, Ohio. App. filed April 30, 1903. Details of a combined automatic and manually operated switch.

747,537. Electrical Switch; George J. Crossland, Mobile, Ala. App. filed July 12, 1902. Details of a circuit closer for operating an electro-magnetic railway switch.

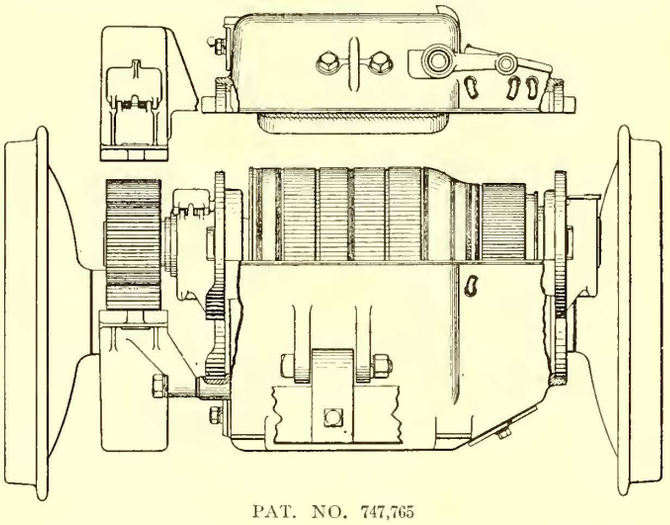
747,539. Track-Sanding Apparatus; John J. Dolan, Jr., Baltimore, Md. App. filed March 4, 1903. A track-sanding device, provided with a sand-inlet and a fluid pressure inlet, and also having a sand outlet which is interposed between the two inlets.

747,596. Apparatus for Removing Ice from Track or Conductor Rails of Railroads; Patrick B. Delany, South Orange, N. J. App. filed March 2, 1903. A wheel having a notched periphery is pressed into engagement with the rail to crush the ice, and is followed by a brush or scraper.

747,607. Trolley Pole; Jonah R. Hollis, Brockton, Mass. App. filed Nov. 7, 1902. The trolley harp is so mounted as to permit the wheel to swing laterally.

747,655. Car Replacer; Ezra Showalter, Massillon, Ohio. App. filed April 29, 1903. Details.

747,765. Railway Motor; Edward D. Priest, Schenectady, N. Y. App. filed Sept. 16, 1902. Details of construction of a split frame



PAT. NO. 747,765

for car motors, whereby the advantages of a box frame are also obtained.

747,774. Switch; Isaac B. Ritter, Philadelphia, Pa. App. filed July 8, 1903. Details.

747,795. Automatic Apparatus for Controlling and Operating the Points of Electric Railways or Tramway; Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. App. filed April 1, 1902. Details.

747,796. Apparatus for Controlling and Operating the Points of Electric Railway or Tramway; Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. App. filed March 6, 1903. Details.

747,847. Street Railway Switching Mechanism; Walter J. Bell, Los Angeles. App. filed May 7, 1903. Hydraulic pistons for moving the switch, which are locked and released by an electro-magnetic latch.

747,885. Switch-Operating Mechanism; Oliver D. Hunt, Columbus, Ohio. App. filed March 21, 1903. Details.

747,886. Switch-Operating Mechanism; Oliver D. Hunt, Columbus, Ohio. App. filed March 21, 1903. Details.

747,912. Brake-Shoe; Joseph D. Gallagher, Glenridge, N. J. App. filed Feb. 24, 1903. A brake-shoe comprising a back or body portion consisting of a partly worn brake-shoe and a wearing sole cast upon the face thereof.

UNITED STATES PATENTS ISSUED DEC. 29, 1903

747,955. Railway Frog; Edward B. Entwisle, Johnstown, Pa. App. filed June 5, 1902. Relates to a novel construcion of the wing rails.

