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Railways on the Pacific Coast

We have presented several very interesting articles of late upon the electric railways of the Pacific Coast, and these will be supplemented by further contributions from the same section, describing in detail the latest practice in construction and operation. It must be evident to all who have followed this series of articles closely that great progress has been made in electric railroading on the Coast. These improvements have not been confined to city service but have extended to the wider field of suburban and interurban work. The climate of California is favorable to such enterprises, as it makes it possible for a larger proportion of the people doing business in the large cities to have their homes out of town the whole year round, and in California, as in the East, the electric railway has been found to be the ideal means of communication between city and suburban communities.

A fair example of the possibilities of an electric road in building up a suburban resort is found in the growth of San Mateo, which owes its present popularity and prosperity to the high-speed trolley service afforded by the extension of the United Railroads of San Francisco, for in spite of its natural attractions and unrivaled climatic advantages, San Mateo could not be regarded as a desirable place of residence before the trolley made it accessible to the metropolis of the Pacific Coast. Until recently the only means of reaching it from San Francisco was by steam train or driving. The distance, 23 miles, made driving an impossibility as a regular means of going back and forth, and trains were infrequent. Shoppers had to devote a whole day to a trip, theatergoers had to "catch the last train" or spend the night in San Francisco, with incidental hotel expenses, and if business men missed their regular train in the morning or evening they had to wait an hour or more for the next one. Another drawback under the old service was that the steam line did not take its passengers to the business district, making a 10-minute or 15-minute ride by trolley necessary to reach any point in that section. The new trolley line gives a car every half hour, and on Sundays and holidays a 15-minute schedule is maintained; as a result, heavy traffic has been developed on this line, and San Mateo has grown to be a very popular residence district in a very short time.

The "Key Route," another electric system, which is described in this issue, may be accepted as fairly representative of the most advanced practice on the Coast. It is operating in direct competition with steam service, and has been enabled to do this successfully, because of the higher speeds, more frequent trains and greater comfort and convenience afforded by the new equipment. The San Francisco, Oakland & San Jose Railway, which is the official title of this company, has provided ample facilities both in equipment and terminals for handling the traffic which has come to it. The conditions which obtain in this particular instance are peculiar to San Francisco, as are the provisions that have been necessary for hauling this business. Unlike most suburban and interurban lines four-car trains are run, and a printed schedule is followed after the manner of steam roads. Indeed, the very best features of modern steam railroad practice have been embodied.

Still another installation that has attracted much attention is the North Shore suburban division, between San Francisco and San Rafael. Formerly this was operated as a narrow-gage steam railroad, but two years ago ownership of the property changed, and then it was decided to introduce electricity upon the line. The entire roadbed was rebuilt and a double track was put in for most of the way; third-rail equipment was installed, and on part of the road the contact-rail was protected in a manner similar to that on the Wilkesbarre & Hazelton line, and an automatic block-signaling system was introduced, the first to employ alternating current for the operation of the signals in regular commercial service.

The experience of these roads has been so satisfactory that additional electrical equipments are contemplated for similar service, and it is now known that the Southern Pacific is engaged upon plans for the electrification of its suburban division. What is more noteworthy still, the Santa Fe company has secured control of the North Shore Suburban, since the changes here mentioned have been completed, and it is believed that further electrification of steam lines on the Coast will result from the experience gained with those already in operation. This is really a splendid tribute by steam railway managers to the engineers who designed and built these lines, but all who are familiar with the situation agree that it is well deserved.

New Subway Cars

The Interborough Rapid Transit Company announces that it has succeeded in securing a car for operation in the subway which will be absolutely fireproof and practically indestructible. The new type of car was designed by George Gibbs, the consulting engineer of the Rapid Transit Construction Company, especially for this service, and was built at the Altoona shops of the Pennsylvania Railroad Company. It is the first complete metallic car built for passenger service, and is probably the most radical departure that has yet been made from recognized standards by the subway management. But the conditions governing the operations of this underground railway were different from those that obtain in ordinary city railroad properties, and it was found necessary to make special provision for these contingencies. Mr. Gibbs devoted a great deal of study to this problem, and he believes that he has succeeded in producing a car that will meet all objections that have been made against cars for the subway in which wood or any other inflammable material enters. Naturally, a great deal of interest has been manifested in this investigation by steam and electric railway managers throughout the country as well as by car builders. The latter have maintained that the original type of car adopted for the subway met all the requirements, and that the precautions taken for fireproofing afforded ample protection, but the Interborough management, recognizing the sentiment against the use of wooden cars of any description in the subway, endeavored to meet the public demands by providing steel cars for this service.

The principal objections that have been urged against the operation of steel cars are the danger of short-circuiting the system, and in case of a serious accident, such as collision or derailment, the danger of the car framing becoming twisted and distorted so that it might be difficult to rescue passengers. In answer to the first objection it may be said that the electrical hazard should be no greater in a steel car body, and probably would not be as great as with the wooden frame, as serious accidents that might cause damage in the former would in all probability result in much more serious loss through fire in the latter. It is not considered that there is any serious ground for apprehension of danger from the collapse of the steel car body, as particular attention has been given to this feature of construction, and it is believed by experts that the new car is practically indestructible. It would seem that any accident that would demolish one of these coaches would be of such a character as almost to preclude the possibility of the survival of any passengers who might be aboard at the time.

The inventor of the car claims that he has entirely overcome the minor difficulties which have always been urged against this type of construction, chief among which are the objections in the way of noise and extreme heat and cold. Judging from the short experience of the Interborough company with the sample car this claim is justified by the results achieved. Of course, it is possible that continued operation of the car may develop defects and "loosen up" the metal construction so that the noise may become objectionable, but it would seem that these are merely mechanical details which ought readily to be overcome.

When the subject of steel cars was first broached the Interborough Company found it impossible to interest any of the large car builders of the country, and it was only through the courtesy of the Pennsylvania Railroad Company that facilities were afforded for building the sample car. Even after the car was completed many of those familiar with the plans of the company were skeptical as to the outcome of the experiments, and the decision of the management to order 200 cars of this type at once will awaken universal interest. It is unnecessary to say that many modifications of the original plans were found necessary as the work progressed on the sample car, and that the experience gained will result in further changes which will be incorporated in the plans of the new cars. The policy of the subway company throughout this investigation and the spirit which prompted it are highly commendable, and they should go far toward satisfying the public that every possible means to ensure safe operation are being employed. Whatever may be the ultimate decision regarding the practicability of steel cars the Interborough management has not only contributed its share toward the advancement of the art, but it has certainly earned the gratitude of the public and the railway industry for having carried on the most comprehensive experimental investigation of this subject that has ever been undertaken.

Personal Injury Claims in Texas

It is evident that the people of Texas have not fully discarded the theory that corporations are soulless, and consequently are not entitled to the same consideration as individuals. Following this line of reasoning it becomes natural for them to assume an attitude of hostility toward such institutions, to cheat and defraud them wherever opportunity is offered or can be made, and to regard such practices as perfectly legitimate. Measured by this standard the best citizen is the one who gets the most out of the game, and it is evident that there are many Texans eager for that distinction. The records for the last year indicate that Houston is a stronghold of eminent citizens of this class; the army of patriots is constantly receiving accessions to its ranks, and there is no danger that it will be compelled, for some time at least, to open recruiting offices in that section if there is a corporation doing business.

The latest object against which this public zeal has been directed is the Houston Electric Company, and the favorite form of attack is the familiar personal injury claim. Actions for damages aggregating $1,000,000 were instituted during the last year, and to these were added during the first month of the present year claims for upwards of $100,000. At this rate it will not be many months before the amount of damages claimed will approximate the entire value of the property and franchises. As it is, the suits begun last year are for claims aggregating two-and-a-half times the gross receipts of the system for that period. The rapacity of the lawyers and claimants engaged in this litigation has alarmed the conservative element of the population, and the daily papers have even called attention to the disastrous effect of this policy upon the municipality as a whole. Attention is directed to the fact that the street railway company has invested considerable money during the last year in improvements, including new track, pavements between tracks, additional cars and apparatus, all of which has benefited the people directly, as the transportation facilities were increased and improved and employment given to a large force of men. It is, likewise, pointed out that "there have been no big wrecks during the year, and there have been very few accidents of a serious character," in fact, everything tends to show careful management and skillful operation of the property —conditions which would be appreciated in almost any other part of the country—and utterly disproving and discrediting the validity of the claims presented.

But Texas seems bound to preserve its individuality in this respect. It has long had an unsavory reputation because of this tendency to bilk corporations, and many steam railroad and manufacturing enterprises proposed for that State have

been discouraged from putting their plans into effect on this account. All of which is detrimental to Texas, as it has greatly retarded its development, but considerations for the future seem to be of minor importance when there is a chance to hold up a corporation.

Overhaul Your Wires

We wonder how many railway managers can tell off-hand the percentage of energy lost in their respective systems. When we find one who has definite knowledge on this point we are going to ask him the distribution of the loss in (a) the station, (b) the feeders, (c) the working conductors, and (d) the track return. A good many managers have a general idea of the facts, and a few have systematized information, but from the conditions which we have seen not infrequently there are others who could not even give a fairly close guess at the figures. Now, energy costs money, and an electric railroad gets neither profit nor glory from its efforts to raise the mean annual temperature of its territory. It is no joking matter when at times of full load the losses run up to 20 per cent or 25 per cent, let alone more. There are many roads which have well designed feeding systems, but there are at least as many more on which the conditions are almost unbelievably bad. How about a 10 per cent loss before the current leaves the station, 200 volts lost in feeders, or an equal amount lost in the track return? These are not fancy figures, although, happily, not all derived from the same system, and losses nearly as great as these are by no means as rare as might be imagined. We smile now at the No. 6 trolley wire of the good old times, but No. 00 trolley wire can show much larger losses if regularly overworked in proportionate degree. When bus-bars run blue and boosters are perfumed of simmering insulation, it is a sure sign that there is something doing which will show in the yearly balance sheet. All these conditions should be overhauled before the building season and the heavy summer traffic comes on, else trouble will be at hand. Time spent in finding out and stopping losses is time profitably spent, and there is so far too little thus spent in the railway business.

Low efficiency in the distributing system is not necessarily a grave indictment of a road's management, but countenance of such a condition is. Most of the trouble comes not so much from bad engineering at the start as from failure to grasp the effects of increased service. So long as the cars can be run without a positive breakdown the station bears the brunt of the work uncomplainingly. Half the large systems of the country are perpetually behind their demand for station capacity. The management temporizes with a call for increased capacity, and every week makes the situation more difficult to remedy. A new unit ordered after considerable delay falls behind its promised date of shipment, and by the time it is turned over it has to be overloaded. Meanwhile the feeder copper has stayed at its old figure, the work being shifted back to the station, and presently the losses, at first moderate, have risen to startling amounts. A long line served by a booster gets a few new long cars for its increased business, and the loss rises from a hundred volts up to two or even three hundred. An old track lightly bonded is kept in service unchanged because it seems hardly worth while to rebond, when the track must be relaid with a heavier section within a year or two, and before the true state of things is recognized the drop in the return circuit has stealthily crept up to a couple of hundred volts. It is much easier than it seems to lose a hundred kilowatts of regular output by absolutely needless and undetected shortage in conducting capacity, costing many times more than the interest on the necessary copper to avert the loss. And several times this amount of unnecessary loss must be charged against some of the sinning roads. What the added cost may be in extra repairs we will not attempt to figure. Line copper is not, perhaps, a quick asset, but it is a mighty valuable one all the same, and strongly to be recommended.

The moral of all this is that it behooves every manager of an electric road to find out just where his losses of energy are and how great they are. Having this information, the next step is to get after them *seriatim*, and stop them as quickly and thoroughly as may be. They are not all equally serious or equally likely to involve the equipment in disaster, and there is, therefore, room for the exercise of shrewd judgment in applying the remedies. It is not always the most conspicuous drop in voltage that involves the greatest total energy loss. It may be wise to improve the overhead system in one case and to attack the bonding in another, but in order to know what step to take it is first necessary to know just what the trouble is. If new cars are to be added to the equipment it is as easy to prepare for the extra output required before they are put in service as after, and a great deal more satisfactory to the public. Careful and systematic inspection of the general equipment as well as of the rolling equipment pays. As to the latter it is too often a perfunctory sort of examination that passes a car just about as long as it will run. An interurban car took fire the other day, scared the passenger's out of a year's growth, and badly damaged the car itself. The loss, let alone the possible ensuing legal expenses, was enough to have paid an extra inspector. In these days cars do not catch fire unless something is radically wrong, and it is the business of an inspector to see that things are not going to go wrong. The manager of a road has troubles of his own—he has to be in more places and to be doing more things at the same time than any other functionary with whom we are acquainted, but somebody has to look after these very important matters of detail, for success in operating a complicated system comes by looking after details. We do not wish to be prophets of evil, but there certainly is a bad time coming for the road that neglects its conducting system.

Increase in Traffic on Stormy Days

Among other interesting things mentioned in the report of President Thomas Lowry to the stockholders of the Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, is the influence that semi-convertible cars have had upon the traffic during rainy days in summer. A similar observation was noted in these columns about two years ago, and it is again emphasized by President Lowry's report. It would appear from the experience related that when the ordinary open cars were used, enough would walk or stay at home on stormy days in summer to reduce the gross receipts from 25 per cent to 30 per cent. The semi-convertible car which can be closed against a storm at a moment's notice, and is a comfortable convenience on a rainy day, offers sufficient inducement to people to seek the shelter of the cars. Consequently, many who walk or use bicycles in pleasant weather for short trips, now take the cars in rainy weather, where otherwise they would continue their regular practice of walking on rainy as well as pleasant days. Then, too, the fact that closed cars are available in storms doubtless tempts many to venture out in threatening weather who would otherwise stay at home. The report also contains some interesting figures showing the influence of the new, well-warmed, double-truck cars with double windows and double bottoms, in increasing the relative gross receipts of the winter months.

THE SAN FRANCISCO, OAKLAND & SAN JOSE RAILWAY—"THE KEY ROUTE"—I

California has several very good electric railway systems, both city and interurban, of which the more important are those in San Francisco, Oakland, Los Angeles and Sacramento. In the building up of the communities which they serve these roads have been prominent factors. This fact is especially evident in Southern California, with its many attractions for tourists. The present systems are being extended generally, and are being put into better condition; new lines are under construction, and many more have reached only the paper stage, but give good promise of being built during the coming year. Until last summer only the single-car method of operation was employed on the electric systems. During the last few months the North Shore Railroad of San Francisco has put into service an excellent system of train operation, as described in the Street Railway Journal of Jan. 2 and 9. This was closely followed by the electric train service on the new line of the San Francisco, Oakland & San Jose Railway, on the Oakland side of San Francisco Bay. In the latter system, which

The San Francisco, Oakland and San Jose Railway was constructed primarily to afford a rapid and frequent service between San Francisco and the cities of Oakland and Berkeley

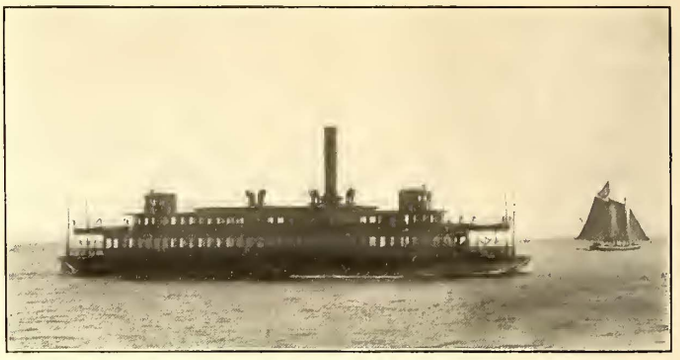


FIG. 3.—ONE OF THE KEY ROUTE FERRYBOATS

across the Bay. These cities and the towns immediately adjoining are preferred for residence by many persons whose business is in San Francisco. They are situated at the base

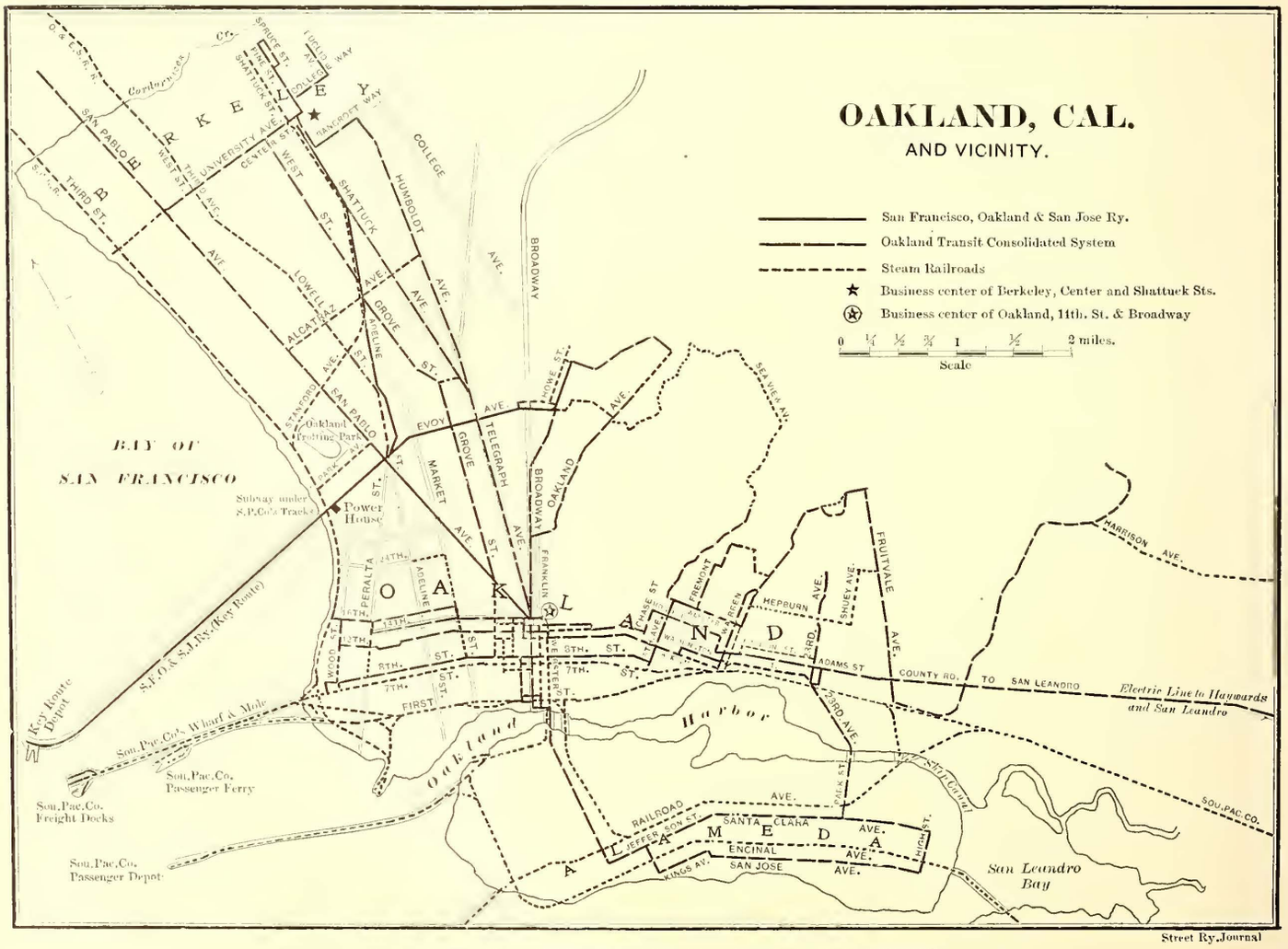


FIG. 1.—MAP OF DISTRICT SERVED BY THE KEY ROUTE

forms the subject of this article, are found many interesting features, some of which are unique, having been influenced by conditions not met with in the Eastern States.

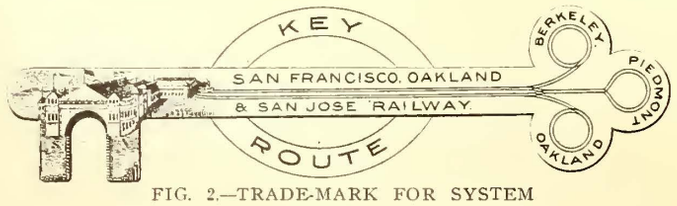


FIG. 2.—TRADE-MARK FOR SYSTEM

of the foot hills of the Coast Range, and have a milder climate than the metropolis and less wind and fog.

The transbay travel can be handled only by ferryboats, and since the bay traffic began some forty years ago it has been cared for almost exclusively by the Southern Pacific steam railroad and its predecessors.

Since Oakland is the land terminus for all the San Francisco trains of the Southern Pacific road, excepting those of the coast division, the company is obliged to operate an extensive system of passenger ferries across the Bay. These ferries ply between the Oakland pier or mole and the Market Street Ferry

Depot, which is also the San Francisco terminus for ferry lines running to points on the northern shore of the Bay. In order to make connections with the through trains the ferries have to make frequent trips across the Bay, and the plan of operating them at regular intervals with local train connections naturally followed. Hence, at the present time a local train service from the Oakland pier to West Berkeley, Berkeley, Oakland and Alameda is in operation. Another ferry line, known as the narrow-gage, gives a similar service over different routes from the Alameda mole, on the south side of Oakland Harbor, to parts of Oakland and Alameda. Each of these lines gives a half-hour service.

The new San Francisco, Oakland & San Jose Railway Company was organized by interests practically identical with those owning the Oakland Transit Consolidated Railway Company, the local traction company operating in Oakland, Berkeley and Alameda. A pier, over 3 miles in length, has been constructed from the Oakland shore, and fast ferries have been put into service, connecting at the end of the pier with electric trains running with but few stops to the center of Berkeley and Oakland. At this writing only the Berkeley branch is in full operation. As soon as a few track changes have been made and more equipment received, the Oakland line will be started. A line, midway between these two, running to Piedmont, a fine residence section newly developed, is in operation as far as completed.

FIG. 6.—TRAIN SHED AT FERRY DEPOT, WAITING ROOMS AT LEFT, TRAIN AT RIGHT AND FIRE CAR IN DISTANCE AT END OF SHED

FIG. 4.—BOAT SLIP AND PIER AT FERRY DEPOT

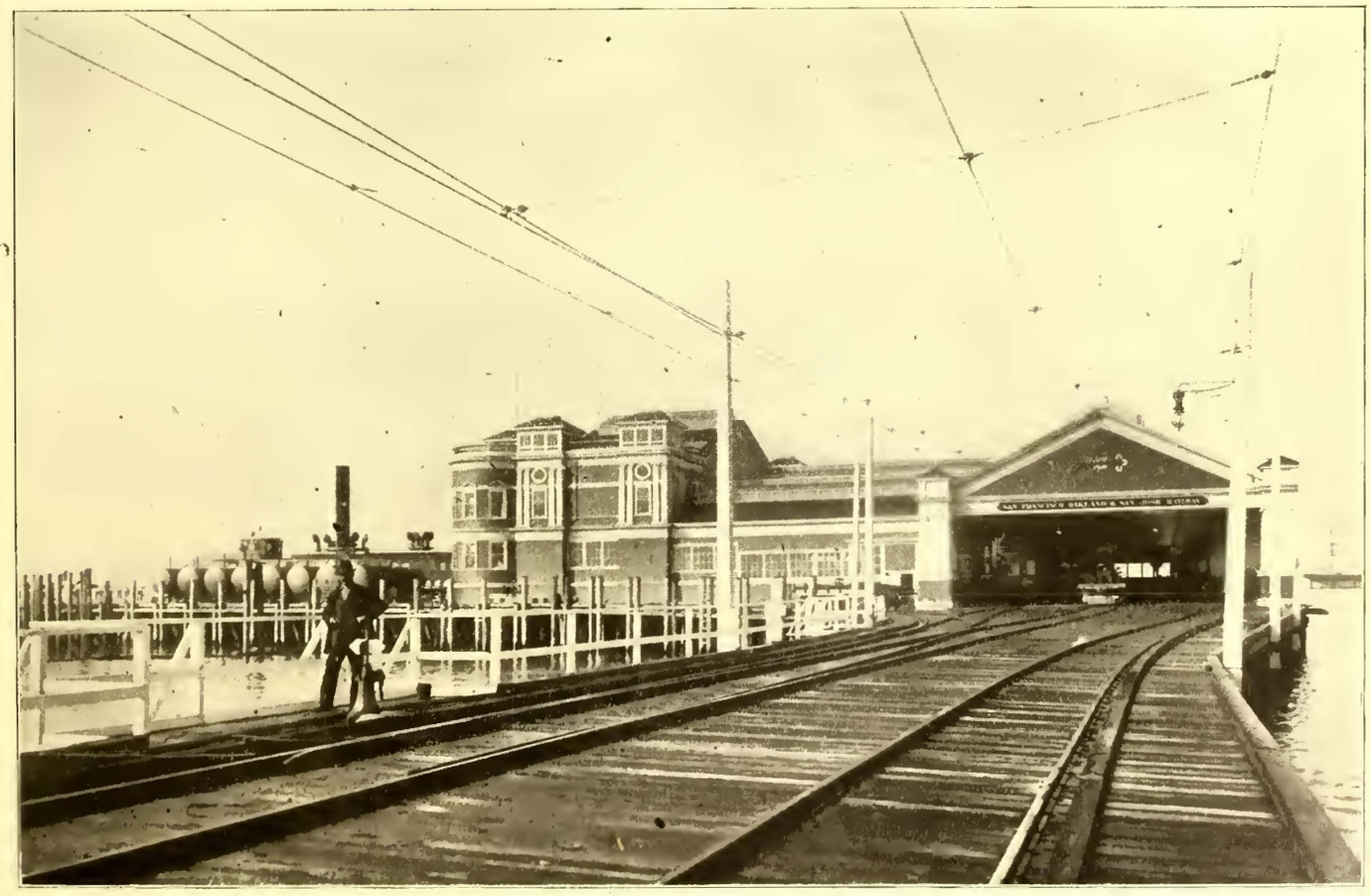


FIG. 5.—KEY ROUTE FERRY DEPOT, TRAIN SHED AT RIGHT AND FERRYBOAT LEAVING SLIP AT LEFT

The accompanying map, Fig. 1, shows in heavy, full lines these three branches and the main line. The lines of the Oakland Transit Consolidated are represented, on the map, by long dashes, and the steam lines by short dashes. As the name of the subject of this description indicates, it is planned to extend the road eventually to San Jose, a growing city with a population of about 25,000, situated 45 miles south of Oakland, at the southern end of San Francisco Bay. No definite plans have as yet been made for this extention.

W. F. Kelly, general manager of the San Francisco, Oakland

FIG. 7.—HYDRAULICALLY OPERATED APRON, LEADING TO LOWER DECK OF FERRYBOATS AT KEY ROUTE DEPOT; WAITING ROOMS ON BOTH SIDES OF APRON

& San Jose Railway, as well as of the Oakland Transit Company, has been indefatigable in his efforts to give the public good and efficient transbay transportation; and to him is given the credit of the happy choice of the name "Key Route" for this new system. By reference to the map and to the drawing (Fig. 12) showing the form of the ferry slip at the pier depot, the resemblance of the outline of the route to that of a huge key is apparent, the slip and depot forming the foot of the key; the long pier, the shank, and the three branches with Berkeley, Piedmont and Oakland as their termini, the three-lobed head.

The full title of the company being too long for popular use, the name "Key Route" has been officially adopted for the system, and is used on stationery, time-tables, tickets and advertising literature. Fig. 2 is a reproduction of the letter head of the company. The caps of trainmen and boat crews bear the words across the front, and the wearers are further distinguished by small brass keys stamped with the employe number, and worn on the coat lapel.

FERRY BOATS

The company has two ferryboats, both constructed exclusively for passenger traffic. They were designed by H. J. Gielow, engineer and naval architect, of New York City, and were built in Alameda, Cal., by John W. Dickie. Hopper & Ransom, of San Francisco, superintended the construction. The boats

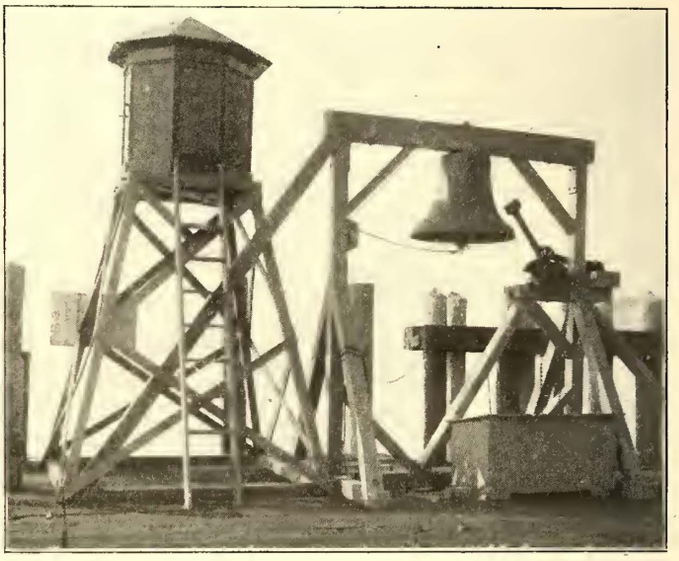


FIG. 8.—PIER SIGNAL LIGHT AND FOG BELL

are duplicates, and have the following dimensions: Length over all, 200 ft.; length on keel, 175 ft. 4 ins.; beam, moulded, 35 ft. 4 ins.; beam, over guards, 58 ft.; depth of hold amidships, 17 ft. The seating capacity of each boat is 1200, but having a ferryboat license many more passengers can be carried. The net tonnage of each is 758 tons, and it draws 11 ft. of water. Each boat is propelled by stern wheels, driven by a triple-expansion 18-in. x 27-in. x 42-in. diameter, 28-in. stroke marine engine, which develops 1200 hp on 180 lbs. of steam, with 165 r. p. m. The engines were built by G. Sullivan, of New York City. Two Babcock & Wilsox marine boilers, with a collective heating surface of 5000 sq. ft., supply the engine. Crude oil is used for fuel on the boats as well as in the power house, that for the boats being stored in tanks on the company's pier. Each boat has four 17-ft. 6-in. x 6-ft. 2500-gal. tanks for oil storage. Two water tanks, 11 ft. x 7 ft., with a capacity of 3100 gals. each, are provided. Independent air, feed and circulating Dow pumps form part of the equipment, while a 15-kw General Electric direct-connected generator set supplies current for the electric lights and searchlights. The boats are each fitted with four water-tight bulkheads, so that they are practically unsinkable. They have a rated speed of 13 knots, but operate at present at about 12 knots an hour, making the run between the company's own ferry depot on the Oakland

FIG. 9.—SIDE POLE OVERHEAD CONSTRUCTION, WITH CENTER POLE CONSTRUCTION IN DISTANCE ON THE DEPOT-END OF THE PIER

pier and the Market Street ferry station of San Francisco in 15 minutes or less. These boats are named "San Jose" and "Yerba Buena," the latter being shown in Fig. 3.

FERRY DEPOT

The company's ferry depot on the end of its Oakland pier (Figs. 4 and 5) is built in a medieval style, the idea having been to get away as far as possible from the stereotyped design common to other depots on the Bay. As it stands, the building is the material expression of the combined ideas of Howard C. Holmes, the consulting engineer, and Walter J. Mathews, the architect. In designing this station the question of handling the passengers between the trains and the boats in the most expeditious manner has, of course, received the chief consideration. One particularly good feature of the building is that it provides for each boat to run under a shed, which covers about a third of the boat, and thus keeps the passengers, embarking and disembarking, from being exposed to inclement weather.

The trains, approaching the building, run from the open track into a three-track train shed, Fig. 6, with trussed roof, 65 ft. wide and 358 ft. 6 ins. long. The embarking passengers pass from the trains into waiting rooms at each side of the lower deck apron, shown in Fig. 7, and wait there until the boat is unloaded before being allowed to pass onto it. At the outer sides of the two waiting rooms are inclines leading to aprons that connect with the upper deck of the boat. One of these is used for loading, the other for unloading. In the boat shed are located the hydraulic accumulator and pumps which operate the aprons. Rooms are provided in the building for sleeping quarters of the boat crews, for the superintendent's office, repair shop, etc.

FOG BELL AND SIGNAL LIGHTS

The fog question is one of the most serious problems to be solved in the navigation of San Francisco Bay, the mist rolling in from the ocean being at times so dense that accidents are almost unavoidable, as there are so many ferryboats and other craft on the Bay. On Goat Island, near which the ferryboats pass, is located a government fog whistle station, and on each of the ferry piers fog bells are placed. With the electric power at hand it was decided to operate the bell on the Key Route pier by a motor attachment. Accordingly, the arrangement illustrated in the view, Fig. 8, was devised. The bell is mounted on a scaffold, and is arranged so that it may be rung by hand when necessary. The mechanical ringer consists of an arm and hammer, raised and dropped by a cam, which is in turn driven by a sprocket chain from the motor shaft below. This countershaft is belt-driven, with the aid of a belt tightener, by means of a General Electric shunt-wound, 1-hp, 500-volt motor operating at 1300 r. p. m. The gearing is such that, at the rated speed of the motor, the bell is struck ten times a minute. The bell itself is of special construction, and weighs 1640 lbs.

On the pier's end, at each side of the slip, is a pier headlight, also shown in Fig. 8. Each lamp has seven panes of glass. For the illumination of each headlight fifteen 32-cp incandescent lamps are installed, in the usual multiple-series railway arrangement.

CONSTRUCTION OF PIER

The pier is a double-track wooden trestle, constructed so that

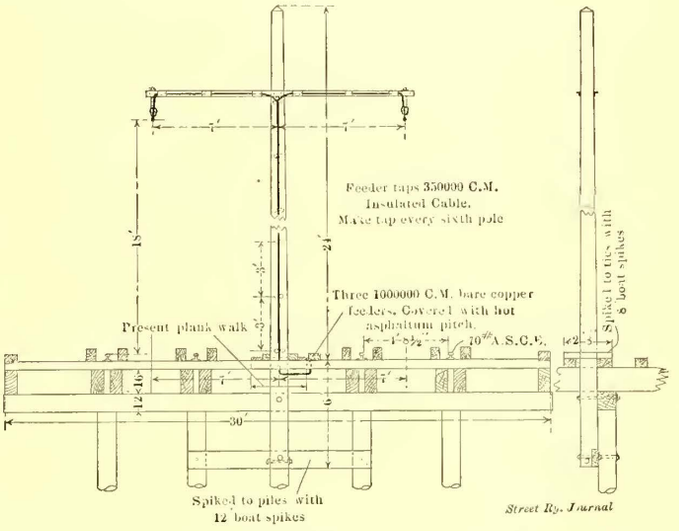


FIG. 11.—TROLLEY POLE CONSTRUCTION ON EMERYVILLE WHARF

the rails will be 7 ft. 9 ins. above high water, and 15 ft. 9 ins. above low water. It has a uniform width of 30 ft. throughout, except at the outer end, where it broadens out for the terminal tracks and ferry depot. From the middle of the boat slip to the west end of the subway under the Southern Pacific tracks at the water's edge, the pier has a length of 16,240 ft., while the total length to the end of the wharf is 16,400 ft. There is 14,423 ft. of tangent track on the pier. Eucalyptus piles were used, the braces and frame work being of Oregon pine. The piles varied in length from 35 ft. to 65 ft., and were driven to hard clay. At the end a water depth of 30 ft. is afforded for the boats. Fig. 9 presents a view of the pier near the outer end, looking toward land from a point just beyond the end of the tangent track. Fig. 10 is a side view of the pier from the depot end, and shows two of the regular four-car trains, one just pulling out of the station and the other pulling in. From these illustrations and the sectional drawing, Fig. 11, the construction of the pier may be understood. The piles are driven in

FIG. 10.—VIEW OF PIER LOOKING TOWARD LAND, SHOWING TWO REGULAR 4-CAR TRAINS

cross rows of five to form the bents of the pier, which are spaced 16 ft. apart. The five piles are capped with a 12-in. x 12-in. pine timber, 30 ft. long, and on this are bolted 8-in. x 16-in. stringers, 32 ft. long, two stringers being bolted together with cast-iron 4-in. separators over each pile and midway between each bent. Across the stringers are laid 6-in. x 8-in. pine ties, 30 ft. long, and on these are placed the 70-lb. track rails, 14 ft. center to center. Double-pine guard rails, 6 ins. x 8 ins. x 32 ft., are laid 6 ins. from the rails. Each bent is fastened by two 3-in. x 8-in. cross braces. Fig. 12 is a diagram, showing the tracks at the end of the pier. The bumping post illustrated in Fig. 13 is similar to that employed at the end of the tracks in the train shed. The 70-lb. rails are turned up for a distance of 7 ft. 2 ins., and secured to the post, each rail being held to the pier at the angle by strut or rail braces.

SUBWAY UNDER SOUTHERN PACIFIC TRACKS

In order to avoid a grade crossing with the Southern Pacific Company's main tracks at the land end of the pier, the tracks of the electric line were carried under those of the other company, through a subway. As this subway had to go below sea level, and as the trains would have to pass through at a fairly high rate of speed, its construction presented some interesting problems. At the point of crossing, the width of the right of way of the Southern Pacific Company is 100 ft., and for that distance the tracks of the Key Route system lie on a level, 16 ft. below the girders which support the steam tracks. The tracks of the steam road are carried on an especially constructed floor, consisting of wooden ties embedded in concrete in steel troughs, the latter being supported between longitudinal girders. The ends of the girders rest upon concrete walls with granite caps, and the centers are supported by a row of laced columns. The walls, or inclined sides of the subway, are also of concrete, but strengthened by 40-lb. old street railway rails, laid on from 2-ft. to 8-ft. centers. This construction gave a strong piece of work and saved considerable concrete. For the sides 6-in. and 4-in. Oregon pine sheet piling was used. The total length of the subway is 1070 ft., and the inclines are of a 4 per cent grade. Fig. 14 is a view of the subway looking toward the bay. Old steel girder rails are used for guard rails in the subway. Storm water and the drainage that runs to the lowest part is collected in a sump, and emptied into the bay by

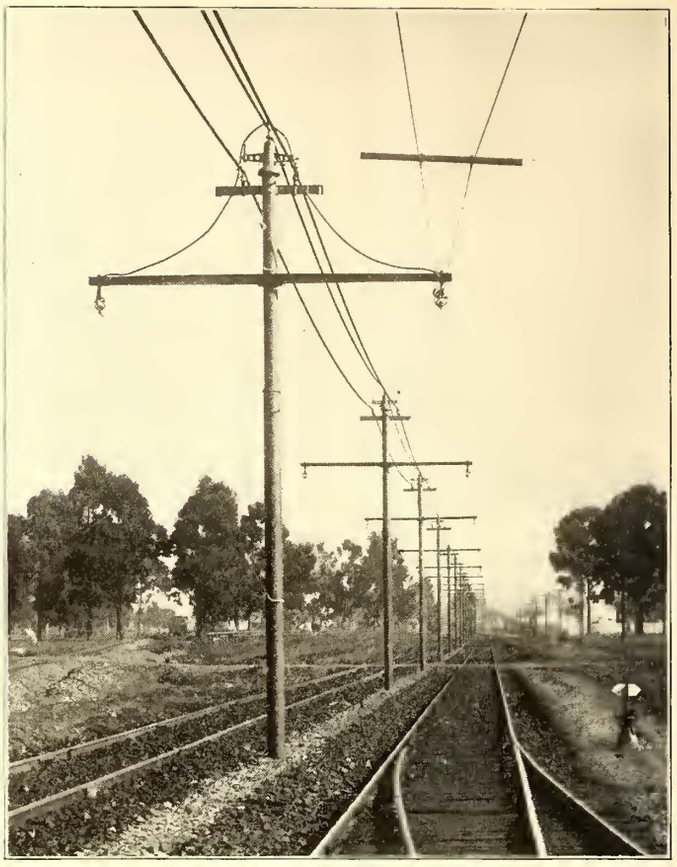


FIG. 16.—DOUBLE-TRACK CENTER-POLE CONSTRUCTION, WITH FEEDER TAP ON FIRST POLE, AND SPRING TROLLEY WIRE HANGER; BALLASTED AND OILED ROADBED

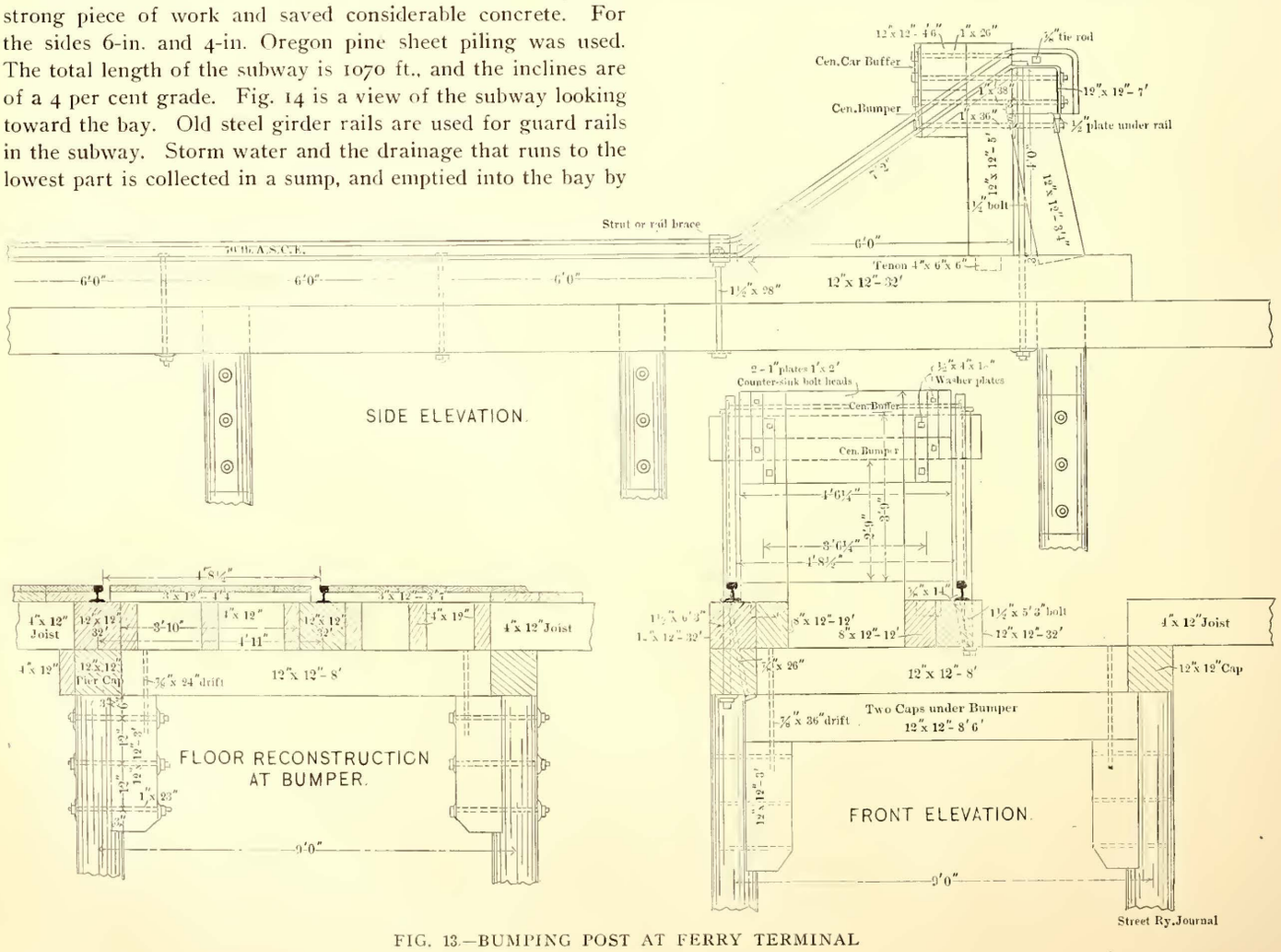


FIG. 13.—BUMPING POST AT FERRY TERMINAL

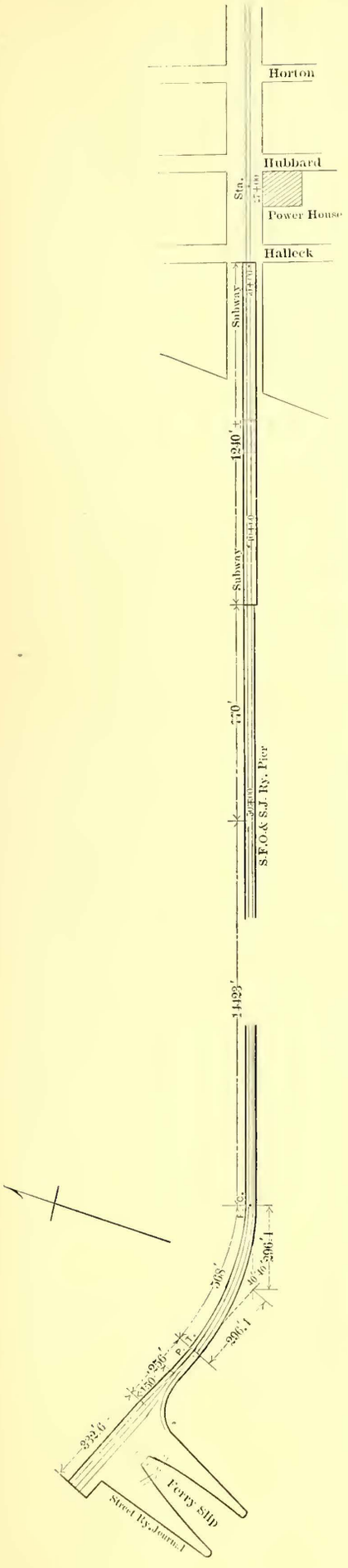


FIG. 12. — DIAGRAM OF TRACKS, SHOWING CURVES AND CROSS-OVERS ON PIER

means of a centrifugal pump, automatically driven by an electric motor.

TRACK CONSTRUCTION

For 2980 ft. east of the subway the double tracks are carried on Yerba Buena Avenue to the station at the crossing of San

FIG. 14.—CONCRETE SUBWAY UNDER SOUTHERN PACIFIC MAIN LINE AT END OF PIER. METHOD OF CARRYING FEEDERS UNDER SOUTHERN PACIFIC TRACKS SHOWN AT RIGHT

Pablo Avenue. At this point, illustrated in Fig. 15, the Berkeley line branches off and runs nearly north to the business part of the city at Center Street and Shattuck Avenue. The Piedmont branch is being constructed east from San Pablo Avenue on Fortieth Avenue, and the Oakland branch will run south on

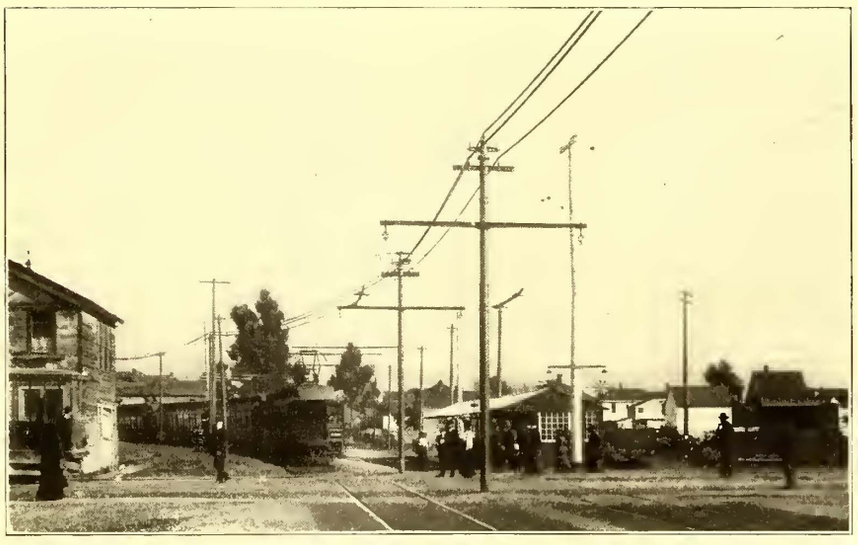


FIG. 15.—KEY ROUTE STATION AT SAN PABLO AVENUE, AND CROSSING

San Pablo Avenue to Fourteenth Street and Broadway, the business center of that city. The line to Berkeley is all double track with the exception of two portions, aggregating 4980 ft. in length. From Lorin station to Berkeley the Key Route parallels the Berkeley and Berryman local tracks of the Southern Pacific, and the two trains make the same stops, viz., Lorin, Ashby, Dwight Way and Berkeley.