747,956. Spring Switch; Edward B. Entwisle and Frank G. Wertz, Johnstown, Pa. App. filed Dec. 22, 1902. A reversibly-acting spring on a rod connected to the switch tongue and actuating means connected to the rod.

747,957. Car Seat; Francis K. Fassett, St. Louis, Mo. App. filed Jan. 28, 1903. Details of construction of a "walk-over" seat.

747,983. Car Wheel; George S. Kyle, Chambersburg, Pa. App. filed Aug. 4, 1903. The wheel has a detachable brake ring attached to its inner side.

748,098. System For Controlling Fluid Pressure; Edward D. Priest, Schenectady, N. Y. App. filed May 21, 1903. When a train stops, the air pump is automatically cut out by the controller, thereby avoiding annoyance to passengers by the operation of the pump.

748,106. Brake Head; Wiliam D. Sargent, New York, N. Y. App. filed June 8, 1903. A cast brake-head has attaching lugs of malleable metal embedded therein and running around the eye in the head.

748,195. Self-Adjusting Car Fender; Alexander O. Lamson, Bridgeport, Conn. App. filed Mar. 12, 1903. The fender is always maintained at substantially the same distance from the rails regardless of any tipping or tilting of the car.

748,210. Sand-Car; Atlas F. McConnell, Nashville, Tenn. App. filed May 1, 1903. Funnels mounted in the car truck and through which sand is fed to the center of the rail, sand being fed to the funnel by valve-regulated openings in the car platform.

748,220. Separable Brake-Block and Shoe; William D. Sargent, New York, N. Y. App. filed Jun. 10, 1903. A combined brake-shoe made in separable parts and the two parts being attached by means of a malleable eye-lug between them.

748,268. Magnetic Contact Box For Electric Tramways; Alfredo Diatto, Turin, Italy. App. filed Apr. 8, 1902. A magnetic field is established when the contact in the box is moved and Foucault currents opposing the movements of the field are at the same time created with the object of preventing the formation of an arc between the various parts of the apparatus.

748,322. Trolley Device; Ralph P. Tisch and Robert Kissinger, Hebron, Ohio. App. filed May 23, 1903. The wheel is mounted on cone bearings having threaded shanks by which they can be set up to compensate for the wear.

748,345. Switch Operating Device; Joseph E. Campbell, Pittsburg, Pa. App. filed Sept. 15, 1903. Details of a switch lever attached to a car.

748,422. Trolley; Walter J. Rowley, Allegheny, Pa. App. filed May 7, 1903. Opening and closing levers adapted to retain the wire within the groove of the wheel.

748,441. Trolley; Thomas F. Varley, Lowellville, O. App. filed Aug. 14, 1903. Pivoted guards extending above the trolley wheel on each side to retain the wire and counterweighted to yield when they strike an obstruction.

748,508. Switch Operating Apparatus for Tramway or Other Cars; Albert King, Nottingham, England. App. filed June 10, 1903. Apparatus by means of which, when a lever in the top of a car is thrown, it will engage with mechanism overhead to throw the switch.

748,557. Electrically Controlled Railway Switch; Frederick T. Kitt, Denver, Colo. App. filed Mar. 4, 1903. Details.

PERSONAL MENTION

MR. C. F. DREW, general manager of the Coal Belt Electric Railway, of Marion, Ill., died very suddenly in his room at a hotel at Harrisburg, Ill., Dec. 28.

MR. GEO. H. EARLE, Jr., of Philadelphia, has been elected a director of the Philadelphia Company, of Pittsburg, to succeed the late Mr. William L. Elkins.

MR. THOMAS JENKINS has been appointed superintendent of the Marion Railway, Light & Power Company's street railway system at Marion, Ohio, and division superintendent of the Columbus, Delaware & Marion Railway, which is owned by the same interests. Mr. R. A. Amann, formerly superintendent of the Marion system, has been made master mechanic of the Columbus, Delaware & Marion Railway.