Figs. 16 and 17 are double-track views on the Key Route line, the former showing center-pole construction on tangent track, and the latter side-pole construction on curves. The track consists of 70-lb. A. S. C. E. section, 30-ft. rails, laid with 26-in.

FIG. 17.—DOUBLE-TRACK, SIDE-POLE CONSTRUCTION AT CURVES; WOODEN CROSS-PIECES TO PREVENT DIAMOND TROLLEY FROM TOUCHING SPAN WIRES

angle-bar, 6-hole joints, the ¾-in. bolts being fastened with National lock washers. The rails are laid on 6-in. x 8-in. x 8-ft. redwood ties, 9-16-in. x 5½-in. spikes and Glendon tie-plates being used. As shown in the vertical section, Fig. 18, the track is ballasted with broken rock 12 ins. below the ties, and drainage is provided through 4-in. tile laid in the center of each track. This drawing also shows the concrete anchoring for the iron trolley poles in the center-pole construction. Nearly all of the work was done by the company's track department. Each joint of the track is bonded with two No. 0000 solid copper Brown-Edison bonds for the track return. On the pier the rails are cross-bonded every 1500 ft. with ½-in. x 3-in. iron clamped to the bottom of the rail with plastic alloy in the joint. The track is connected to the negative bus in the power house by means of six 1,000,000 circ. mil copper cables, and a very good track return is afforded.

Practically all of the special track work was made in the Piedmont shops of the Oakland Transit Consolidated. Samples of the special work used are shown in Fig. 19, which illustrates a bolted and riveted frog, and in Fig. 20, which is a drawing of the double crossing at San Pablo Avenue, switch stands, such as are shown in Fig. 16, are employed. The land lines have needed no bridges, except the Berkeley branch, which crosses Temescal Creek on Linden Street, on the short trestle illustrated in Fig. 21. A row of old 60-lb. girder rails, laid close

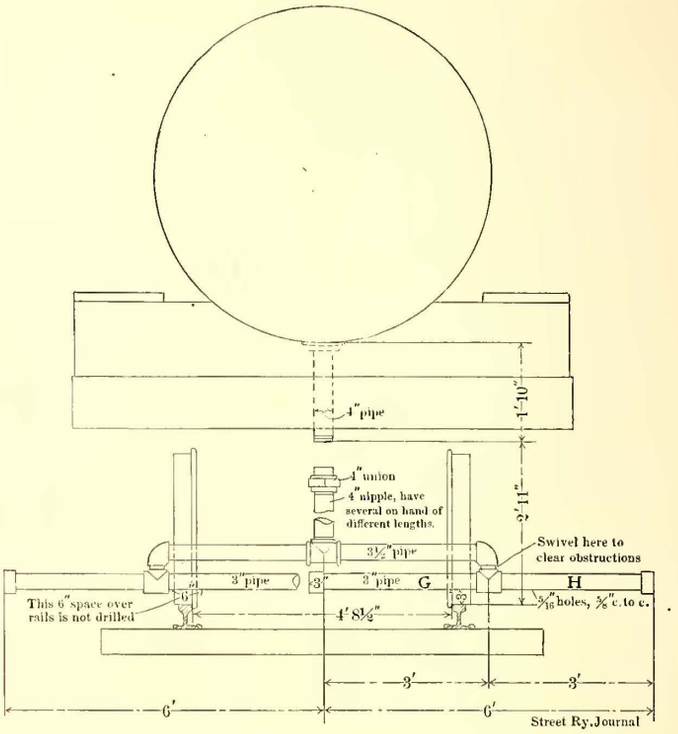


FIG. 22.—TRACK OILING ATTACHMENT FOR RAILWAY TANK CARS

together, forms the principal support for the track. The maximum curve on the line is one with a radius of 420 ft.

The roadbed on land has been treated with crude oil, the advantages of which are that it effectually lays the dust, prevents vegetation in the treated portion of the roadbed, and also tends to unite the rock ballast in a firmer mass. About three oilings are regarded as sufficient for a year. A special device is employed to sprinkle the oil, the ar-

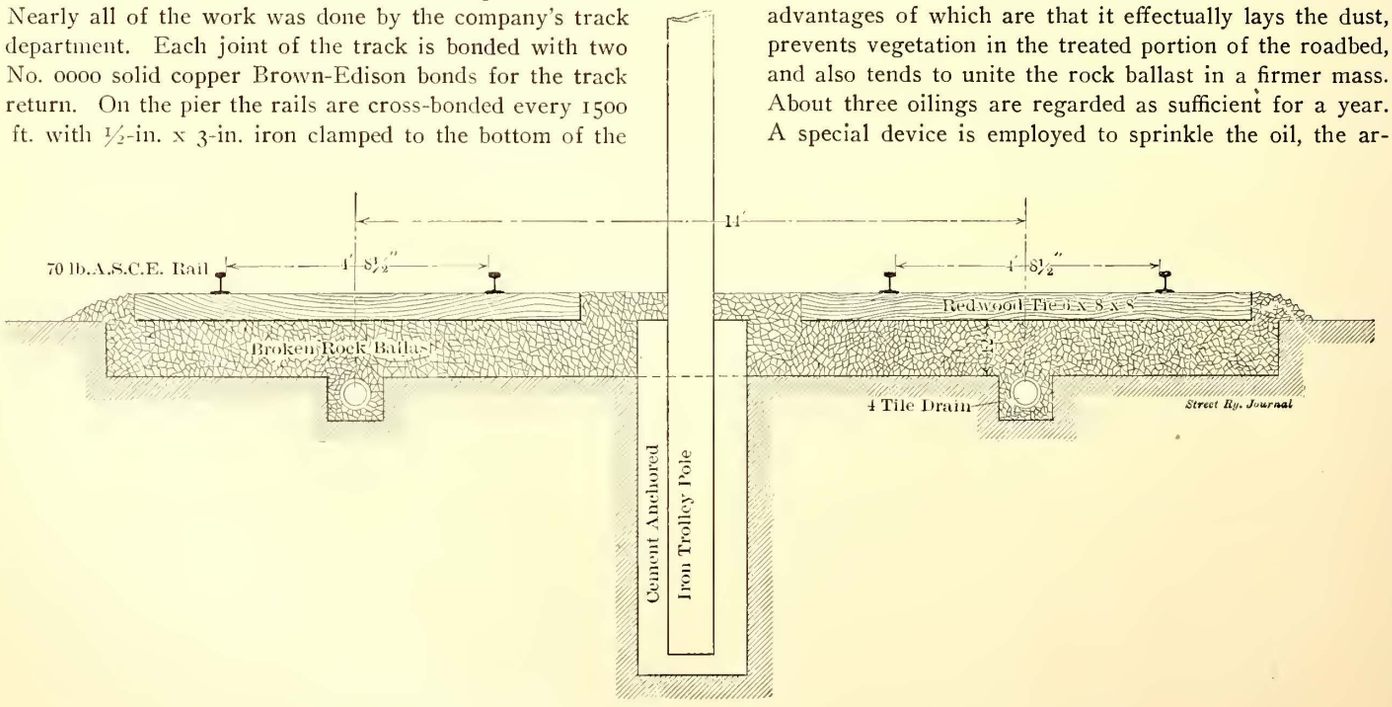


FIG. 18.—SECTION SHOWING TRACK CONSTRUCTION AND POLE SETTING

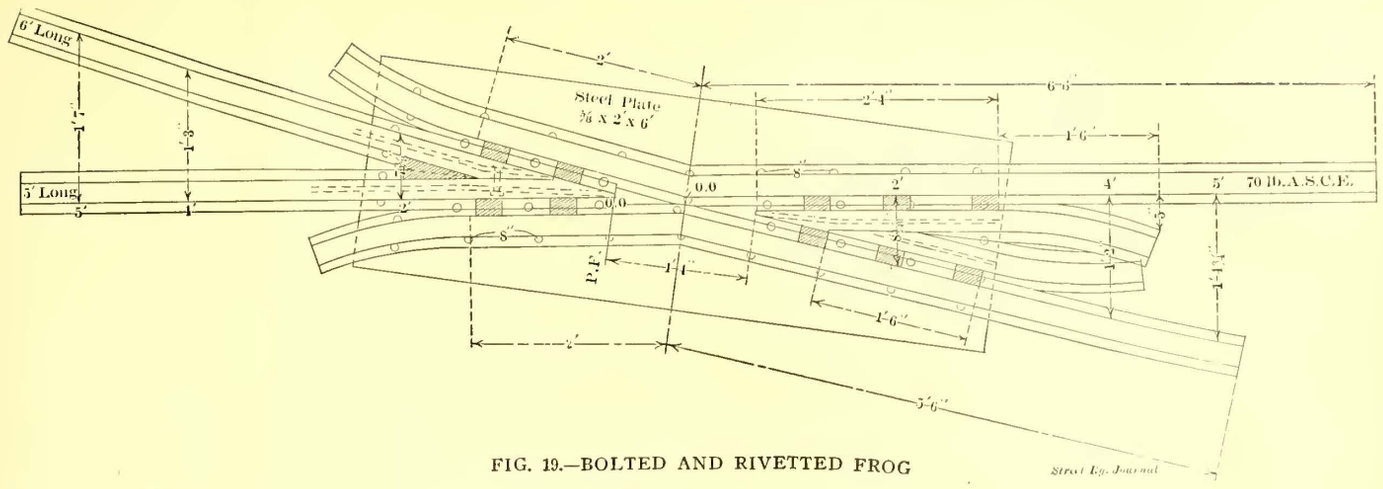


FIG. 19.—BOLTED AND RIVETTED FROG

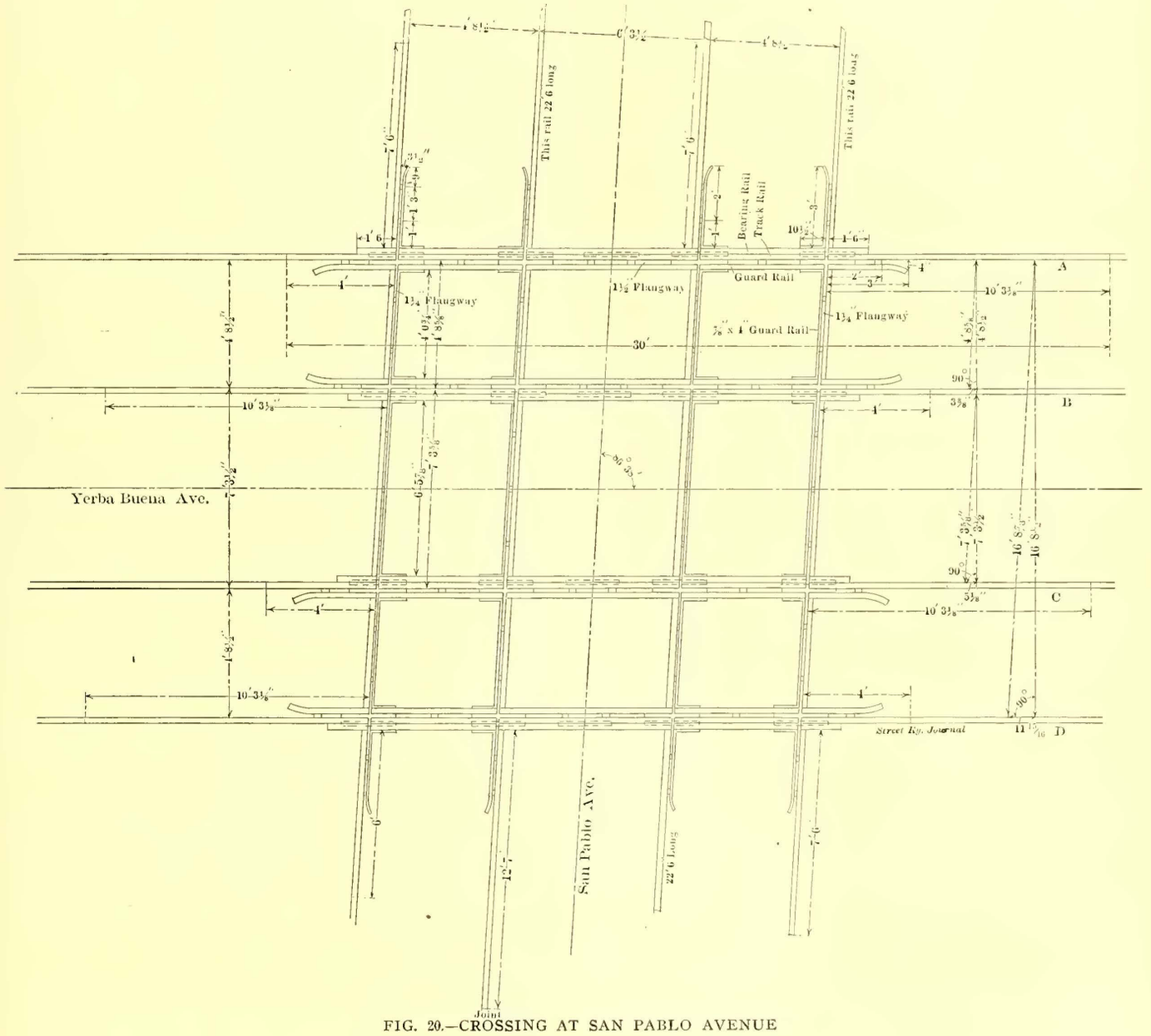


FIG. 20.—CROSSING AT SAN PABLO AVENUE

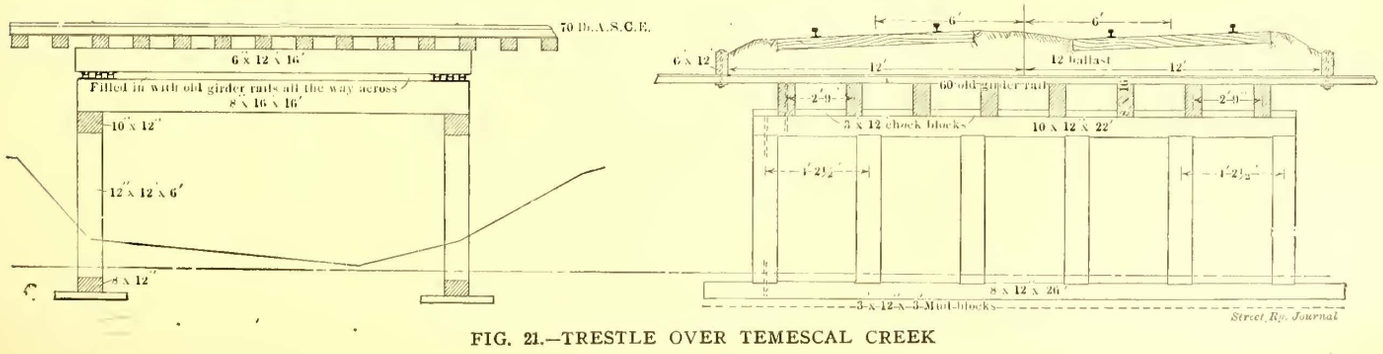


FIG. 21.—TRESTLE OVER TEMESCAL CREEK

rangement being shown in Fig. 22. To an ordinary tank line car is fitted, by means of a 4-in. nipple and union, a 3½-in. pipe, from the ends of which are hung, by swivel joints, two 3-in. pipes that overlap in the center of the track and extend beyond the rails on each side. Along the underside of the 3-in. pipes are drilled 5-16-in. holes

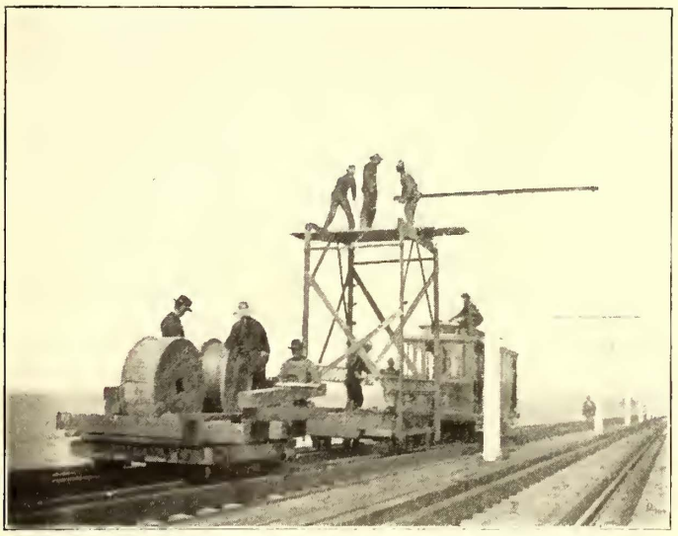


FIG. 24.—STRINGING TROLLEY WIRE ON PIER

on ⅝-in. centers, for the discharge of the oil. A 6-in. space over each rail is not drilled, so the oil does not come in contact with the rail. This arrangement gives a 12-ft. stream of oil, the tank line car being hauled over the track by any work or motor car. To regulate the discharge of the oil, air pressure is introduced at the top of the tank.

OVERHEAD CONSTRUCTION

For the overhead equipment of the Key Route No. 0000 grooved trolley wire is used, it being hung on 8-in. extra heavy ears with ¾-in. studs. Feeder ears for 300,000 circ. mil taps are used. The three 1,000,000-circ. mil feeders, leading each way from the power house, are supported throughout the land portion of the system on glass insulators, which, together with the other overhead fittings just mentioned, were supplied by the Ohio Brass Company.

All the overhead work on the pier was special, the general design of the straight-track center pole construction being shown in Fig. 11. The poles are of sawed redwood, 8 ins. sq. at the top, 12 ins. sq. at the bottom, and 30 ft. long, being placed so that 24 ft. of the poles are above the ties and 6 ft. below. Each pole is fastened to the cap of a pier, bent by means of two ⅞-in. bolts, the bottom of the pole being cut away 4 ins. so as to rest on and be bolted to a 4-in. x 12-in. plank that is spiked across three piles, as shown. To keep the pole from splitting a ½-in. cross bolt is driven through 5 ins. from the lower end. These poles are placed on every seventh bent on the pier, and on every sixth pole are run 350,000-circ. mil feeder taps to the trolley wires, the taps being carried up the poles on insulators, as shown. The feeders, which run the length of the pier, are laid in a three-duct wooden conduit, covered with hot asphaltum pitch. At the outer end of the pier the side-pole span construction is used, as illustrated in Fig. 9.

For the land lines iron poles are used, both for center and side-pole construction, the feeders being carried on a short arm near the top. For use on both the iron and wooden poles a special steel pole bracket has been devised, with a spring support for the trolley wire. The details of this bracket and spring are shown in Fig. 23. The bracket consists of two 3-in. x 3-in. x 5-16-in. angles, fastened to the iron pole by means of two cast-iron clamps, with hardwood insulating blocks, 4 ins. x 4 ins. x 14 ins., next to the pole. In the case of the wooden poles the angle brackets are bolted directly to the pole. Between the ends of the angle-irons are fastened 4-in. x 4-in. x 10-in. hardwood blocks, which support the trolley springs. The springs are made of No. 7 spring steel, 3-16 in. diameter, and are 6 ins. long, with an outside diameter of 2½ ins. and a ¾-in. pitch. The springs are designed to close tight under a load of 60 lbs., and the pressure of the trolley wheel is intended not to exceed 60 lbs. to 64 lbs. At the bottom of each spring are a cast-iron yoke and a clamp, the latter holding the trolley wire insulator. The dimensions of the bracket and springs are such as to bring the trolley wire 18 ft. above the rail and 17 ft. from the center of the pole. At crossings the wire is placed 21 ft. above the rail. The spring construction was adopted so as to make the trolley wire more flexible, thus rendering it less apt to break.

The span-wire construction comprises no distinguishing features except the wooden cross pieces or spanners used on curves, as illustrated in Fig. 17. It was found that there was a tendency for corners of the diamond-shaped trolleys used on the cars, to come in contact with the span wires on curves, due to the elevation of the outside track. To overcome this difficulty the wooden spanners mentioned were introduced, and they serve the purpose very well, as they hold the trolley wire in the proper position and yet are out of the way themselves. They consist of 2½-in. x 2½-in. x 18-ft. pieces, to which the trolley insulators are fastened by iron brackets or yokes.

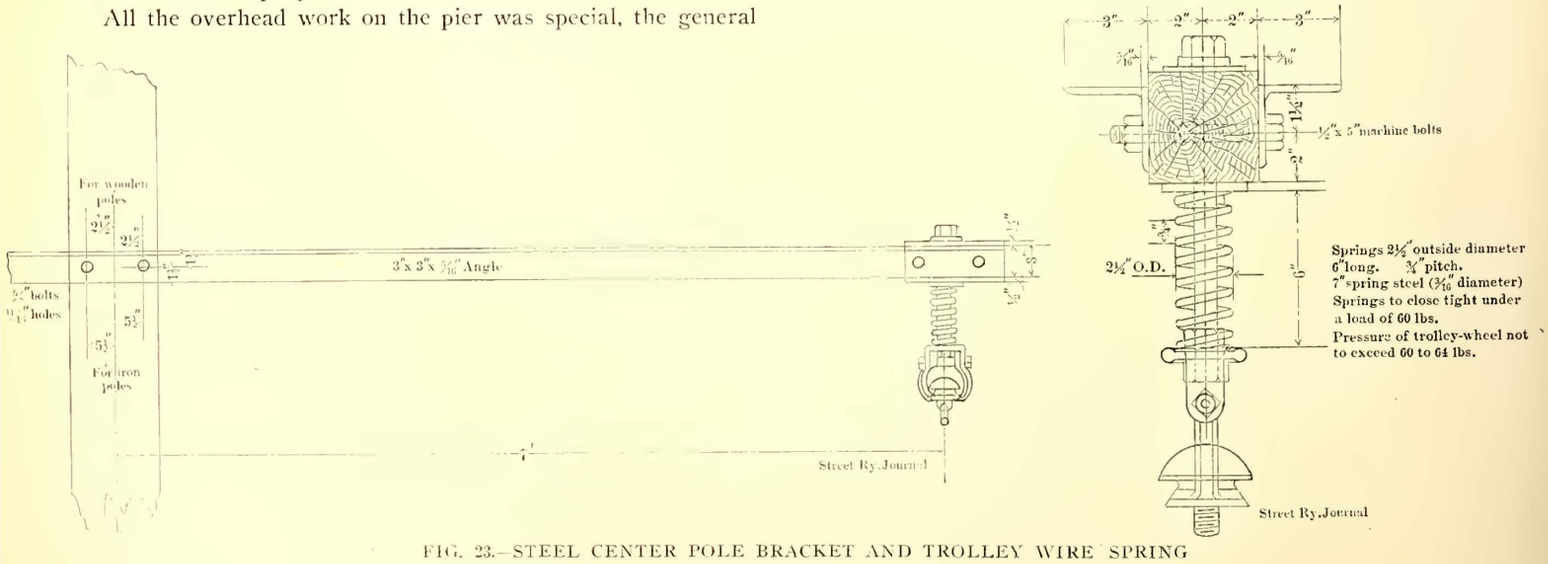


FIG. 23.—STEEL CENTER POLE BRACKET AND TROLLEY WIRE SPRING

In stringing the trolley wire on the pier the method illustrated in Fig. 24 was followed, the reel car and tower car being pushed over the track by an ordinary work car, which obtains its current from the live trolley as it is strung.

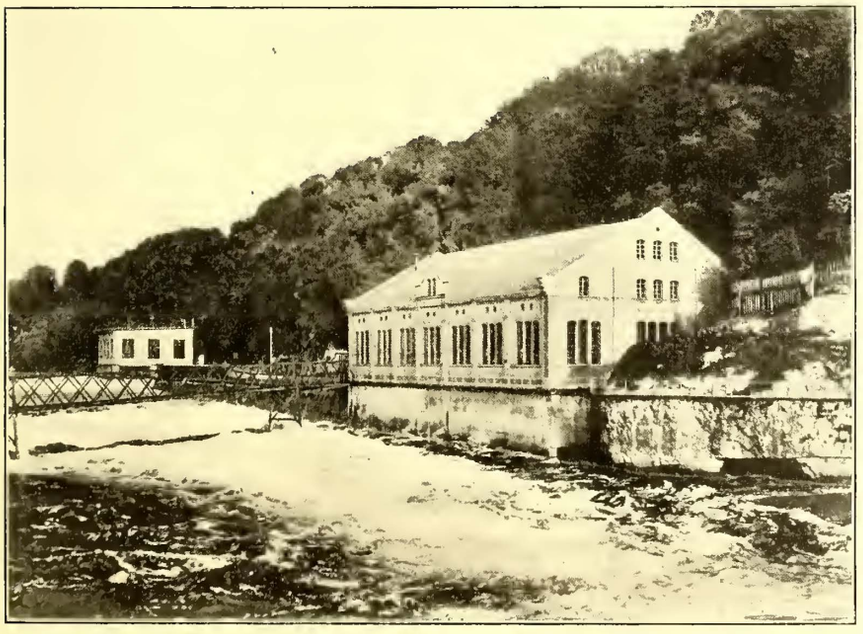
THE STREET RAILWAY SYSTEM OF SCHAFFHAUSEN, SWITZERLAND

The abundance of water-power and scarcity of coal in Switzerland have stimulated greatly the growth of hydro-electric plants in that country during recent years. One of the most prominent Swiss installations is owned and operated by the municipality of Schaffhausen, the capital of the like-named canton. It was completed in 1901, and is divided into an upper and lower station, built on the Rhine River, 3 miles from Schaffhausen. The two stations are not built at the Schaffhausen Falls, but utilize the power from the rapids at the points where they are located. Power is transmitted to the city for manufacturing and lighting purposes, and for the operation of the Schauffhausen-Neuhausen Electric Railway. This railway is also owned by the city, and has been in operation since 1901. All of the electrical apparatus for the power plants and railway was furnished and installed by the Oerlikon Company, of Oerlikon, near Zurich, Switzerland.

LOWER POWER STATION

The lower power station is located on the River Rhine, about 450 ft. below the upper one, and is conected to the shore by an iron bridge, which serves to carry the transmission cables.

The western portion of this station contains the power equipment of the Schaffhausen Worsted Works, consisting of two Jonval type turbines, built by J. J. Rieter; two Oerlikon generators and Oerlikon controlling apparatus. The turbines give 350 hp at 60 r. p. m., with a fall varying from 13 ft. to 18 ft., and 8000 to 8900 second-liters. They are fitted with two concentric paddle-wheels, both being used at high water, and the outer one only at low water. The outside diameter of the turbines is approximately 14 ft., and the inner diameter, 7 ft. The turbines are connected to the generators through bevel gearing and rope drive. The two generators are each of 300-hp capacity, giving 700 volts to 750 volts direct current at 200 r. p. m.

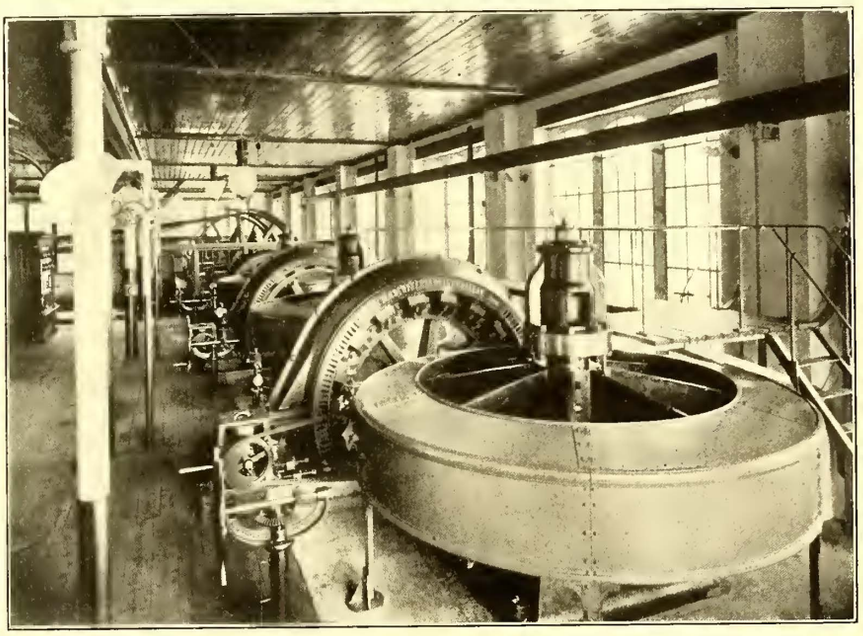


VIEW OF BOTH POWER STATIONS FROM THE RIGHT SHORE OF THE RHINE

The eastern part of this station contains three hydro-electric sets, two of which generate single-phase current, and the third either single-phase or polyphase current, as may be required. The turbines are of Jonval type, and were built by Escher, Wyss & Company, of Zurich. The two turbines connected to the single-phase alternators run at 48 r. p. m., are built for a waterfall of 15 ft. and a flow of 6800 second-liters. Concentric paddle wheels are also used on these turbines. The turbines are connected to the corresponding generators through intermediate shafting and gearing, owing to the low peripheral speed of the turbines and the limited space.

It may be mentioned in this connection that these turbines were not intended originally for electric service.

The 300-hp single-phase generators used with these turbines



INTERIOR OF LOWER POWER STATION

are of the inductor type, and at 167 r. p. m. generate 100 amps. at 2000 volts and 50 cycles. The full and half-load efficiencies of these machines are 92 per cent and 87 per cent, respectively. Each generator is furnished with a 6-kw exciter.

The third generator has a rated capacity of 350 hp. As a single-phase machine it gives, at 167 r. p. m., 210 K. V. A., at 2000 volts, 50 cycles, and 300 K. V. A. as a polyphase alternator at same speed and voltage.

The southeast portion of the station contains two motor-generator sets for railway service, of which one is used as a reserve. The motors receive current either from the upper station or from the reserve generator in the lower station. These polyphase motors are of 150-hp capacity, running at 490 r. p. m. The motors are connected to the direct-current generators by flexible couplings. Each of these generators supplies 182 amps. at 550 volts.

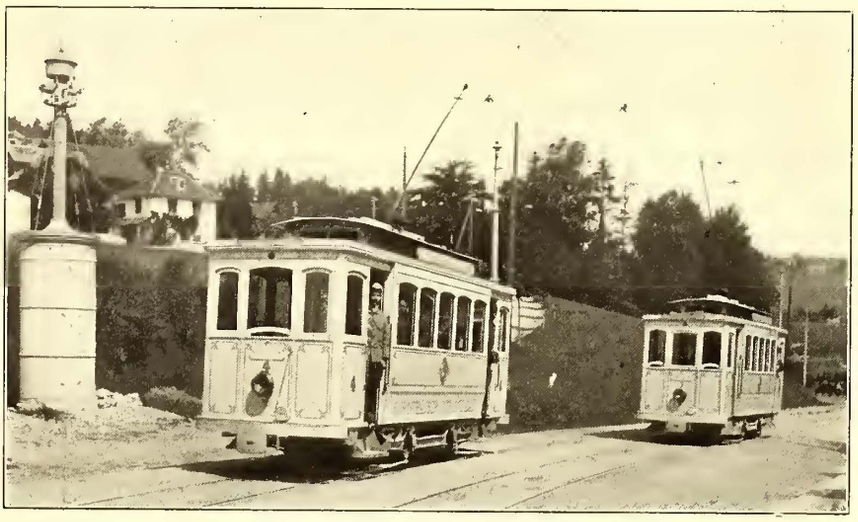
All of the controlling apparatus in this station is enclosed in separate housings with marble fronts. There is no general switchboard, as the several units were installed at different times, and the present arrangements do not permit any extensive changes.

UPPER POWER STATION

The lower turbo-generator set in the upper station is owned by the Schaffhausen Cotton Works, which, like the Schaffhausen Worsted Works, lease power from the municipality. The two

upper turbo-generator sets are used for general current distribution. All the generators are connected to their respective turbines by gearing.

The two upper turbines were built by Escher, Wyss & Company, and the lower one by J. J. Rieter & Company, each to give



AT THE SCHEIDEGG CROSSING

350 hp at 60 r. p. m., at a flow varying from 7800 to 8400 second-liters.

The lower turbine is of Jonval type, and is connected to a 350-hp, three-phase generator, which, at 170 r. p. m., gives 420 amps. per phase, 400 volts. This generator is direct-coupled to a 6-kw exciter.

The two upper turbines are of Francis type, and run at 60 r. p. m. The generators coupled to the m are of the same size and type as the one used with the lower turbine. The exciters are also direct-coupled, as in the previous instance. There are two switchboards in this station, one being owned by the Schaffhausen Worsted Works.

OPERATING COMBINATIONS

Under normal operating conditions the lighting circuits are fed by the two single-phase alternators in the lower station, and the power circuits (including the railway) are fed by the two alternators in the upper station. Should an accident occur the reserve generator in the lower station can be operated in parallel with the generators on the lighting circuit. If, however, one of the power service generators in the upper station is disabled the reserve generator can be used for the power circuits.

The single-phase, 2000-volt current leaves the lower power station through six lead-covered cables laid in clay pits. Upon reaching the city the voltage is reduced to 120 volts for lighting by transformers placed in cylindrical housings at convenient points. The three-phase high-tension current is similarly transmitted and transformed to 200 volts for motor work.

STORAGE BATTERY

A storage battery has also been installed in connection with the railway service. It is located in a building on the left shore of the Rhine, and between both power stations. The battery consists of 276 elements, and has a capacity of 165 amp.-hours. A repair shop is located in the same structure.

LINES AND EQUIPMENT

The Schaffhausen-Neuhausen line begins at the southern portal of the steam railroad station in Schaffhausen, passes to the Oberthor, crosses the Government steam railroad below grade, and ends in the center of Neuhausen in front of the Hotel Rheinfall. The second line (Breitelinie) runs between the railroad station and Marksmen's House. The third line connects the Emmersburg quarter and the railroad station.

All of the lines are single-track construction, with turn-outs averaging 263 ft. (80 m) in length. The distance between track centers is about 8 ft. 2 ins. (2.5 m), leaving a clearance

SCENE AT SCHAFFHAUSEN STEAM RAILROAD STATION

CROSSING STEAM ROAD BELOW GRADE

of 1 ft. 7½ ins. (50 cm) between passing cars. The minimum distance between outer rails and curb is 3 ft. 3¼ ins. (1 m). The total length of the turnouts on the Neuhausen line is about 1676 ft. (510 m), and on the Breitelinie 885 ft. 10 ins. (270 m). The Neuhausen line is almost 2 miles (3136 m) long, and the Breitelinie over one-half mile (856 m).

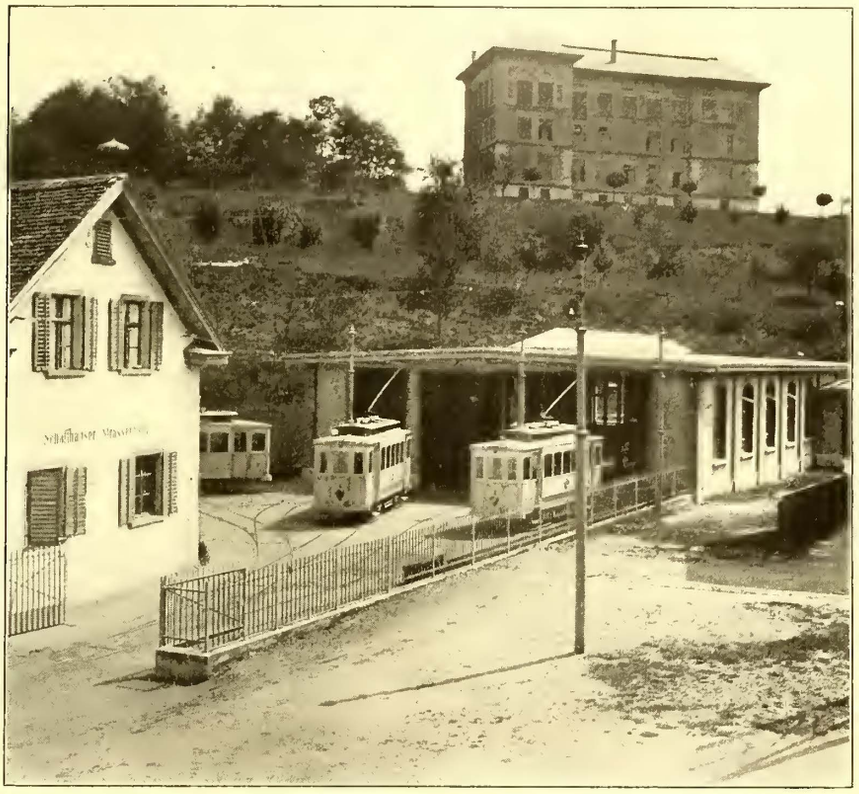
The smallest radius of curvature on either line is 65 ft. 7 ins. (20 m). The track is divided on the Neuhausen and Breitelinie lines respectively, as follows: Straight track 53 per cent and 66 per cent, curved track 47 per cent and 34 per cent.

The Neuhausen line climbs a 5.4 per cent grade on the way to Oberthor, and a 4.6 per cent grade between the steam railroad crossing and Scheidegg. The Breitelinie route has a maximum grade of 8.1 per cent.

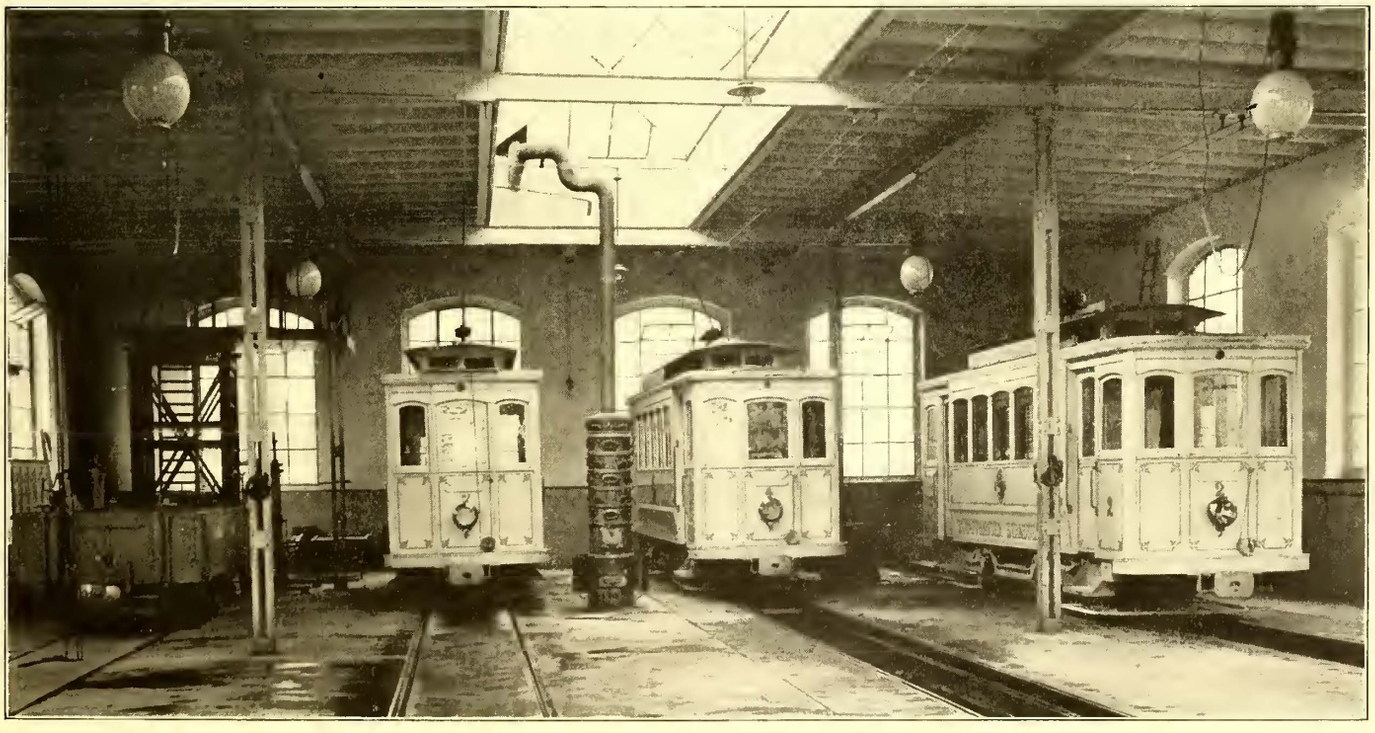
All of the lines run on the public highway, and, as the rail-heads are flush with the street, wagon traffic is not inconvenienced. The rails are laid on a foundation of large stones, averaging 16 ins. x 10 ins., covered by rubble.

The track gage is 39.37 ins. (1 m). Grooved rails are used throughout. The height of rails is 5.9 ins. (150 mm); width of top, including groove, 3.8 ins. (97 mm); width of base, 5.9 ins. (150 mm); weight per running foot, 28.5 lbs. (42.4 kg per meter); length of rails, 39.37 ft. (12 m). The joints are made by mitering in a way common in Germany, milling out a portion of the head of the rail each side of the joint and extending the top of the outer angle-bar, so that it fits into the milled section and carries part of the weight from the wheel. Edison-Brown bonds are used throughout.

The line voltage is 550, and the drop is not permitted to exceed 50 volts. Current is transmitted by buried cables from the two motor-generator sets located in the lower power station. The power wire is made of No. 0 hard-drawn copper (8 mm thick), supported by No. 3 (6 mm) steel span wires, 21 ft. 3 ins. (6.5 m) above the rails. Return to the power station is made through the rails. The lines are protected by lightning arresters mounted on poles, and an automatic arc extinguisher is also placed at the point where the feeders leave the power station. Steel guard wires are placed parallel to the power wire to prevent contact with falling telephone or telegraph wires. These additional wires are attached to a No. 3 (6 mm) copper wire connected to the running rails. All the trolley poles are constructed of steel tubing.



ENTRANCE TO CAR HOUSE

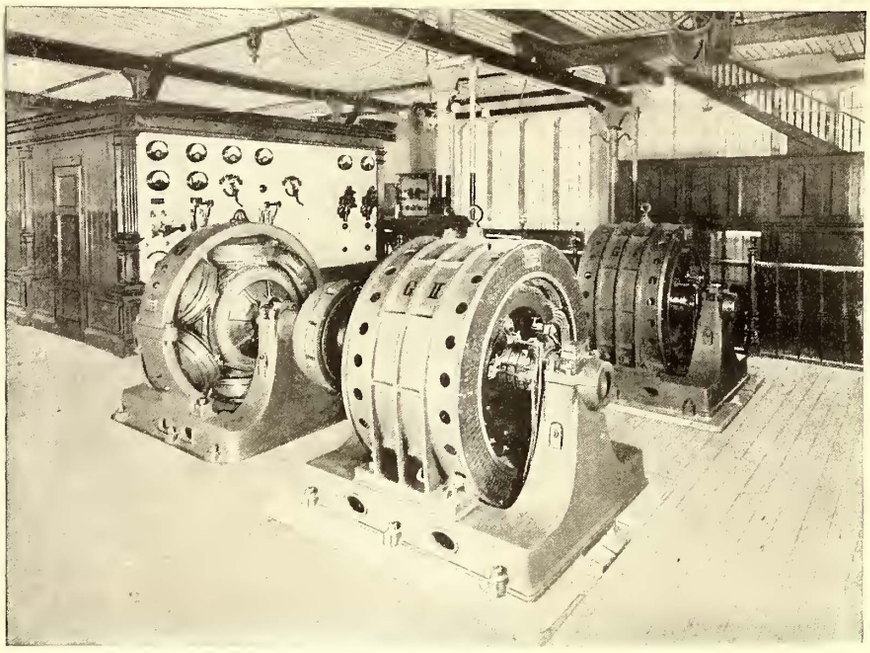


INTERIOR OF CAR HOUSE

ROLLING STOCK

The rolling stock consists of nine single-truck motor cars,

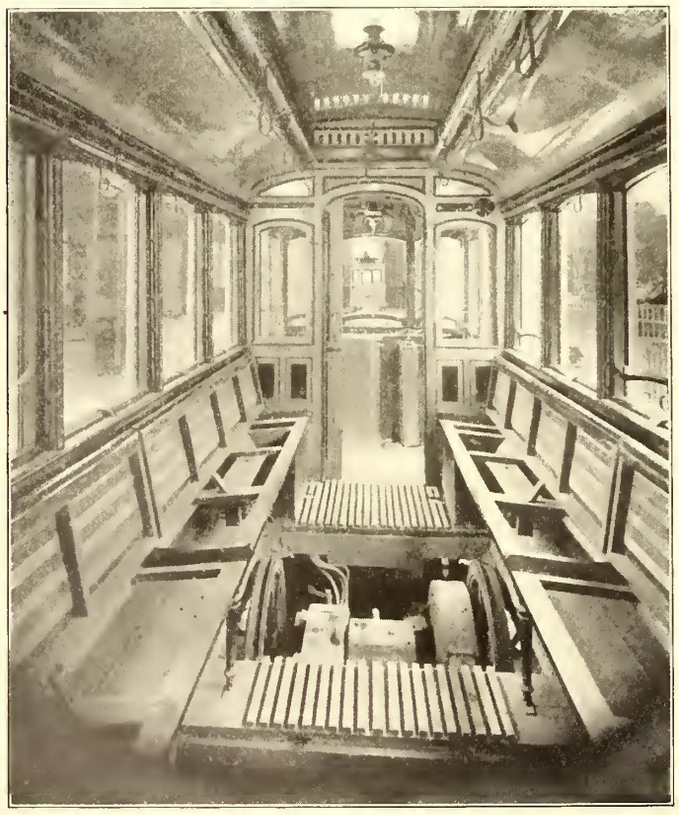
one sanding car and one repair car. The mechanical part of the motor cars was built by the Schweizerischen Industriegesellschaft, of Neuhausen. All car seats are made of wooden



MOTOR-GENERATOR SETS FOR RAILWAY WORK IN LOWER STATION

slats, and are arranged longitudinally. The windows have metal runways and are furnished with roller curtains.

Each car has two 24-hp motors. The poles are made of laminated iron and tin, and are screwed to the inside of the frame. The latter is divided into two parts, and its interior may



INTERIOR OF MOTOR CAR, SHOWING TOP OF MOTOR AND GEAR CASE

be inspected from the top by first lifting the part of the car floor above the motor. The frame may also be opened from the bottom, making all parts easily accessible.

Current is taken through four collector brushes, which are so placed that they may be quickly removed from above even when the motor is mounted for immediate service.

The armature is 13 ins. (335 mm) in diameter and 4.7 ins. (120 mm) in width. Each of the thirty-seven grooves contains 36 wires, triple-covered with silk and varnished. The four poles, which are connected in series, have each 20 turns of wire.

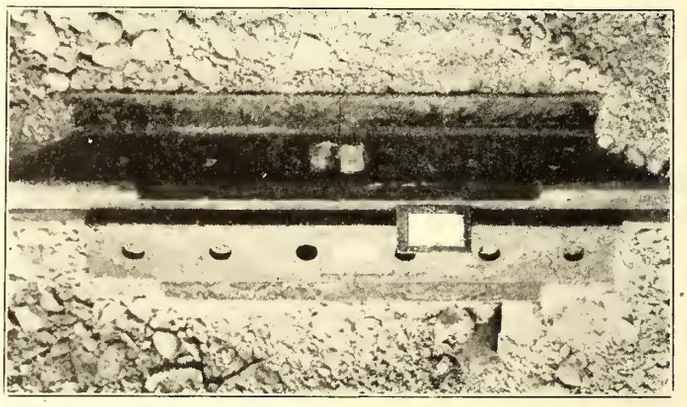
The motors are series-coupled when running slowly, and parallel-coupled at high speeds and heavy loads. For control there are four series, six parallel and six braking positions. One of the motors can be put out of circuit, without interfering with the running and braking of the car, by lifting a contact on the reversing handle. All of the controller contact-fingers are furnished with arc extinguishers. Some of the cars are fitted with emergency brake beside the usual hand brake.

CAR HOUSE

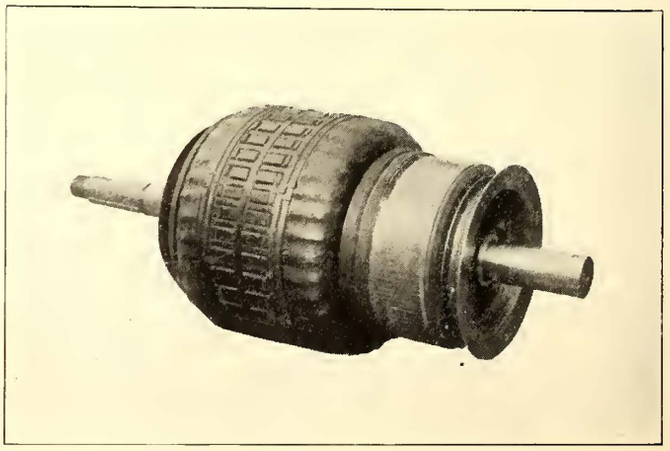
The car house has a capacity of twelve cars, with two car pits and four tracks. It is constructed of brick with skylights and wood and cement roof, and is lighted by four arc lamps and ten incandescent lamps. A smithy and repair shop adjoin the car house. The repair shop contains two lathes, planer, boring machine and grinder. All of the machines are operated by belting from a 2-hp Oerlikon motor.