MR. W. A. BIXBY, manager of the Decatur Traction & Light Company, of Decatur, Ill., and other interests of the McKinley syndicate, has assumed the management of syndicates at Quincy, Ill.

MR. DAVID R. POWELL, who built at Joplin, Mo., the electric railway which finally became the nucleus of the system of the South West Missouri Electric Railway Company, died in St. Louis a few days ago of heart failure.

MR. PALMER WARDMAN, for several years master mechanic of the Cleveland, Painesville & Eastern Railway Company, has been appointed general superintendent of the Pennsylvania & Ohio Railway, with headquarters at Ashtabula, Ohio.

MR. T. F. MANVILLE, president of the H. W. Johns-Manville Company, New York, started for the West on Dec. 22, and before returning to New York will visit the company's Milwaukee, Chicago, St. Louis and New Orleans branches.

MR. FRED. D. SAMPSON, who has held the position of engineer and superintendent for the past nine years, has resigned his connection with Charlotte Electric Railway, Light & Power Company, and will be associated with the D. A. Tompkins Company, of Charlotte, N. C., in the capacity of engineer.

MR. N. B. RHOADS, who has been connected with the Savannah Electric Company, of Savannah, Ga., for about two years, and who was formerly with the Richmond Traction Company, Richmond, Va., has been appointed superintendent of Transportation of the Savannah Electric Company. Mr. Rhoads' appointment took effect Jan. 1.

MR. B. F. VERMAN, for thirty years a prominent citizen of Lorain, Ohio, died at his home a few days ago. He built the Lorain Street Railway system and later sold a portion of his holdings to Mr. Tom L. Johnson, although he held a part interest up to the time of his death. Mr. Verman was formerly Mayor of Lorain.

MR. S. M. MANIFOLD, late general superintendent of the Western Maryland Railroad Company, has assumed charge of the management of the York County Traction Company's system at York, Pa., and will have charge of the building of several important lines the coming summer.

MR. W. P. COSPER has accepted a position as salesman for the Garton-Daniels Company, of Keokuk, Ia. Mr. Cosper will give special attention to pushing the automotoneer, and will also look after lightning-arrester sales. Mr. Cosper has a large acquaintance among street railway companies, having for some years been Western representative for the Consolidated Car Heating Company. Recently he has been in the sales department of Fairbanks, Morse & Company, Chicago.

MR. W. S. MONTGOMERY, who for the past five years has been connected with the Conover Condenser Manufacturing Company, of Jersey City, N. J., as its secretary and sales manager, severed his connection with that company on Jan. 1, 1904, to assume the management of the Payne Engineering Company, of New York City, which is the selling agent of the Payne Company, of Elmira, N. Y., builders of simple and compound automatic engines. The Payne Company has removed to new offices in the Havemeyer Building, New York.

MR. DAVID J. EVANS has severed his connection with the Chicago office of the Lorain Steel Company and resigned his position of secretary-treasurer of the North American Railway Construction Company, and has taken an office at No. 1564 Monadnock Building, Chicago, where he will handle railway supplies, iron and steel. Mr. Evans has been connected with the Chicago office of the Lorain Steel Company and its predecessor, the Johnson Company, since early in 1893, having had charge of the business for the past three years, during the sojourn in Colorado of Mr. A. S. Littlefield, the Western sales agent.

SEVERAL CHANGES have taken place in the management of the Eastern Ohio Traction Company. Mr. R. L. Andrews, general manager, has resigned to devote his time exclusively to the work of the Youngstown & Southern Railway Company, of which he has been general manager since the proposition was started some months ago. The duties of general manager of the Eastern Ohio Company have been assumed by Mr. George T. Bishop, president of the company. Mr. James J. Doyle has been appointed superintendent of the Cleveland & Eastern division with headquarters at Gates Mills, and Mr. Lawrence O'Toole has been appointed superintendent of the Cleveland & Garrettsville division with headquarters at Chagrin Falls. Mr. James A. Currie, secretary and treasurer of the company, has assumed the duties of purchasing agent.