GENERAL DATA ON COST, TRAFFIC AND OPERATION OF SYSTEM

The total cost of the street railway system was $108,284.66 (561,060.4 francs), or $36,167.21 per mile.



ELECTRIC RAIL CONNECTION

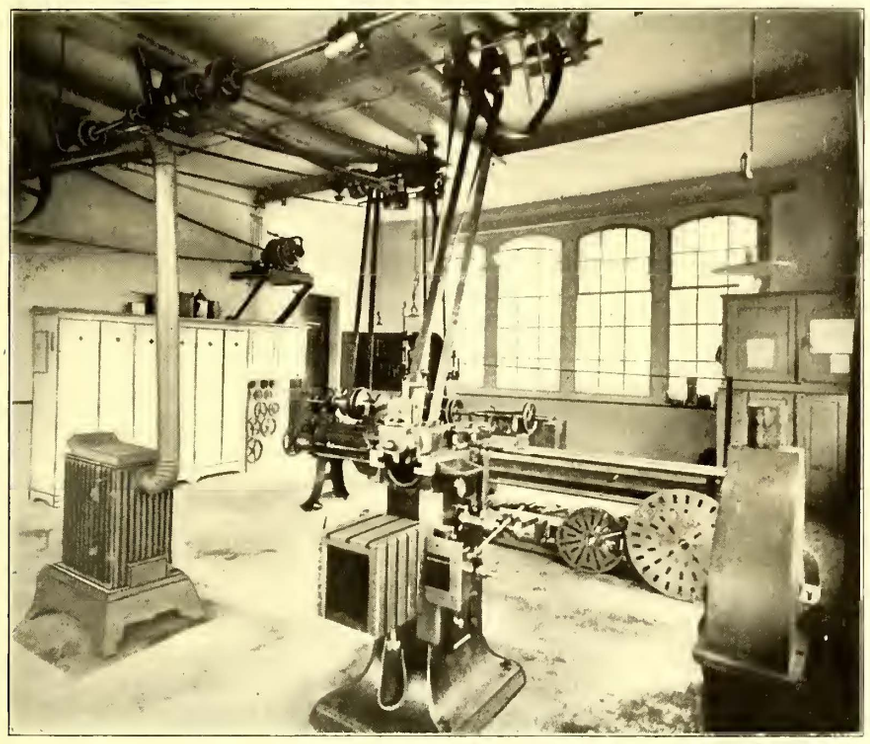


RAILWAY MOTOR ARMATURE

The total number of passengers during 1901 was 481,143, or 6.5 per trip. The consumption of 131,541 kw-hours was required to carry this traffic.

Fares are paid according to the zone system, the first zone

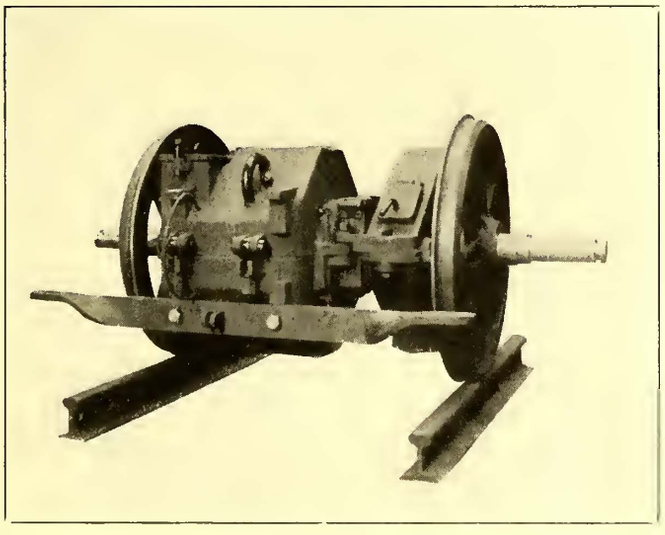
costing 1.93 cents (10 centimes), and .965 cents (5 centimes) for further zones. The highest fare is 4.825 cents (25 centimes). Reduced-fare tickets are sold to school children and workingmen. Passes are granted to employees of the railway.



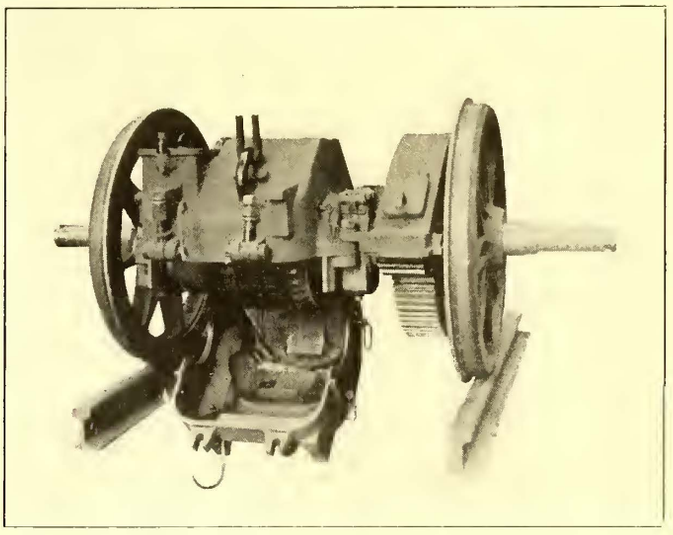
INTERIOR OF REPAIR SHOP

The cars are run under the following headways: Thirty minutes between 6 a. m. and 7 a. m., 15 minutes between 7 a. m. and 8 a. m., 10 minutes between 8 a. m. and 8 p. m., 15 minutes between 8 p. m. and 10 p. m.

The operation of the system (exclusive of power stations) requires the services of twenty-nine men, including the director, starter, cashier, two ticket agents, three shop men, three track men, nine motormen and nine conductors.



RAILWAY MOTOR, CLOSED

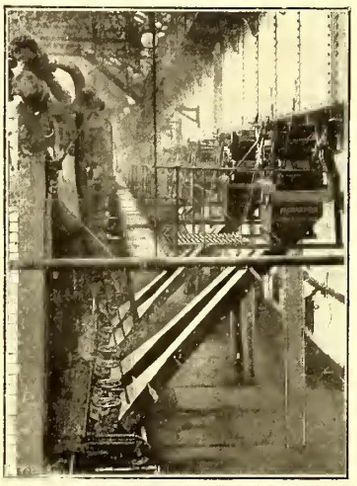


RAILWAY MOTOR, WITH LOWER HALF OPEN

AUTOMATIC COAL SCALE

Since the introduction in large power stations of the present method of storing coal in overhead bunkers and allowing it to fall by gravitation to the stokers, engineers seeking efficiency with economy have experienced the necessity of providing a reliable method for accurately weighing and registering the coal thus delivered to the boilers. An automatic device to meet these requirements has been designed by Henry Richardson, of the Richardson Scale Company, of New York, and is now being manufactured in this country.

This apparatus is by no means experimental, but thoroughly perfected, and has been introduced largely in the chief power stations of Great Britain—that of the Glasgow Corporation, which is shown herewith, having as many as fifteen machines, each fitted to a Babcock & Wilcox boiler. The coal stored in the bunker is delivered to the receiving hopper, through which it passes to the weighing hopper on the apparatus—an automatic scale fitted below the bunker by special brackets. Constant delivery is insured by a feeding device driven by a rope gear, the only power necessary in connection with the entire arrangement. The scale is of the "beam" type.

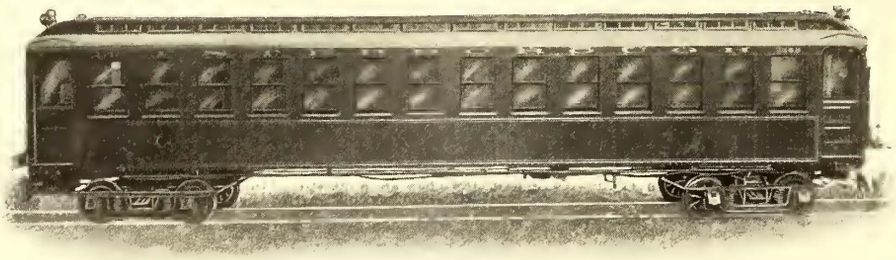


AUTOMATIC SCALES IN GLASGOW POWER HOUSE

The machine is fitted with double shutters, which regulate the supply, adjusting themselves to the coal consumption so as to pass automatically only so much coal as the stoker requires. Every time the exact weight has been drawn from the bunker the supply is cut off, and due allowance is made by a special contrivance for the amount descending at the moment of cut-off and the charge dumped to the automatic stoker. The scale is also fitted with a mechanical self-registering instrument, hermetically sealed, which records every weighing so that a glance suffices to show the quantity consumed during any desired time.

STEEL CAR FOR THE NEW YORK SUBWAY

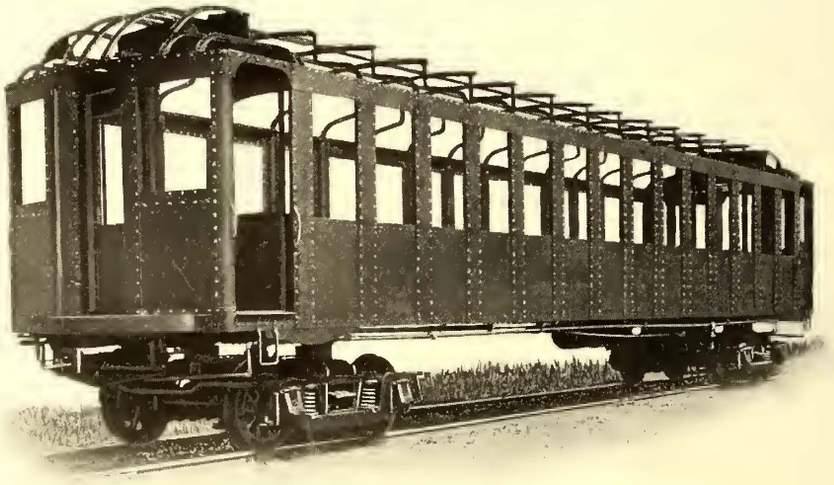
The Interborough Rapid Transit Company has received the new steel car which was designed for the subway by George Gibbs, consulting engineer for the Rapid Transit Subway Construction Company, and it will soon be placed in regular service on the Second Avenue elevated structure, where the other subway cars are being used. The new car is intended to be absolutely fireproof, and to ensure this it has been constructed entirely of metal, transite board and asbestos. No inflammable material whatever enters into the construction of the car body itself. In fact, the seats are the only part of the car, or its furnishings, which are of wood, and it has been determined to replace these by pressed steel frames as soon as they can be provided. The new car differs materially in appearance from the copper sheathed wooden coaches already built for the subway. It will be remembered that the sides of the latter slope toward the roof, giving them rather an unusual appearance, but in the new car the usual form of construction was followed, as it was found that steel framing resulted in economy of space so that approximately the same interior width at the floor as in the wooden car could be secured without encroaching upon clearance.



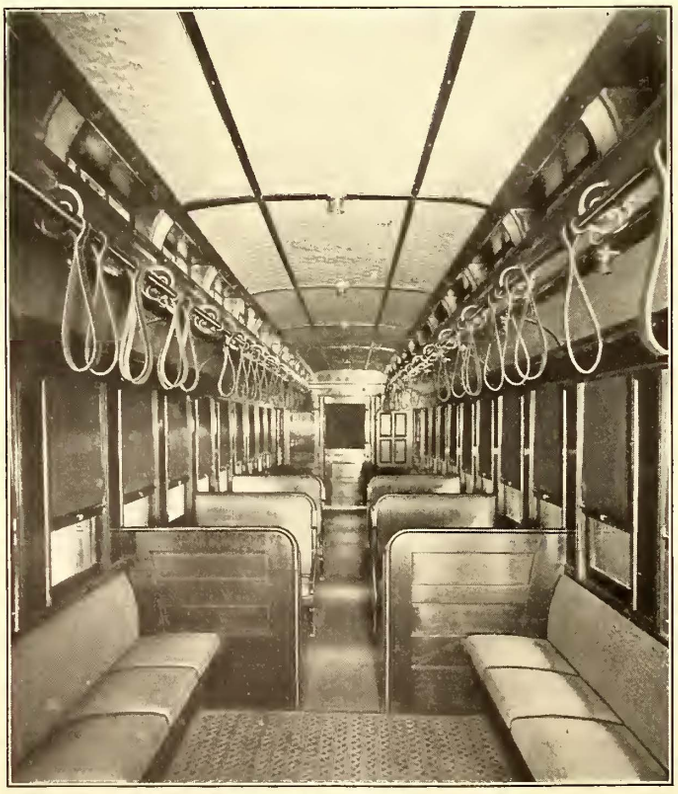
EXPERIMENTAL STEEL CAR FOR SUBWAY

The steel car is of the same dimensions as the wooden car, has the same capacity, and in general design follows similar lines. The car framing is unusually heavy, and the body weighs about 2 tons more than the wooden cars. A number of modifications will be made, however, based upon the experience gained in building this car, by which the weight can be reduced without sacrificing structural strength, thus making the steel car approximately the same weight as a wooden car.

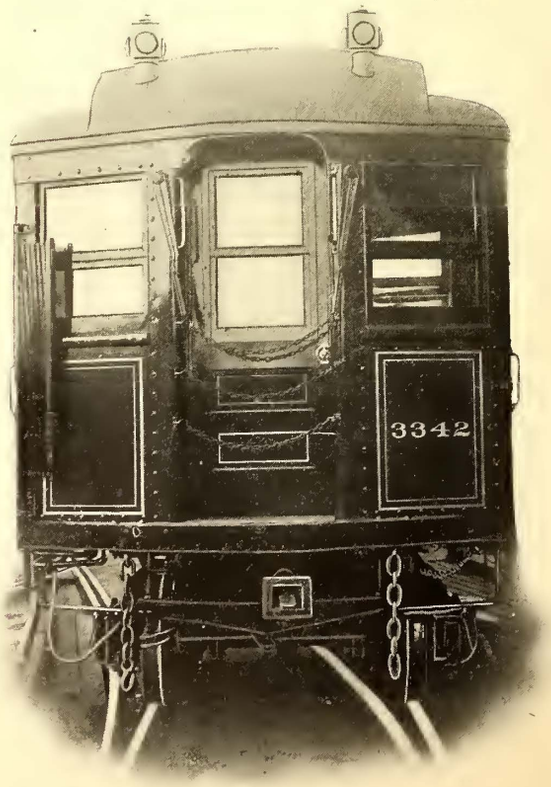
The car body is double lined and is built of steel and asbestos composition. The sides are covered with steel plates, and the outside roof is of transite board. The inside lining is of electrobestos, the ceiling being covered with stamped sheet steel. Electrobestos is also used for the under panels, and the mouldings throughout are of copper. The flooring is of corrugated steel covered with monolithic composition. Longitudinal seats have iron frames covered with cushions, but the cross-seat frames, as already mentioned, are of wood, and are the same type as those



FRAME OF STEEL CAR



INTERIOR



END VIEW

used in the regular cars, but these will be replaced by pressed steel frames as soon as the latter are completed.

The accompanying cuts show the appearance of the completed car and also give some idea of the principal features of construction. An examination of these illustrations will convince those who are familiar with car construction that the new coaches are exceptionally strong. It is believed that the designer has entirely overcome the chief objection to the steel car, namely, the excessive noise which it was believed would inevitably accompany the operation of a car of this description. It has always been asserted that cars of this type would be extremely cold in winter and hot in summer, but these objections have also been overcome. As far as practical operation is concerned the present car meets all the requirements of the service, the principal difference between it and those formerly employed being that the steel car is heavier, but even in its present form it will be noticed that this car does not exceed the weight of cars ordinarily used for this class of service in steam railway work. However, if the reduction in weight now proposed can be accomplished without entailing any structural weakness in the car framing, the last objection will be entirely removed.

BRITISH PATENT OF B. G. LAMME ON THE SINGLE-PHASE SERIES MOTOR

In a recent British patent, No. 2746, of 1902, B. G. Lamme sets forth the principles of the series railway motor which he has been developing for the last two years. The patent specifications include a drawing of the motor, which gives much information showing how the result that has been claimed for these motors has been accomplished.

The principle of the series alternating-current motor is not, of course, a new one, but hitherto it has only been utilized in small size machines, and even then difficulties have arisen in the form of undue heating, excessive sparking and want of regulation. By varying the proportions of the machine and making suitable arrangement of the circuits, Mr. Lamme has overcome these troubles, and his changes in design form the basis of his claims. The inventor points out that there are three very important electromotive forces which must be taken into consideration in designing such a motor, namely, the self-induction of the field magnets, the self-induction of the armature, and the counter electromotive force set up by the armature due to its rotation in the field. Mr. Lamme's theory is that certain definite relations must obtain between these electromotive forces in order that the motor shall have proper performance curves of torque and speed.

To prevent sparking provision is made that the short-circuited bobbin shall have as few turns as possible, and shall contain a resistance properly proportioned to keep down the commutating current in the bobbin. Means are provided for minimizing the cross magnetizing of the armature by ingenious shaping of the pole pieces, and also by employing a closed secondary circuit.

Mr. Lamme directs attention to the fact that the self-induction of the field magnets and counter electromotive force set up by the armature depend upon the strength of the field, and, therefore, that a relation exists between them which is proportional to the speed of rotation of the armature, the relative ampere turns of the field and armature, and the alternating-current frequency. A high speed gives a high counter electromotive force in the armature; a low frequency and a minimum number of turns on the field magnet give a small counter electromotive force of self-induction in the fields; all of which is taken into consideration in the design of the present instance.

If saturation is not approached the field strength and armature magnetism increase with the current, and the torque increases as the square of the current, which is highly advantageous for electric traction. Unfortunately, however, the self-induction of the fields increased under these conditions, and consideration must be given to this fact. The resultant of all the electromotive forces is, of course, equal to the applied electromotive force, and, therefore, increase in self-induction would result in a fall of speed. The field magnet would act as a choking coil and the speed would reach zero when the electromotive force of self-induction became practically equal to the applied electromotive force, the resistance of the system in this case being relatively so low that it does not enter materially into the computation.

If the strength of the field be kept constant by working the field magnet at saturation or other devices, the armature speed will not fall unless the self-induction of the armature itself is very high, but the torque curve will not be as good.

The first case prevents a good torque curve in the early stages, but the maximum torque may be kept down by the limitation of the current, due to choking coil action. In the second case, the torque is not so limited, but it does not rise as rapidly in the early portions of the curve, which is a very desirable feature in railway work. Mr. Lamme has adopted proportions for his motor which combine these two features, and has thus acquired a condition where the field strength is approximately proportional to the current, while the motor is still capable of developing the required torque. It is further asserted that the self-induction of the motor, as a whole, in normal working should not absorb an undue proportion of the applied electromotive force, and it should have such a value that it is less than the applied electromotive force, even when maximum current is flowing, so that there will still be both torque and speed.

The self-induction of the field is equal to the alternations multiplied by the field turn in series by the induction of one pole and by a constant. The back electromotive force of the armature is equal to the speed, times the number of armature wires, times the induction of one pole, times a constant. If these two are placed in ratio the following fractional relations obtain:

$$\frac{\text{Field self-induction}}{\text{armature C. E. M. F.}} = \frac{\text{line frequency} \times \text{field turns} \times \text{induction per pole} \times \text{constant}}{\text{speed} \times \text{armature wires} \times \text{induction per pole} \times \text{constant.}}$$

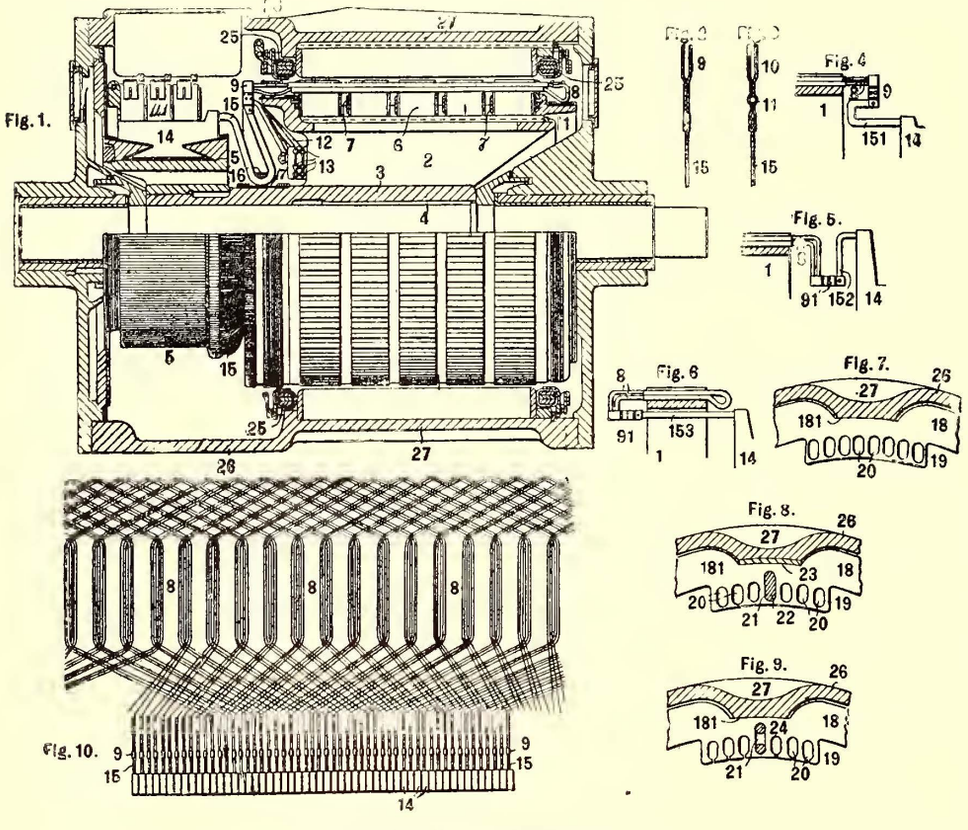
The induction per pole in the numerator and the denominator cancel, and since the number of armature wires equals twice the number of poles, times the armature turns in series in the case of a lap winding armature, the fraction becomes

$$\frac{\text{Line alternations} \times \text{the field ampere turns} \times \text{a constant}}{\text{Poles} \times \text{revolutions} \times \text{armature ampere turns.}}$$

In order that the ratio of self-induction and counter electromotive force of the armature be low, it is clear that there must be a small number of line alternations, a small number of field ampere turns, a relatively large number of armature ampere turns, a high speed and a large number of poles. Mr. Lamme has found that the minimum ratio of the field ampere turns to the armature ampere turns, should be greater than .5, and may sometimes be as high as .75. This is very unusual motor design, and is important in suggesting field distortion, because, according to Mr. Lamme's method, the magnetic power of the armature is always greater than that of the field, and the reverse arrangement is a condition which has always been sought for in direct-current design. These two ratios having been fixed there now comes a definite relation between the alternations of the supply circuit, the number of poles in the motor and its rate of revolution, or, practically speaking, between the line alternations and the armature alternations. Mr. Lamme has found that for a certain number of revolutions the number of poles must be directly proportional to the number of alternations of the supply circuit increasing and diminishing with

them, and that in order to obtain a motor that is simple in its polar structure, the line alternations must be very low; for instance, a 700-revolution motor having 2000 alternations per minute must have eight poles.

The method by which these motor characteristics are secured is interesting. Both the field self-induction and the armature self-induction are limited by a special construction of the pole pieces. Referring to the diagram it will be noted that slots or holes are cut in the pole piece from end to end, parallel to the shaft. These spaces are holes rather than slots, on account of the greater magnetizing power required when slots are used. The cross section of the field magnet is such that the principal magnetic reluctance is found in the air gap and in the teeth of the field and armature, and the magnetic circuit is so proportioned that beyond normal current the teeth in the pole slots rapidly approach saturation.



DETAILS OF LAMME MOTOR

The self-induction of the armature is, of course, proportional to the square of its turns and to the permeability of its magnetic circuit, and that part of the magnetic circuit which is in the armature itself must have low permeability for the reason that it carries the main torque producing flux. The poles of a direct-current armature, which are due to the armature winding, appear between the pole pieces of the field on the surface of the armature, and find their return magnetic circuit through the structure of the pole pieces from tip to tip, in accordance with well-known laws and many familiar diagrams. At this point Mr. Lamme attacks the integrity of the armature magnetic circuit, and by means of his slots in the pole pieces he has evidently contrived to reduce the cross magnetizing of the armature to such an extent that in spite of the very large number of armature turns the reactions are brought within reasonable limits. This cross flux in the armature is further limited by the interposition of a secondary circuit, which may be used if desired. It has been found convenient to install this secondary circuit in the slot in the middle of the pole, which consists of a conducting plate or closed coil, and by reason of the currents induced any magnetic flow which tends to cross the slot is opposed..

Mr. Lamme has adopted the type of armature winding which is closed on itself before being connected to the commutator, and high resistance leads are inserted between the winding and the commutator bars. When a turn of the armature is short circuited by the brush two of these high-resistance leads are included in the short circuit, which keeps down the secondary circuits set up in the bobbin by reason of alternations of the supply circuit. When these currents are large, as has been the case with series alternating-current motors heretofore designed, the sparking is severe, and Mr. Lamme has found that if the resistance of the leads is sufficient the sparking can be cut down to a point where it is not injurious. The resistance of these leads in their position in the armature circuit constitute a very large factor in the resistance of a short-circuited bobbin, but a very small factor as compared with the resistance of the entire armature, and, consequently, does not entail serious loss. He proportions this resistance so that the current in a short-circuited bobbin to a full current in the motor will not be more than twice the value of the full-load current. He finds, also, that for good commutation the armature circuits of the motor should be connected in parallel, therefore his armatures are lap wound. Moreover, the number of turns between consecutive armature bars should be small. This fits in exactly with the first condition that the armature ampere turns should largely exceed the field ampere turns. Naturally, this calls for a large number of turns in the armature, and a system of winding is, therefore, possible whereby the number of turns between bars can be reduced to a single turn. However, if this arrangement is to be adhered to throughout, it limits the working voltage of the motor. In direct-current motors this would be a serious matter, because it would limit also the voltage of transmission, but in alternating-current motors the employment of a transformer allows the armature voltage to be adjusted to any value, which is found best to enable minimum turns per bar in the design of the motor. This flexible arrangement also allows the controller to handle currents which are small in comparison with the currents taken by the motor.

In the diagram which appears with the patent, and which is reproduced herewith, a number of features of great interest are shown. The high-resistance armature leads are shown in the loop, passing from the corner of the closed coil winding at 9 and looping down to the shaft of the motor and then up to the commutator lug 15. At suitable points along the winding the armature is tapped to balancing rings shown at 12 and 13, in order to prevent reaction between the various parts of the armature. The field coils are connected in parallel, the transformer action between them producing a condition of balance. Figs. 4, 5 and 6 show alternative methods of resistance construction in forming the armature leads, and Figs. 7, 8 and 9 show methods of slotting the pole pieces to prevent cross magnetism of the armature. In Figs. 9 and 8 are shown also the introduction of a closed circuit-secondary winding to prevent additionally the demagnetizing action of the armature.

The armature is a skeleton open frame, or spider, suitably keyed to a shaft and built in the usual manner with thin plates or laminæ. In the form shown there are seventy-two slots,

eight conductors per slot, each coil spanning the first and ninth slots. In Fig. 3 the arrangement of the commutator leads is provided with a socket (11), which is connected to the balancing rings. The leads are made of strips of German silver, and their dimensions are very accurately determined. The motor here shown and illustrated has eight poles and eight brushes, and is designed for a frequency of 2000 line alternations per minute.

The field magnet is in the form of a hollow cylinder, built up in the form of thin plates or laminæ, and held together in their proper relation to the shell by the thin frame 27, which is not intended to be any thing more than a support, and is no part of the magnetic circuit. The slots in the pole pieces are made shallow, being only of sufficient depth to keep down the cross magnetism, and are so dimensioned that the iron frame between them shall be quickly saturated when the current in the field winding exceeds the rated amperage for which the field magnets are designed.

The patent rehearses a number of methods of controlling the motor by well-known alternating-current principles. The claims are very interesting and are rehearsed herewith:

1. A single-phase alternating-current series-wound motor, in which the ratio of the field-magnet self-induction to the armature counter E.M.F. is approximately equal to the ratio of the line alternations to armature alternations, substantially as described.

2. A single-phase alternating-current series-wound motor having a closed-coil parallel-wound armature with relatively high resistance leads connecting the armature coils with the several commutator bars, and a field-magnet the poles of which have slots transverse to the direction of rotation of the armature and with or without a closed conductor inserted in one of the slots and extending through approximately the central portion of the pole, substantially as described.

3. For use with single-phase alternating electric currents, a series-wound motor having the ratio of the number of its field poles to the number of current alternations per minute approximately as 1 to 250, and having a ratio of field ampere-turns to armature ampere-turns approximately as 20 to 27.

4. Electric motors for use with single-phase alternating-currents constructed substantially as described with reference to the accompanying drawings.

STATE BUILDS A TROLLEY LINE

Construction work is now nearing completion on an electric railway at Bismarck, N. D., which was financed by the State. It seems that when Bismarck was first settled the pioneers thought that the city would soon grow to be a metropolis, and in the enthusiasm of their expectations for the future they set the capitol upon a high hill, more than a mile from the business section of the town and the various hotels at which legislatures and visitors to the city had to stop. It turned out, however, that the city did not boom as much as the founders of it had anticipated, and the capitol now stands far removed from the center of population, with practically no means of transit. The fierce weather that prevails throughout the Northwest so added to the trials and tribulations of the law-makers in attending sessions, that they decided to lessen their troubles by appropriating State money for the construction of an electric railway to the capitol. In order to do this, part of a parcel of 82,000 acres of land, which was a separate allotment made by the Government for the endowment of each of the State institutions, was sold.

The line begins at the railroad depot, and is 8500 ft. in length. The construction was begun last autumn, and is under the direction of an electrical engineer employed by the State. No contracts were let for building the line, and the actual work of construction is being carried out with labor paid by the State. The road will be operated by the State under a franchise granted to the State authorities by the Common Council of the City, which gives the State the right to operate a street railway for a term of twenty years, with a maximum fare charge of 5 cents.

The purposes to which the road will be put are unique. It will serve as a freight and passenger line. Coal for heating the capitol will be transported over it, and mail, express and other matter will be taken daily to the State House in a trolley car. Then, too, the legislators and representatives of the State will be transported free of charge.

The plant that will supply power to operate the road will also be used to light the administration buildings.

NEW SURFACE CONTACT SYSTEM

The accompanying illustrations show the method of constructing the Bourne Surface Contact System, which is designed not only for street railway service but also for interurban and heavy trunk line traffic.

In street service the system employs two sets of studs; the main operating set, from which current for operating the car is obtained and an energizing set. In interurban or trunk line traffic an overlapping double third rail is used.

The special feature of this system is the solenoid circuit closer, which is the invention of Frank Bourne, E. E., of New

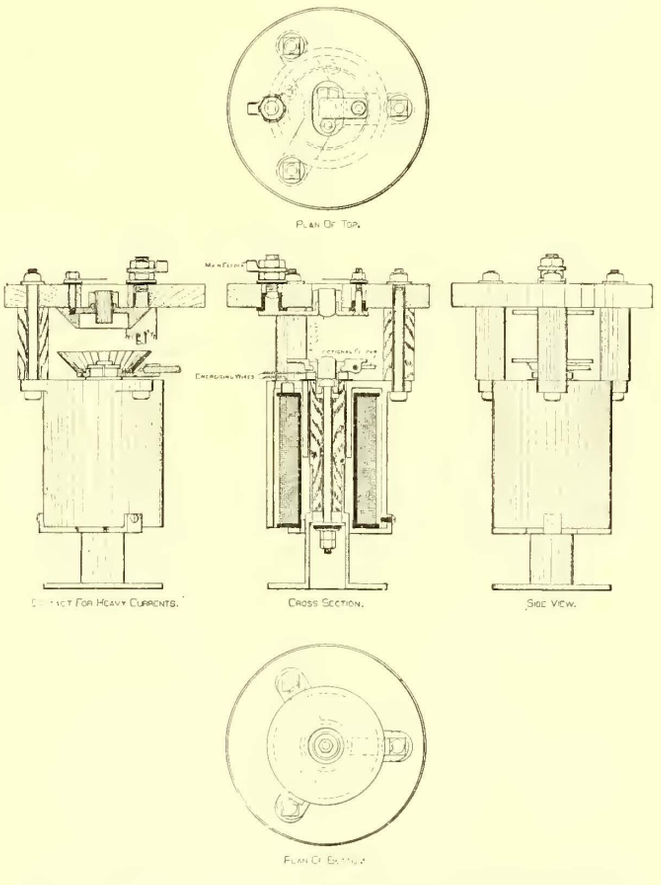


FIG. 1.—SOLENOID CIRCUIT CLOSER FOR SURFACE-CONTACT SYSTEM

York. This is shown in the cross-section, Fig. 1. The movable core, or plunger, is a hollow iron stem filled with a wooden plug, which carries at its base an iron plate, and on its upper end a gun metal contact-plate. This plate is provided with a rocking joint, which automatically adjusts itself to any inequalities of the upper contact-plate, which is connected with the street stud or third rail. In the center of both upper and lower contact-plates are carbon contacts. The upper carbon contact has a free vertical movement of about ¼ in., and is guided by a hollow stud on the top plate. This allows it to act as an automatic secondary break. In ordinary street railway service

the contacts are 1½ ins. apart when the circuit is broken. The solenoid is excited by means of line current taken from the energizing set of studs referred to and shown in the general diagram or from the energizing half of the third rail.

When the magnet is energized the plunger is raised, bringing up the lower flange of the armature until it is within the magnetic field. In this way the forces on both the plunger and armature are in unison up to a certain point. After the solenoid reaches its neutral position in the center of the magnetic coil, the force on the armature is opposed to that on the solenoid. By this method a comparatively uniform magnetic pull is obtained throughout a large part of the movement, and it requires almost as much current to keep the circuit closer closed as to raise it. Where heavy currents are used a special form of split cup-shaped contact for the top of the plunger is used.

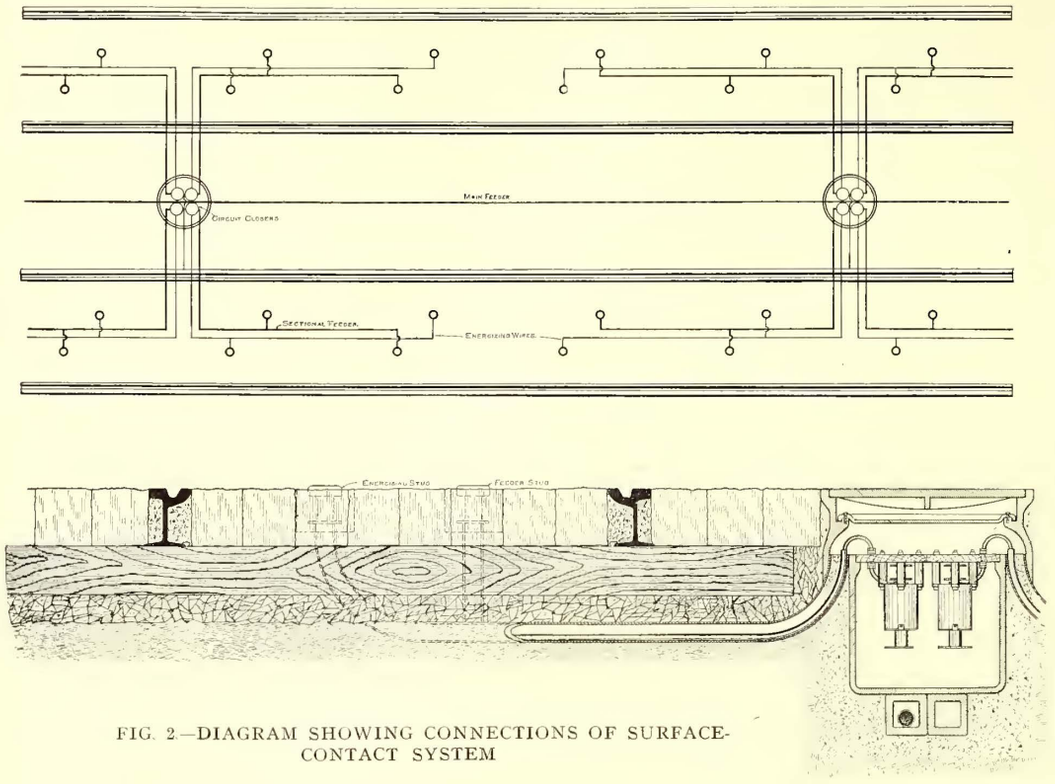


FIG. 2.—DIAGRAM SHOWING CONNECTIONS OF SURFACE-CONTACT SYSTEM

One of the special features claimed for the system is that there is no tendency for the solenoid to stick when there is a slight current due to surface leakage flowing through the magnet coil, for, as stated above, it requires almost the full current to hold it closed.

A working section of double track, about 1400 ft. in length, has been built at Aberdeen, Scotland, for experimental purposes. This has been successfully operated in various conditions of weather, and in no single instance has the circuit closer failed to work satisfactorily.

The company has also worked out a method for applying the same system to third-rail roads, using the same circuit closer and an overlapping twin third rail, both members of which are spanned by the collecting shoe on the car. In this way the third rail of an interurban road can be divided into sections of any convenient length, and only that section from which current is being taken for the operation of the train is alive.

The system is owned by the McElroy-Grunow Electric Railway Company, of Bridgeport, Conn.

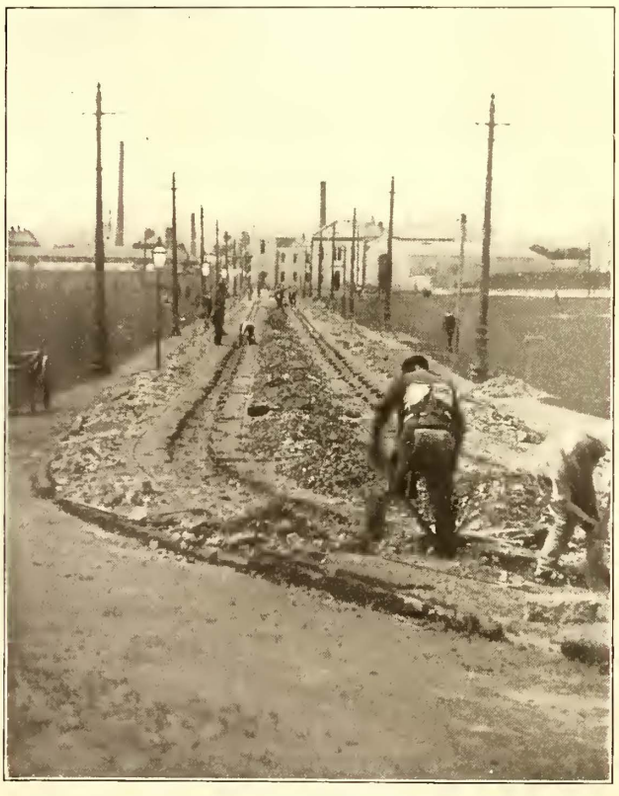


FIG. 3.—LAYING CONTACT SYSTEM IN ABERDEEN

CUTTING ICE BETWEEN RAILS

Manager F. E. Merrill, of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, believes that he has solved the difficult problem of preventing ice forming between the rails in the center of the track. During the severe weather of last month ice formed in considerable quantities at different points along the road, and on the night of Jan. 23 the large interurban cars had great difficulty in moving, on account of the solid hammocks of ice in the center of the track. In some places they were raised so high that the motor cases of some of the cars scraped in passing over them, and there was constant danger of the car being thrown off the track. Mr. Merrill had a car rigged up with a large, knife-shaped piece of iron plate, between the motors on the rear truck. This cutter projected 3 ins. over the rails on both sides, and was controlled from the car above, so that it could be raised and lowered at will, working on the plan of a road scraper. The car was first taken out on Saturday, Jan. 30, and the ice cutter worked satisfactorily. Mr. Merrill says the arrangement comprised the ideas of his men and himself and was not the idea entirely of any one man, but was worked out in the shops.

A muskrat was responsible for the complete suspension of traffic on the Springfield & Xenia Railway, of Xenia, Ohio, a few days ago. The rat was drawn in through the feed-water in-take, and the engineer had to shut down the power house. After about 12 hours work the pipe was cleared.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 10, 1904.

The Money Market

A slight change has come over the money market during the past two weeks, pointing toward a gradual raising of interest rates. The banks, which, a short time ago, were freely offering their funds on the long-term contracts at 4 per cent, are now restricting their offerings, and holding out for 4¼ per cent. Owing to the fact that demands for speculative purposes have been light, call money has not yet hardened. But it is to be remembered that when the tendency of rates is upward, it is always apt to appear first in the time money market before it appears in call money. The hardening of rates on time loans is directly due to the decrease in the surplus bank reserves, which, from the high point of the season, a fortnight ago, amounts to $4,200,000. This, in turn, has been caused chiefly by the winter's remarkable bank loan expansion, which has reached a larger total than for any corresponding period in previous years. The loan account now stands very close to the billion-dollar mark, and it is $46,000,000 larger than the high total of last year, which heretofore has been the record. Nothing in the present financial situation has attracted so much attention and such eager controversy as the circumstances which have produced this great inflation. Some critics insist that it is due almost entirely to the shouldering of credits formerly borne by the trust companies and out-of-town institutions, by the Clearing-House members, the argument being that the outside institutions find it more profitable with call money at 2 per cent to keep their funds on deposit. On the other hand it is well known that enormous sums have been borrowed during the last two months by the railroads, the principal transaction of the kind being the $50,000,000 loan announced last week by the Pennsylvania Company. In the cases where new securities have been issued against these borrowings, it is well known that they have not yet been sold, and that in consequence large sums of bank capital has been tied up and have necessarily been made to show in the loan item. We are inclined to the view that it is these corporate borrowings, rather than the shifting of credits, which is responsible chiefly for the recent enlargement of Clearing-House loans. On this assumption it is impossible to look upon the present money outlook optimistically. The season has now arrived when currency usually ceases to flow in the direction of this city. The interior markets will soon begin to prepare for the spring trade, and will draw upon their New York balances more or less heavily. At the same time, the abnormal demands for cotton financing are drawing money in considerable quantity to the South. Already the effect has begun to appear, last Saturday's bank statement showing a decrease of $2,500,000 in cash holdings. The Secretary of the Treasury has given notice that he will draw upon the banks for at least $30,000,000 of the total sum of $60,000,000 odd, which the government must pay for the Panama Canal. Whether or not this will lead to the export of gold, is a doubtful point, but it is at least certain that the operation will tend to diminish rather than increase local cash supplies. With the probability, therefore, of a considerable decline in cash holdings during the next two months, and with the loan account in its present shape, where liquidation cannot be easily effected, the chances are all in favor of a heavy reduction in surplus reserves with the inevitable tendency toward rising money rates.

The Stock Market

The stock market has gone through another severe experience during the last ten days. Prices have fallen heavily, and liquidation on a large scale has occurred through the entire list. Had there been nothing else than the conditions just described in the money market these would have undoubtedly sufficed to produce a fall in prices. The Stock Exchange, of course, foresees that should it become necessary to forcibly curtail bank credits the pressure would fall heaviest in their quarter. It is simply last year's situation over again, the alternative lying between forced liquidation of securities, which have a ready market, and those which cannot be easily sold, and the choice falling necessarily upon the marketable securities. Preparation for such a contingency is undoubtedly one of the main causes for the past week's decline in stocks. But the movement has been very much more violent than it would otherwise have been, owing to the presence of three extraordinary factors on the outside. One of these is the collapse in the speculation on the commodity markets, particularly in cotton, in the course of which enormous losses have been incurred by speculators actively identified with the stock market. The second is the outbreak of war between Russia and Japan, which although pretty well expected for several weeks past, has nevertheless been a severe blow to investment confidence. Finally, and worst of all, is the appalling disaster at Baltimore, the full consequences of which, at this writing, are still undetermined. Monday's collapse on the Stock Exchange was largely the result of this astounding news. Apprehension is gravely felt that this may mean the wholesale suspension of insurance companies, and that the enormous security holdings of these institutions will be pressed for sale upon the market. This fear may prove to have been greatly exaggerated, but it is certain that it was the real motive for the tremendous outpouring of stocks in Monday's Wall Street dealings. When the more immediate disturbances have subsided the market will be entitled to a fair recovery. But in the present pessimistic state of sentiment, it takes a very sanguine person to look for any permanent change for the better.

The downfall of speculative values has told more heavily against the traction stocks than any other quarter, because of the fact that these have been a favorite object of manipulation for the rise. A very large account in Brooklyn Rapid Transit has been hastily liquidated, the gossip being that many of the politicians who bought the stock around 50, have been forced out at a heavy loss. Rumors that the Brooklyn company were about to announce another sale of bonds contributed toward the decline, but there seems no reason to believe this is anything more than a story gotten up for speculative purposes. The statement of earnings for the December quarter, showing a fairly satisfactory increase over a year ago, attracted little attention. In both Manhattan and Metropolitan there has been some liquidation of speculative holdings, but the selling has been comparatively light, and both stocks seem to have been well taken on the decline.

Philadelphia

The traction stocks suffered comparatively little during the general slump in prices of the past week. The most that happened was a check upon speculative operations for a rise, which had begun to make headway in a few of the active specialties. Philadelphia Rapid Transit, which two weeks ago sold as high as 15¼, fell by gradual stages to 14. Union Traction declined a point from 48 to 47. Philadelphia Electric dropped from 6¼ to 5 13-16. American Railways declined from 45 to 44 bid, but no sales were reported at the lower figure. The only heavy liquidation occurred in Philadelphia Company shares, in which a fair-sized account for the rise was open. The common stock on active trading, broke from 42½ to its extreme low point of 38¾, reached in Monday's session; then it rallied to 39⅛. The preferred sold down a point from 46 to 45, and recovered to 45½. Philadelphia Traction held stubbornly at 97½. Other sales included United Traction of Pittsburg preferred at 49, Reading Traction (110 shares) at 30. Railways General at 1¼ and 2, and Consolidated Traction of New Jersey from 64 to 63½.

Chicago

Liquidation in some quarters of the Chicago market, at least, seems to have definitely ceased. This is particularly true of the Lake Street Elevated securities, which, since the successful completion of the reorganization plan, have been holding very steady, and of South Side Elevated stock which is being well taken around 93. Lake Street trust receipts sold a week ago as high as 2¾ but later reacted to 2¼. The strength in South Side shares is partly due to the excellent earnings statement recently submitted for November, which broke all records for the period. Although the increase in gross receipts is accounted for by what the road gained by the strike on the surface lines, and may therefore be temporary only, it is noteworthy that the November operation ratio—51 1-3 per cent—was the smallest in the history of the South Side system. It compares with an average ratio for the year 1903, of 59 per cent, with 58 per cent in 1902, and with 63 per cent in 1901. In contrast to the strength of these stocks, other parts of the traction list have shown renewed weakness. Metropolitan Elevated preferred, on intimations that dividends cannot be maintained, declined from 52 to 49½, which is a new low record figure. The common stock held comparatively steady at 17. One hundred shares of Northwestern Elevated common sold at 17. The surface line securities have all lost ground during the fortnight. North Chicago after selling as high as 73 for a small lot, dropped on sales of about 100 shares to

70. West Chicago rallied from 45 to 47, but fell back to 46. City Railway declined from 167½ to 165. Union Traction common was noticeably heavy at 5, and the preferred lost a half point from 30 to 29½.

Other Traction Securities

Realizing sales, owing to the unfavorable state of the general market, caused a decline in Massachusetts Electric issues, the common dropping from 22¼ to 20¾, and the preferred from 80¼ to 77½. West End common lost a point from 91 to 90, and the preferred suffered an equal loss from 109 to 108. Boston Elevated sold to the extent of a few hundred shares at 137, "ex" the dividend. Business has been suspended during the last two days in Baltimore, owing to the great fire. Previous to that time, decided strength was shown in the United Railways bonds, the incomes holding at 56½, and the general 4s at 92. The stock sold down from 8⅜ to 8, and back again to 8⅛. Other sales in Baltimore during the fortnight comprise City Passenger 5s at 106⅝, Lexington Street Railway 5s at 97, City & Suburban of Washington 5s at 95, Anacostia & Potomac 5s at 93¾, and Charleston Consolidated Street Railway 5s at 103. On the New York curb the feature was a sharp decline in Interborough Rapid Transit which naturally accompanied the weakness of the other local tractions on the Stock Exchange. It took 3700 shares to put Rapid Transit down from 108¾ to 107, 2000 shares to put it down to 104½, and 1000 more to carry it to the low level of 101½. After this there was a slight rally to 102¼. Nassau Electric 4s advanced from 79 to 80, but later reacted to 79½. Washington Traction 4s declined from 76⅝ to 76, while 300 shares of the preferred stock sold at 47. Chesapeake Traction 5s were bid up sharply to par. One hundred shares of American Light & Traction sold at 50, 150 United Railways of St. Louis preferred at 56½, and New Orleans 4½s at 80¼ to 80½. On the Stock Exchange, both Twin City Rapid Transit and North American lost all their recent gains in the general market 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	
	Jan. 26	Feb. 9
American Railways	44¼	44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	*136
Brooklyn Rapid Transit	49⅞	41
Chicago City	160	166
Chicago Union Traction (common)	5¼	5
Chicago Union Traction (preferred)	30	29
Cleveland Electric	70½	70½
Consolidated Traction of New Jersey	64	63
Consolidated Traction of New Jersey 5s	105½	105
Detroit United	65	59¾
Elgin, Aurora & Southern	a30	a30
Interborough Rapid Transit	107½	104½
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	2	2¼
Manhattan Railway	145	141½
Massachusetts Electric Cos. (common)	22¼	20½
Massachusetts Electric Cos. (preferred)	79	77
Metropolitan Elevated, Chicago (common)	17½	17
Metropolitan Elevated, Chicago (preferred)	52	49
Metropolitan Street	122¼	117⅜
Metropolitan Securities	89	84½
New Orleans Railways (common)	9¾	9
New Orleans Railways (preferred)	29	30
New Orleans Railways 4½s	a79½	80
North American	88½	83
Northern Ohio Traction & Light	15¼	14
Philadelphia Company (common)	42¼	39¼
Philadelphia Rapid Transit	†14⅞	13½
Philadelphia Traction	97⅝	97½
St. Louis Transit (common)	11½	5¾
South Side Elevated (Chicago)	92	92½
Third Avenue	121½	115
Twin City, Minneapolis (common)	94	89
Union Traction (Philadelphia)	47¾	46¼
United Railways, St. Louis (preferred)	52	50
West End (common)	90⅛	90½
West End (preferred)	108⅛	108½

a Asked. † Includes new $5 assessment.

Iron and Steel

According to all accounts the iron market has taken on a distinctly better tone during the last fortnight. The reports now are that the demand for steel is much more active than it has been for several months; a large business is being done in wire products, sheet steel and plates, and that a better inquiry has developed for structural material. There is some reflection of this naturally in the lower branches of the industry, where an increasing tonnage in pig iron is recorded. Nothing further is said of the situation in steel rails, but the predominant feeling here is that the mills must sooner or later make concessions. Quotations are as follows: Bessemer pig iron $13.50 to $13.75, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12¼ cents, tin 28¼ cents, lead 4 7-16 cents, and spelter 4⅞ cents.

THE BALTIMORE FIRE

A particularly distressing feature of the lamentable Baltimore fire is the destruction of the Pratt Street power station of the United Railways & Electric Company, from which the main street railway and lighting lines received current. The street car service has necessarily been greatly curtailed because of lack of power, and the lighting service has been even more seriously crippled. It is not thought that the curtailment of the street car service will materially hinder the work of salvage, but the cutting down of the lighting service is particularly unfortunate, because the work of policing the burned district at night will be rendered more difficult, not to mention the other inconveniences that will result from inadequate illumination.

From the information at hand as the Street Railway Journal goes to press, the Pratt Street plant is a complete loss. It was the largest of its kind in the city, and a model in design and construction. Built up from one of the smaller plants of one of the constituent companies of the United Railways, it was well located on tide-water front and near the theoretical load center of the system. The original building comprised the northerly wing of the completed plant and contained the direct-current apparatus. Adjoining this on the west was the boiler house. The southerly wing housed the alternating-current machinery. The boiler house, which supplied steam to the engines in the new addition, was erected between the site of the new annex and the old plant. The outlying districts were supplied by high-tension distribution from the alternating-current plant, while the suburban lines in the northwest and western sections of the city were furnished with current from the same source through two sub-stations.

ELECTRIC RAILWAY PROJECTS IN VENEZUELA

The conversion into electric motive power of a number of steam and horse car lines operating in Venezuela is being contemplated. The most important project refers to the proposed change of power on the steam railroad system which runs between La Guaira, the port of Caracas, and Caracas, the capital city of Venezuela. The road is operated by La Guiara Railroad Company, of which Harry J. Almond is general manager, and whose head offices are in London. It is a 36-in. gage line, 26 miles in length. Power is to be derived from an hydraulic plant, there being considerable water power available in the vicinity.

There is also a proposition on foot to develop power at Juan Diaz, where there is a water fall capable of developing 5000-hp. The power will be largely utilized to operate the Macuto & Maiquetilla Street Railway, which is to be extended along the seashore to La Guaira, making about 15 miles in all.

The horse car lines in Maracaibo, about 15 miles long, are also to be converted into electric traction. The change into electric motive power of the horse car lines of the Compania Anonima Tranvias Bolivar (the Bolivar Tramways Company), and the Tranvias de Caracas (the Caracas Tramways), aggregating 12 miles, is also being considered.

Carlos G. Palacios, the chief engineer of the electrical department of the Caracas Gas & Electric Light Company, is now in the States for the purpose of investigating the latest electric traction and power systems. Mr. Palacios, some twenty years ago, was connected with the old United States Electrical Company, of Newark, N. J., and has been the pioneer introducer of Yankee electrical equipment into Venezuela. He will be here for about three weeks, and can be found at the offices in the Orient Building, 79-81 Wall Street, of the export commission house of Kates & Bok.

ANNUAL REPORT OF THE TWIN CITY RAPID TRANSIT COMPANY

The reports of President Thomas Lowry, of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, are usually full of interesting facts regarding the condition of that prosperous company, and this year's review is no exception. It is given here in full:

Minneapolis, Jan. 21, 1904.

To the Stockholders:

The increased travel of the Twin City Rapid Transit Company predicted in our last report has been more than verified, and the growth of St. Paul and Minneapolis has proved the necessity of providing additional power, as stated in the report of 1902.

NEW POWER PLANT

The work on our new steam power plant is rapidly nearing completion. This building is located near our present water power plant, and is 156 ft. x 255 ft. x 86 ft. high, with heavy limestone foundations and brick superstructure. The floors, roof and coal bunkers are a combination of steel and concrete, and the building is entirely fireproof.

This building will contain three engine and generator units of 27,000-hp. maximum capacity; boilers and stokers of 30,000-hp. maximum capacity; coal bunkers of 3000 tons capacity with a complete equipment of condensers, heaters, pumps and auxiliaries.

The plans allow an increase in the total equipment to five engine and generator units of 45,000-hp. maximum total capacity and 24 boiler units of 40,000-hp. maximum total capacity.

Work on the two sub-stations and office buildings in Minneapolis and St. Paul is nearing completion. Both buildings are located near the business district of the two cities and are constructed of pressed brick, terra cotta trimmings, roof and floors of steel and concrete, and entirely fireproof. The Minneapolis building being three stories in height with dimensions 80 ft. x 150 ft., and 56 ft. high, and the St. Paul building being two stories, with dimensions 80 ft. x 150 ft., 44 ft. high.

Each sub-station will contain three rotary convertor units of 9600-hp maximum total capacity, and the buildings will allow for an increase of 100 per cent. The present equipment of rotaries will be rearranged, four of the units being installed in the present water power station, two in a sub-station located in the Midway district and two in a sub-station on the Stillwater interurban line.

The steam power house will be connected with these sub-stations by a complete system of underground conduits, cables and overhead transmission lines, sufficient cables being installed at present for the present capacity of stations, and the conduits are sufficient for the ultimate capacity of the stations.

CARS AND TRAFFIC IN BAD WEATHER

The company builds its own cars, and has adopted a standard car 45 ft. 2 ins. in length, with four motors, 40-hp capacity each, and air brakes. For interurban lines the seats are similar to passenger cars on steam roads, and on local lines the cars have half cross and half longitudinal seats, each car having a seating capacity of fifty-two persons. They can be changed from open to closed cars in five minutes, and greatly increase our earnings by being able to follow any change in the weather.

On stormy days in summer, previous to adopting these cars, when operating open equipment, receipts would drop from 25 to 30 per cent, but with the standard cars now in operation, earnings on such days have largely increased.

During the period from 1893 to 1897, the style of our equipment was 18 ft. and 22 ft. open and closed motors, with trailers converted from old horse cars.

The following table shows the difference in earnings between summer and winter months to be $614,398.80:

		Per cent
1893-1897—April, May June, July, August and September	$5,367,837.80	53.03
1893-1897—October, November, December, January, February, March	4,753,439.00	46.97
	$10,121,276.80	100.00

In the spring of 1897 we introduced the large cars and have gradually replaced the small equipment. A similar table to the above, for the years from 1898 to 1902, inclusive, shows winter earnings in excess of summer, $3,702.60:

		Per cent
1898-1902—April, May, June, July, August and September	$7,299,987.45	49.99
1898-1902—October, November, December, January, February, March	7,303,780.05	50.01
	$14,603,767.50	100.00

EXTENSIONS

Many new extensions and improvements will be made as soon as possible, among which are the following:

The Marshall Avenue line in St. Paul will be extended across the Mississippi River on Lake Street and connect with Cedar Avenue and across Thirty-first Street in Minneapolis, which completes a third interurban between St. Paul and Minneapolis, and will extend across the city of Minneapolis to connect with Lake Harriet, giving the residents of St. Paul direct connection with the beautiful lakes of Harriet and Calhoun, an important part of the Minneapolis park system. In the near future it will extend to Lake Minnetonka, the largest summer resort in the Northwest. The Minnehaha line in Minneapolis will be extended about 3 miles to Fort Snelling, making a connection with St. Paul, and complete a fourth interurban between the two cities. The government has within the last two years expended large sums of money in improving Fort Snelling, and has under contract large improvements for the coming year. It will be one of the six large permanent forts in the United States.

An extension will be made to South St. Paul, where are established the large packing industries; one to White Bear Village, a popular summer resort; one to South Stillwater, a manufacturing point, and another to Lake Phalen, in St. Paul, which is part of the St. Paul park system. These are all short extensions, and would have been built long ago if the company had had sufficient power for their operation. They will all be attractive to excursionists and have sufficient regular travel to make them more than self-sustaining the entire year.

GROWTH OF BUSINESS

The growth of business has been most satisfactory, gross and net earnings having more than doubled in the period between 1897 and 1903, as will be seen by the following comparative statement:

	Gross Earnings	Net Earnings
1897	$2,009,121	$1,007,041
1898	2,170,716	1,151,324
1899	2,522,794	1,365,821
1900	2,839,356	1,534,667
1901	3,173,976	1,758,524
1902	3,612,211	1,982,041
1903	4,063,938	2,185,888

NEW BOND ISSUE

A joint mortgage has been issued by the Minneapolis Street Railway Company and the St. Paul City Railway Company, providing for an issue of twenty-five-year 5 per cent gold bonds not to exceed $10,000,000—$1,000,000 of said bonds are reserved to retire a like amount of joint bonds of said companies maturing in 1911; $3,500,000 to pay for the new power plant, sub-stations, electric equipment, conduits and other requirements, new shops and fifty new large double-truck cars. The remaining $5,500,000 of bonds under this mortgage are to be issued for future extensions and improvements of 90 per cent of the cash cost of the same.

The Minneapolis Street Railway Company and the St. Paul City Railway Company are the two most important of the underlying companies of the Twin City Rapid Transit Company, and operate under franchises and ordinances which are unusually valuable and liberal in their provisions. They own all the street railways in the cities of Minneapolis and St. Paul. The fares are irrevocably fixed at 5 cents in each city. It also operates a line from St. Paul to North St. Paul, to Wildwood on White Bear Lake, and to Stillwater—a distance of about 20 miles—and all the lines in Stillwater, a city of about 14,000 inhabitants.

The properties of the company have been maintained in excellent physical condition and substantial improvements and betterments have been made each year, the cost of which has been met largely out of the current revenues. With the completion of the new power plant, the additional equipment and the other improvements provided by the sale of these bonds, the revenue earning power of the company will be considerably increased, further economies in operation will be developed and the physical condition of the properties will be unequaled by any other street railway system in the country.

Former reports of this company have shown a large surplus. The 1901 report shows $2,700,284.86, and the 1902 report $2,991,346.01 This is, in a sense, misleading, as it does not represent actual cash surplus on hand, but shows surplus earned over operating expenses, interest charges and dividends, but expended in betterments and improvements. We have, therefore, transferred former surplus to roadway, equipment, etc., and surplus appearing in future reports will mean cash on hand or its equivalent.

The gross earnings for the fiscal year ending Dec. 31, 1903, show an increase of 12.51 per cent over the previous year, and 10.28 per cent net over same period with same mileage. The operating expenses including taxes and all charges, except interest and dividends, were 50.36 per cent of the gross, as against 49.30 per cent for

the preceding year. Twenty thousand dollars ($20,000) 7 per cent bonds of the Minneapolis Street Railway Company were cancelled May 1, 1902, and twenty thousand dollars ($20,00) May 1, 1903, and in lieu thereof $39,000 consolidated bonds of the Minneapolis Street Railway Company were issued.

We have paid four dividends of 1¼ per cent on the common stock and four dividends of 1¾ per cent on the preferred stock leaving a net surplus of $419,296.97, which has been expended in betterments.

The company has expended during the year $2,216,810.43 for power plants, cars and new paving construction, distributed as follows:

Paving, St. Paul	$306,052.74	
Paving, Minneapolis	285,732.98	
		$591,785.72
New Power plants		1,273,252.68
Car equipment—		
Forty-two cars complete, four motors and air brakes	$309,294.03	
One hundred and thirty-four additional air brake equipments	42,478.00	
		351,772.03
Total		$2,216,810.43

The following is a comparative statement of the liabilities of the company Dec. 31, 1902, with Dec. 31, 1903:

	1902	1903
Total common stock issued	$16,511,000	$16,511,000
Total preferred stock	3,000,000	3,000,000
Funded debt	10,868,000	12,637,000
	$30,379,000	$32,148,000

Respectfully submitted,

Thomas Lowry,
President.

In addition to the foregoing report a number of statements are submitted on receipts, and other matters which will also be found equally interesting. They are therefore appended herewith:

MONTHLY STATEMENT OF GROSS EARNINGS, 1903

	Passenger earnings	Miscellaneous earnings	Total earnings
January	$310,084.50	$1,753.35	$311,837.85
February	280,946.75	1,654.07	282,600.82
March	317,838.70	1,717.65	319,556.35
April	315,464.50	1,713.99	317,178.49
May	337,698.70	2,036.58	339,735.28
June	346,018.15	1,726.45	347,744.60
July	362,702.05	1,769.15	364,471.20
August	363,579.10	1,887.13	365,466.23
September	370,348.75	1,903.53	372,252.28
October	346,673.10	1,973.07	348,646.17
November	333,423.60	1,841.07	335,265.57
December	357,451.70	1,731.85	359,183.55
Total	$4,042,229.60	$21,708.79	$4,063,938.39

RECEIPTS

Passenger earnings	$4,042,229.60
Miscellaneous earnings	21,708.79
Total earnings	$4,063,938.39

EXPENSES

Maintenance of way and structures	$117,535.95
Maintenance of equipment	211,297.54
Operation of power plants	331,281.21
Car service	825,462.16
General expense	165,675.02
Legal expense	22,999.90
Injuries and damages	162,694.52
Insurance	41,104.20
Total operating	$1,878,050.50
Net earnings from operation	$2,185,887.89
Interest on debt and taxes	$731,040.92
Surplus applicable to dividends	$1,454,846.97
Dividends, preferred stock	$210,000.00
Dividends, common stock	825,550.00
Total dividends	$1,035,550.00
Surplus used for betterments and new construction	$419,296.97
Per cent total operating (including taxes) to total earnings	50.36

TRACK MILEAGE AND PASSENGER EARNINGS, PER MILE

Total miles single track	38.57
Total miles double track	97.53
Total miles special track	18.98
Total miles all track reduced to single	252.61
Total miles street occupied by tracks	139.31
Gross passenger earnings per mile single track	$16,001.86
Gross passenger earnings, per mile street occupied by single track	29,016.08
Gross passenger earnings	4,042,229.60

STATISTICAL STATEMENT

	1903	1902	1901
Gross earnings	$4,063,938.39	$3,612,210.88	$3,173,975.85
Operating expenses	1,878,050.50	1,630,169.54	1,415,451.70
Net earnings	2,185,887.89	1,982,041.34	1,758,524.15
Revenue passengers carried	80,844,592	71,830,971	63,009,957
Transfers redeemed	20,429,043	17,789,105	15,587,858
Operating per cent earnings	50.36	49.30	48.35
Per cent on preferred stock earned & paid	7.00	7.00	7.00
Per cent on common stock earned	7.54	7.06	5.87
Per cent on common stock paid	5.00	5.00	4.00
	1900	1899	1898
Gross earnings	$2,830,355.78	$2,522,793.85	$2,170,716.01
Operating expenses	1,304,689.11	1,156,972.37	1,019,392.14
Net earnings	1,534,666.67	1,365,821.48	1,151,323.87
Revenue passengers carried	56,284,102	49,526,845	42,901,859
Transfers redeemed	13,909,535	12,983,112	10,602,078
Operating per cent earnings	49.16	48.71	49.92
Per cent on preferred stock earned & paid	7.00	7.00	7.00
Per cent on common stock earned	4.70	3.66	2.49
Per cent on common stock paid	3.00	2.50	...

CLOSED THEATERS INJURE CHICAGO TRAFFIC

The closing of the theaters in Chicago, pending extensive improvements, suggested by the Iroquois Theater fire, has naturally resulted in considerable loss of revenue to Chicago transportation lines during the month of January. The reports of the elevated railroads of Chicago for January show that these roads had a great part of their natural increase of traffic wiped out by the closing of the theaters, and the very cold weather which prevailed during that month.

The daily average of passengers carried on the Northwestern Elevated during January was 70,204, or 2.86 per cent increase over last year. The Metropolitan Elevated carried 112,413 daily, a decrease of .31 per cent. The South Side Elevated carried a daily average of 87,601 passengers, an increase of 1.11 per cent.

ANOTHER WESTERN COMPANY ABANDONS STEAM

J. J. Burns, who was connected with the Chicago & South Shore Electric Railway, has become associated with Simon Bamberger in the Salt Lake & Ogden Railroad, and together they have worked out extensive plans for the extension and rehabilitation of the latter road. In addition to building an extension of the line from Farmington to Ogden, Utah, it is proposed to abandon steam as a motive power on the line already in operation, and equip the entire system for operation by electricity. This will call for an expenditure of about $115,000 on a power station, which will be erected at Farmington or Coleville, and not less than $100,000 on passenger coaches. In order to provide for these improvements, the capital stock of the company will be increased from $800,000 to $1,000,000, and $1,000,000 of bonds will be sold. The plan of campaign as laid out for the extension of the line calls for the work of construction to begin at once. The extension from Farmington to Kaysville is to be completed by April, and the entire line is to be finished and equipped as far as Ogden within eighteen months. The extension will be laid with 60-lb. rails. The policy heretofore maintained by Mr. Bamberger, of keeping his right of way on private ground, and well fenced, will be adhered to; this, of course, will permit of a very fast schedule.

CHICAGO CREATES TRANSPORTATION BUREAU

The Chicago City Council on Feb. 1 adopted an ordinance creating a transportation bureau which will have direct supervision of all matters pertaining to local transportation service. The ordinance provides for appointment by the mayor of a local transportation expert as head of the department, to hold office two years. His assistants shall be civil service employees, with the exception of an attorney. It is provided that this attorney shall be assigned to the department from the corporation counsel's office and shall have charge of all suits and legal work of the department. He is expected to give advice regarding the powers of the head of the department to enforce provisions of the ordinances referring to the street car corporations and the exercise of police powers for the efficiency of the service desired from the companies. If deemed advisable an expert engineer will be added to give advice and information for the department and the committee of the council.

NINETY-NINE YEAR FRANCHISE RIGHTS ATTACKED

The most sensational proceeding in the Chicago traction litigation, involving the franchises of the Union Traction system, was the attitude taken by the city on Feb. 1 when it presented its case in legal form. The principal contentions of the city are:

1. That in amending original incorporation act of 1859 the ninety-nine-year act does not refer to section authorizing the organization of the North Chicago City Railway Company; hence the rights of North Side Company in streets expired in 1884.
2. That the receivership proceeding was collusive and that Judge Grosscup has no jurisdiction because creditors are residents of Illinois.
3. That receivers' claims of rights under the ninety-nine-year act are reckless and dishonest.
4. That the traction interests have failed to give adequate service.
5. That the capitalization of traction interests and floating debts aggregate $96,000,000, and that the present cash value of the tangible property does not exceed $23,000,000.
6. That the traction companies have promoted infamous legislation.

The contention of the city that all the franchises ever held by the North Chicago Railway Company expired in 1884 is based on the ground that it was organized under section 10 of the act of Feb. 14, 1859, and that this section was never amended. The act of 1859 specifically limited the duration of the franchises granted the Chicago City Railway Company to twenty-five years. Later this act, together with that of 1861, which incorporated the Chicago West Division Railway Company, was amended by what is commonly known as the ninety-nine-year act. This act, passed in 1865, amended only sections 1, 2, 4 and 5 of the two acts. As the North Chicago City Railway Company was incorporated under section 10 of the act of 1859, the contention is that the act, in so far as it applied to the charter, was unamended, and that the privileges of the company expired in 1884. If this contention is upheld the Chicago Union Traction Company, which acquired its right to the north side lines from the North Chicago City Railway Company in 1899, is now operating its lines on the north side illegally, according to the city's legal advisers.

This claim affects nearly all the trunk lines on the north side and several of the cross-town lines. It is set out in section 33 of the answer that it is the intention of the city immediately to take legal steps to prevent the operation of these lines unless restrained from so doing by an order of the courts..

While the attorneys for the city declare that the discovery made by David T. Watson, the Pittsburg attorney called in the case, effectually disposes of the claim of the North Chicago Railway Company and the Chicago Union Traction Company to rights or privileges under the ninety-nine-year act, they admit that the discovery does not effect the lines of the Chicago West Division Railway Company now being operated under the management of the Chicago Union Traction Company.

Against the claims that the franchises of all the underlying lines of the Chicago Union Traction Company were extended by the act of 1865, however, the claim is made that this act is unconstitutional.

THE BEGINNING OF THE NINETY-NINE YEAR ACT CASE IN CHICAGO

The attorneys for the City of Chicago have filed their answer to the bills of the Chicago Union Traction Company in the Federal Court. This bill points out that the act of the Legislature known as the ninety-nine-year act, extending the charters of the various street railway companies of Chicago in 1865, omitted to mention the name of the North Chicago City Railway Company, which at that time held the North Side franchises. It is maintained in the bill that the North Chicago City Railway Company, therefore, went out of existence by virtue of the expiration of its charter in 1884. The city therefore denies that these North Side franchises existed longer than the life of the company. These North Side franchises were granted in 1859 for a period of twenty-five years. The validity of the ninety-nine-year act of 1865, as far as it relates to extending the life of the franchises of the other companies is questioned, because, in the old State Constitution, which was in force in 1865, there was a clause that "no private or local law passed by the General Assembly shall embrace more than one subject, and that shall be expressed in the title." As the future extension of the traction system was not brought out in the title, the city's lawyers believe that this part of the law is invalid. The answer further attacks the good faith of the Guarantee Trust Company, of New York, in applying for a receiver for the Chicago Union Traction Company, and maintains further that Judge Grosscup is without jurisdiction in the case because the suit does not involve a case within the jurisdiction of the United States Court. It is denied that the companies had any right to construct or operate any systems beyond the limits of the city as defined when the charters were granted.

Judge Grosscup has set March 1 as the day to begin the hearing of the arguments in the case. The city's bill is a voluminous document accompanied with maps showing the different franchise grants. It was prepared by David T. Watson, of Pittsburg, Edwin Burritt Smith and John C. Mathis, of Chicago, assisted by Corporation Counsel Tolman of Chicago.

THE TRIALS OF THE TOLEDO COMPANY DURING THE FLOODS

The system of the Toledo Railways & Light Company was twice tied up as the result of the recent high water, although the worst of the flood was passed through without a shut-down. The fight made against the elements by the company's officials and employees was a most remarkable one. For nearly two weeks the contest was carried on, and then the plant was forced to shut down through a rather strange cause—the lack of water. The plant is located immediately adjoining the Maumee River, and when the flood was at its worst the water in the boiler room was within a few inches of putting out the fires. Owing to a gorge in the river, this level was maintained for several days. The condensers located in the basement were flooded, and it was necessary to shut them down. The automatic oiling system was also thrown out of service through the flooding of pumps, and tanks and all machinery had to be oiled by hand. The fly wheel pits of the large, direct-connected units were filled with water, and streams were sprayed through the engine room as a result.

One of the greatest difficulties was the removal of the ashes from the pits below the boilers, which were filled with water. Holes were broken through the basement floor and divers employed to rake out the ashes. No attempt was made to get the ashes out of the building, and for five days the ashes from 200 tons of coal per day accumulated on the basement floor. The hot ashes falling into the water caused blinding clouds of steam which rendered movements dangerous. One man was severely scalded by the explosion caused by a hot clinker falling near him. An exhaust pipe burst under water which added to the steam, and as it was an essential part of the system it could not be shut down. The insulation on certain cables which were carried through conduits became soaked, causing a pyrotechnic display that was brilliant in the extreme, but dangerous. Finally a number of lines had to be shut down.

A number of the current transformers in the basement were flooded, which necessitated shutting down many of the lighting circuits. The coal conveyor system was put out of service early in the trouble and fueling had to be done by hand. Switches into the yard were cut off, and for days nearly 100 men were kept busy wheeling fuel across a temporary bridge erected over the flooded street.

The first shut-down of the street railway system was caused by the railroad company delivering coal of such poor quality that steam could not be raised. After the high water had receded and the troubles seemed practically over, a second shut down was caused by the bursting of the water main supplying the station. Under ordinary conditions the station takes water from the river, but the high water disabled the feed-water pumps, so the breaking of the city main left the station without water, but with water all around it.

For parts of two days the people of Toledo walked or rode in cabs.

cabs. All the interurban lines were forced to leave their passengers at the city limits, and the mail and freight delivery throughout a large territory was interfered with. General Manager L. E. Beilstein, Superintendent E. J. Bechtel and Chief Engineer Wm. Long were on duty almost constantly during the two weeks, and for a number of days the superintendent and engineer did not leave the power station.

GRANT TO THE NEW YORK, WESTCHESTER & BOSTON COMPANY

After debating the proposition for more than three hours the Board of Aldermen of New York, on Feb. 9, by a vote of 54 to 14, granted the application of the New York, Westchester & Boston Railroad Company for permission to cross sixty-eight streets in the Borough of the Bronx in the construction of its road, defeating at the same time the application of the New York & Port Chester Railway Company for a like grant. This ends, as far as the Board of Aldermen is concerned, the fight that has been waged during the past two years by the New York & Port Chester Company to get the necessary grant.

Both companies plan to build four-track, third-rail electric railways from New York to Port Chester. The New York & Port Chester Company was opposed in its application to the State for a certificate of necessity by the New York, New Haven & Hartford Railroad, whose lines it will parallel. Its ability to carry out its plans was proved to the satisfaction of the State Railroad Commission and the Supreme Court. The New York, Port Chester & Boston Company has recently come into prominence after having passed through a receivership in 1875. Of its real backers nothing further is known than that Dick & Robinson, prominent New York financiers, have agreed to finance the company after certain rights are secured.

TRAMWAY ACCIDENT IN AUCKLAND, NEW ZEALAND

On the night of Dec. 25 a very serious collision occurred between a double-deck and combination car on the Auckland, New Zealand, electric tramways, near Kingsland. The double-decker was climbing a heavy grade and passed into a loop to await another car. The current was shut off, but the ratchet brake refused to work and the car dashed down the long incline at headlong speed with all lights out, except a couple of oil lamps. As it rounded a bend, the car crashed into a combination car, causing the death of three persons and the severe injury of several others.

The coroner's jury, in returning its verdict, found that the collision might have been avoided if the emergency brakes had been applied by the motorman of the double-decker. It recommended that life-guards be placed on all cars, and that double-deck cars should be discontinued in and about Auckland, owing to the many severe grades in that vicinity.

PURCHASED A COAL MINE

The annual report of President Everett, of the Northern Ohio Traction & Light Company, developed the fact that the company recently purchased 1011 acres of coal lands in Noble County, Ohio, at a cost of $38,000. The property was purchased as an investment, and insures the company against any shortage or advance in the cost of fuel. At the Akron power house the company has erected a coal-storage house, capable of holding 2500 tons. An overhead trestle permits the use of bottom-dump cars. During the year the company added a 1000-hp engine and a 500-kw generator to its equipment; erected a $50,000 trestle which eliminates a number of dangerous curves and reduces the power necessary to operate this portion of the line; reballasted and laid new ties over a considerable portion of the line; made a cut-off over 2½ miles of private right of way, besides making a number of other improvements. The gross earnings of the property show a gain of 18.4 per cent, while the per cent of operating expenses to gross earnings was reduced four-tenths per cent. In view of the improvements, it is expected the property will show even a larger gain this year.

Arrangements have been made with a Norwalk caterer to board through Cleveland-Toledo cars at meal hours and sell prepared lunches to passengers. Tables are provided in the cars, if desired, and the man in charge rides down the road until he meets the next car. In this way cars are not delayed. The service is much appreciated.

CHANGES IN THE CONSOLIDATED CAR HEATING CO.

The Consolidated Car-Heating Company's New York offices will, after March 1, be in the new office building at 42 Broadway, Rooms 1747-49.

The company has recently made the following changes in its sales department: Cornell S. Hawley, general Eastern agent, to be general sales agent, with headquarters in New York; S. B. Keys, of the New York office, to be Eastern representative with headquarters in New York, and W. S. Hammond, Jr., of the Denver office, to be Western representative, with headquarters in Chicago.

TO HAVE NEW YORK CITY BUILD ELEVATED STRUCTURE CONNECTING THE BRIDGES

A director of the Brooklyn Rapid Transit Company is quoted as having said that the company, as a solution of the rapid transit problem, will, if the city build an elevated railroad structure, connecting the Manhattan ends of the Brooklyn and Williamsburg bridges, lease the structure and operate a system of belt line trains. The company owns all the elevated structures in Brooklyn, and with the Manhattan link would connect with those on the other side so as to form an unbroken circuit through Manhattan, Brooklyn and Williamsburg and over the bridges.

The plan would be to run continuous trains on this circuit in opposite directions, transferring passengers at any point in Brooklyn to its own system without an extra fare.

In Manhattan the line would run from Delancey Street down the east side of the Bowery, with frequent stations, so that passengers would be able to walk in two minutes to almost any place in the lower business section of Manhattan. Thus people would be able to get from home to business with one fare. According to this plan the Brooklyn lines to be used in the belt would be the Myrtle Avenue and Broadway Elevated. One great advantage of the plan would be that passengers would board the Brooklyn cars all along the line from Delancey Street to the Bowery on both sides of the street, because, no matter in which direction the train was running, they would have about the same distance to ride to their homes. A free transfer between surface and elevated lines would be a feature of the plan.

IMPROVEMENTS BY THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

President John I. Beggs, of the Milwaukee Electric Railway & Light Company, has outlined improvements to be made to the system during 1904 that will call for an expenditure of about $2,000,000. A general office, central car barn and terminal station is to be erected at Third and Sycamore Streets. An addition is to be built to the Commerce Street power house and the interurban line is to be extended from Hale's Corners to Muskego Lake. A new line is to be built to Wauwatoso and West Allis, and double tracks are to be laid in a number of places where, at present, there is a single track. To provide for the increase in passenger traffic, fifty new cars are to be placed in operation on the city lines, and twenty new trailers are to be added to the interurban equipment. The construction of the northern half of the Commerce Street power house is to be resumed soon. Ten thousand horse power was installed there last year, and 15,000 hp is to be added during the present season. It is thought that it will require about fifteen months to complete the general office building and the central car house.

STANDARD FORM OF OPERATING REPORT

Secretary Brockway of the Street Railway Accountants' Association, and Elmer White, committee of blanks and forms, have just published a pamphlet containing the standard form of report for electric railways as approved by the Street Railway Accountants' Association at Detroit, in October, 1902, and as adopted by the National Association of Railroad Commissioners at Portland, Me., on July 6, 1903, subject to such modifications as the requirements of individual States may make advisable. This pamphlet has been published in conformity with the decision of the association as adopted at the Saratoga meeting, and copies have been mailed to each commissioner of the various State boards, to the Interstate Commerce Commission, and to each member of the Accountants' Association. The pamphlet, being 11 ins. x 9 ins., shows the form to much better advantage than given in the report of the Accountants' Association, and will prove a great convenience to members of the association.

TO RELIEVE BRIDGE CROWDS IN NEW YORK

Bridge Commissioner Best, of New York, says that of the many plans considered by him during the last month for the relief of congested conditions at the Brooklyn Bridge, three seem worthy of special notice and will be laid before the Board of Estimate and Apportionment within the next two weeks. The Commissioner refuses to go into details about any of the plans, except to say that they will probably be perfected and laid before the public on or about March 1. However, it is generally understood that the best-liked plan, which is believed to have the support of Chief Engineer O. F. Nichols, is a revision of the old Martin plan of constructing an elevated track up Centre Street, so that the elevated bridge trains could go up that way, and then follow the Delancey Street extension to the Williamsburg Bridge. By taking this plan and effecting connections on the Brooklyn side, a belt line would be effected, and with cars and trains running in both directions, it is believed that ample transportation facilites could be afforded for all Brooklyn residents. The plan has been laid before the Mayor in a general way, and will have to come before the Board of Estimate and Apportionment, because of the amount of money involved.

THE TROLLEY IN THE ADIRONDACKS

From Paul Smith's comes the report that plans are under consideration for the construction of an electric railway to connect Upper St. Regis Lake and Lake Clear with Paul Smith's. This means that the electric railway soon is to encroach upon the sacred domain of the hunter and camper. Power for the proposed road will be taken from Franklin Falls, in the Saranac River, 20 miles away. It is understood that the plans provide for the connection of Saranac Lake with all the villages thereabouts, as well as with Utica.

PLAN TO COMPEL USE OF DOUBLE TROLLEY IN RICHMOND

So threatening has the attitude of the City Council of Richmond toward the Virginia Passenger & Power Company become that the company has ordered the suspension of all work on improvements until it is definitely learned whether the attempt to usurp the rights of the company will be carried out. It seems that the differences between the city and the company have been caused by the threatened action of the City Council to require the company to install a combined double overhead trolley, and the underground conduit system, in order to prevent damage to the city water system by electrolysis. It seems that immediately after Mr. Gould and his associates assumed control of the Richmond properties they looked into the question of electrolysis, which was then being discussed by the city. In their interest they had a thorough examination of the system made by experts, and adopted recommendations of these experts.

S. W. Huff, general manager of the company, has recently sent to the city a letter, in which the position of the company is clearly defined. Mr. Huff calls attention to the measures adopted to minimize the damages of the escaping return current, and says that the company stands ready, as in the past, to compensate the city whenever specific damages are proved. To the refusal of the city, to give the company an opportunity to prove the value of the means it has adopted to correct the evil, Mr. Huff says:

> These companies must decline to submit to what seems to them an unjust demand, but they still stand ready to meet the city on any equitable plan. We regret very much that the committee has not seen fit to receive and consider the report of the result of the work done by these companies for the city's protection in the matter of electrolysis, which report was offered under date of Oct. 15, 1903, and we feel sure that a careful examination would satisfy you that this cure has been complete and permanent, and we believe that, with this feature settled, the adjustment of damages could be approached by both sides with better prospects for an amicable settlement.

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 JAN. 26, 1904

750,247. Mono-Railway and Truck Therefor; Lina Beecher, Batavia, N. Y. App. filed March 6, 1903. The truck has two grooved traction wheels in alignment with each other, and guard wheels suspended from the truck and arranged to bear upward against their tracks, their bearing portion having rubber tires.

750,261. Brake for Vehicles; William H. Cooley, Brockport, N. Y. App. filed Dec. 9, 1902. In a combined electrical hand brake, an operating-handle and means controlled by the tension applied to the braking apparatus, whereby, when the handle has reached a point in its course, where a predetermined braking effort is applied by the hand-operated mechanism, a breaking effort is also applied by the electrically-operated mechanism.

750,368. Trolley for Electric Railway Cars; Charles J. Johnson, St. Louis, Mo. App. filed May 14, 1903. Details.

750,387. Bogie or Truck for Tramway-Cars, Railway-Carriages, or the Like; Andrew S. Nelson, Albert Stewart and Thomas J. Foster, Motherwell, Scotland. App. filed July 7, 1902. Details of construction.

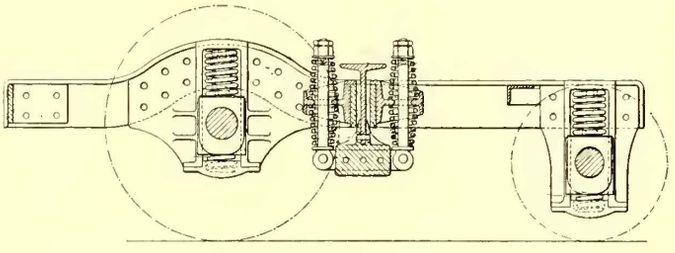
750,396. Convertible Vehicle; Hermann Romünder, Bloomsbury, N. J. App. filed Feb. 24, 1903. The movable side sections are composed of a rigid curved window-sash and a flexible panel, which consists of a number of wood-veneer plates connected together by a number of horizontal slats, so arranged as to leave air spaces between the slats on the inside of the plates.

750,421. Electric Brake; George C. Anthon, Medford, Mass. App. filed Nov. 30, 1901. Consists of a liquid or fluid lock and release for the brakes and means for controlling the same; also in certain improvements in electro-magnetic clutches by which a brake-winding drum is brought into frictional engagement with a driven axle.

750,422. Electric Brake; George C. Anthon, Medford, Mass. App. filed April 11, 1902. A storage battery, charged by the line current, actuates the brakes; provision also for operating the brakes direct from the line.

750,434. Electric Brake; Perley P. Crafts, Boston, Mass. App. filed Nov. 29, 1899. A braking device consisting of a magnet operating the brake, a controlling-switch admitting line current to the magnet, an emergency braking device, consisting of a switch controlling the motor circuits and a disabling device for the latter switch controlled by the line current.

750,458. Overhead Trolley Attachment; Charles Holyland, Sr., Pittsburg, Pa. App. filed June 6, 1903. A trolley harp attachment for retaining the wheel upon the wire.



PATENT NO. 750,387

750,719. Car Fender; Emile Sprich, St. Louis, Mo. App. filed Aug. 28, 1903. Consists of two horizontally-adjustable, telescoping sections and means for operating the same.

750,733. Trolley Pole; John J. Tartt, Los Angeles, Cal. App. filed March 30, 1903. The trolley harp is mounted upon an arm which is pivotally connected to the body of the trolley pole near the wire, and given an upward spring pressure.

UNITED STATES PATENTS ISSUED FEB. 2, 1904

750,818. Trolley Harp or Fork; Fred. P. Crockett and Osro P. Johnson, Kalamazoo, Mich. App. filed April 4, 1903. Those parts contacting with the wheel are massive, so that they will not be quickly consumed by wear.

750,825. Automatic Trolley Line Reel; Charles F. Davy, Mohawk, N. Y. App. filed March 19, 1903. A spring drum and ratchet controlling the trolley cord.

750,852. Pneumatic Roadbed Cleaner; Eli S. Hart, Chicago, Ill. App. filed April 2, 1902. Consists of the combination of a movable car, a suction pipe thereon provided with an inlet-opening arranged adjacent to the surface of the roadbed, an outlet-pipe, and means for creating a vacuum between the inlet and outlet of the suction pipe.

750,913. Railway Rail Crossing; Fredrich W. Umbreit, Clarion, Ia. App. filed Sept. 8, 1903. Main and guard rails provided at the corners receiving the rims of the wheels with recesses located at the heads of the rails, and arranged in the tread thereof, removable plates fitted in the recesses and having upper faces arranged flush with the treads of the rails, the outer edges of the plates arranged at an angle and disposed flush with the adjacent side edges of the heads of the rails.

750,951. Convertible Cab for Railway Cars; James S. Doyle, New York, N. Y. App. filed Sept. 24, 1902. A convertible cab having a movable partition, in combination with a convertible seat, which, when the controlling apparatus on the car is not in use, occu-

pies the space inclosed by the cab when the controlling apparatus is in use by the motorman, the movable partition acting as a support for one end of the seat when the controlling apparatus is not in use and the seat is in position for use by passengers.

750,981. Movable Car Step; Franz Keilwerth, Cincinnati, Ohio. App. filed Oct. 3, 1903. The combination with a car body, of a horizontally slidable step, racks secured thereto, a longitudinally slidable shaft, parts thereon having teeth engaging the racks, a lever for shifting the shaft endwise and means for rocking the shaft.

750,996. Railway Switch Mechanism; Henry B. Nichols, Philadelphia, Pa. App. filed July 20, 1903. Means for operating the switch from a point more or less distant from the track and at the same time permitting the operation of the switch at the track independently.

751,021. Automatic Signaling System for Electric Railways; Harry B. Snell, Cement City, Mich. App. filed April 25, 1903. Details of a signalling switch, operated by a trolley wheel.

751,120. Electrical Controller and Brake-Operating Device; Walter W. Tice, Rahway, N. J. App. filed April 7, 1903. Details.

751,175. Third Rail for Electric Railways; Lloyd G. Johnstone, New York. N. Y. App. filed Oct. 10, 1903. A metal spring-supported plate covers the rail, and is adapted to be forced downward by the shoe on the car to obtain the necessary contact.

751,254. Railway Switch; William H. Braim, Vancouver, Canada. App. filed May 25, 1903. Two guide frames in the line of approach to the switch, blocks slidable endwise in such guides, having positions upwardly projecting through elongated slots in the upper sides of the guideways and designed to engage with depending members from the car, means for connecting the two slidable blocks, so as to be oppositely movable in relation to each other, and means for connecting the blocks to the switch, so that the forward movement of one block operates the switch for the main line, and the other for the branch.

751,277. Car Seat; Charles W. H. Frederick, Melrose, Mass. App. filed April 21, 1903. Details of a walkover seat.

751,298. Trolley; James Kelly, Pittsburg, Pa. App. filed July 11, 1903. Guard arms or finders are thrown into position by the lessening of pressure of the wheel on the wire, thereby preventing the wheel from actually leaving the wire.

751,312. Reversible Car Seat; Paul G. Leistner, St. Charles, Mo. App. filed March 23, 1903. When the back portion of the seat is reversed, and angle of the seat-section is also reversed, a foot-rest is placed in position to be used by the occupants of the next adjoining rear seat.

PERSONAL MENTION

MR. WILLIAM HENRY HAZZARD, who became president of the Brooklyn City Railroad in 1882, died recently at his home in that city.

MR. BISHOP M. BELL, formerly superintendent of the Macon Consolidated Street Railway Company, of Macon, Ga., during a period of fifteen years, is dead.

MR. T. B. REDMOND, who has been superintendent of the Saginaw Valley Traction Company, of Saginaw, Mich., has been appointed superintendent and manager of the East Moline & Watertown Railway, of Moline, Ill., to succeed Mr. Stuart Wise, who has become connected with Blood & Hale, of Boston.

MR. L. TRUDEAU has been appointed to the position of superintendent of the Montreal Street Railway Company, succeeding Mr. L. Robinson, who recently resigned from the company. Mr. Trudeau was at one time manager of the street railway system at Bordeaux, France, and later established the electric car system at Alexandria, Egypt.

MR. W. S. LAYCOCK, the largest British contractor for railroad fittings, supplies, etc., who has introduced a number of American devices for use on steam and electric traction roads on the other side, including the Gold electric car heater, is now in New York. He intends to place substantial contracts for various electric equipment, notably for electric car lighting outfits for British steam railroads. Mr. Laycock is accompanied here by his chief engineer, Mr. George A. Wyld. They are stopping at the Waldorf-Astoria.

MR. GEORGE STEWART JOHNSON, vice-president and general manager of the Grand Rapids Railway Company, of Grand Rapids, Mich., died suddenly at his home in that city, Jan. 30, from the effects of an operation. Mr. Johnson was born at Pontiac, Mich., Dec. 8, 1850, and came to Grand Rapids with his parents at an early age. Here he received his early education, which was supplemented by engineering courses at Philadelphia and Ann Arbor. He was graduated from the University of Michigan in 1873. After preliminary work at Ludington, and in Canada, he entered the engineering department of the Grand Rapids & Indiana Railroad Company as assistant. Rising to the position of chief, he remained in that place, until he resigned some nine years ago to accept the position of general manager of the Grand Rapids Company.

MR. T. E. MITTEN, general manager of the International Traction Company, of Buffalo, N. Y., and Henry J. Pierce, of the Manhattan Spirit Company, sailed from New York Tuesday, Feb. 9, on the Kaiser Wilhelm der Grosse for Amsterdam, Holland. The object of their trip abroad is to inspect the properties of the Netherlands Tramway Company, of which Mr. Pierce is president, and in which Mr. Mitten, Mr. W. Caryl Ely, Mr. Charles W. Goodyear, Mr. Pendennis White, Mr. Spencer Kellogg, and other well-known Buffalonians have extensive holdings. The Netherlands Company has just completed the building of about 17 miles of electric railway, extending from the city of Amsterdam to Haarlem. Mr. Pierce and Mr. Mitten, during their stay at Amsterdam, will prepare for the running of the first cars over the road, and will represent the stockholders of the company in other business transactions relative to the operation of the first electric railway in Holland. Mr. Mitten and Mr. Pierce expect to be gone until the middle of March.

MR. ALBERT H. STANLEY, who, on Feb. 1, was given charge of the street railway department of the Public Service Corporation, of New Jersey, has been in the street railway business over fifteen years, although he is but thirty-one years old. He began his career as office boy for the Detroit City Railway in the horse-car days, afterward serving for the same company and its successors as timekeeper, bookkeeper, traffic superintendent, division superintendent, assistant general superintendent, and finally as general superintendent. During his service in Detroit the daily business of the company increased from $600 to $12,000, and the length of the lines from 43 miles to 550 miles. Mr. Stanley left Detroit last October to accept the position of assistant general manager of the street railway department of the Public Service Corporation. His present title is general superintendent of the railway department, and he will have general supervision of the technical operation of the system.

A. H. STANLEY

MR. WILLIAM COLLINS WHITNEY, whose activities extended in so many directions, and whose success in so many diverse undertakings was so conspicuous that he was often described as one of the foremost of American citizens, died at his home in New York, on Tuesday, Feb. 2. To street railway men Mr. Whitney is principally known through his connection with the Widener-Elkins syndicate, and his active participation until a few years ago in the affairs of the Metropolitan Street Railway Company, of New York. To attempt to sketch his public career would be to summarize the principal political history since late in the sixties, so closely has his name been connected with city, State and national affairs. Born in Conway, Mass., on July 15, 1841, he entered public life in New York almost directly after his graduation from the law school at Harvard in 1865. In 1870 he was active in the campaign against the Tweed ring in New York. Thus began a political career which terminated in his selection to the cabinet position of Secretary of the Navy under President Cleveland in 1884. While serving in this position he outlined a progressive policy for the department, and actually laid the foundation upon which has been built the navy as it is today. After his term of office as secretary ended, Mr. Whitney returned to New York to carry out the scheme, formulated in his mind years before, of unifying the transportation system of New York. To assist him in this work he secured the services of Mr. H. H. Vreeland, now president of the New York City Railway Company, the successor of the Metropolitan Company. His subsequent activities were devoted to his financial interests, in which one of his chief associates was Mr. Thomas F. Ryan. At the time of his death Mr. Whitney was director in not less than twenty different companies.