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Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 385,900 copies, an average of 8210 copies per week.

Increase In Wages

Our news columns during the last twelve months or so have contained frequent references to increases in wages paid by different street railway companies, especially those in the largest cities. These increases have been due partly to the general prosperity of the country which has made labor scarce, and partly to the increased requirements and standards in force among street railway companies, especially those in the larger cities, which have also tended to decrease the number of available employees. In New York City it is estimated that the increase in wages recently adopted will amount to an added yearly expense of between $250,000 and $300,000, and in Boston to about $160,000. In other words, the New York City Railway Company must carry between 5,000,000 and 6,000,000 more fare passengers and the Boston Elevated over 3,000,000 more fare passengers next year for the sole benefit of the men on their cars.

The sums mentioned above, although great in their aggregate, should not properly be considered as direct additions to the operating expenses. In one sense they are. In a larger and broader sense, however, they are investments in increasing the efficiency of the company. The effect in the long run will be not only to develop a stronger esprit de corps but also to strengthen the company by the employment of men of a higher grade. All employees must realize that more is expected of them than in the past, and this fact should inevitably result in a betterment of conditions. The exact extent to which this policy will be of benefit to the company and the public cannot easily be estimated in figures; nevertheless, anything which improves the service is bound sooner or later to develop more business.

The requirements for admission to the uniformed staff of any of the largest companies in this country, such as the New York City Railway Company, or the Boston Elevated Railway Company, are practically as severe as those for enlistment in the regular army of the United States, while the wages on the whole, considering the difference in living conditions, are considerably larger in street railway work. The service of many railway companies includes provision for medical attendance, pensions, etc., such as are offered by the government, while the incidental advantages in street railway work, such as time off, personal liberty and continuous employment in the same city, are much greater than in army life. The ultimate result of building up in this way an efficient staff of platform labor under conditions which appeal to intelligent men, and the probable effect of this policy on the future prosperity of the companies involved are worthy of consideration.

Similarity of Steam and Electric Railway Shop Practice

It must be admitted that electric interurban railway practice has been developed to such a point that it resembles steam road practice in very many features. In the maintenance of rolling stock department, about the only difference is that the care of the electrical apparatus is substituted for the work done on the locomotive in the round house. Steam road practice has been gradually developing for years and has reached quite an advanced state. Under such conditions it would be supposed that a few years ago, when the electric interurban railway began to develop, master mechanics of interurban lines would have copied steam road ideas on the maintenance of equipment. This, however, has not been done to the extent that appearances would seem to warrant. In many instances the electric railway master mechanic has been more content to begin at the bottom and work out for himself ideas already developed in steam road shops. In regard to car body construction, for example, for several years interurban car bodies have been approaching in design and construction the steam coach. At the present time there is very little difference between the two types of cars either in appearance or weight, and practically the only difference is in the increased length and width of the steam coach. In both

these details, however, the electric railway car or coach is getting closer to the steam car.

In the matter of trucks also the tendency has been the same. The fact that the motor must be hung on the trucks of the electric car necessitates a few different points in the design of the two classes of trucks, but other than for these the construction is very similar. In minor shop details, such as painting, the use of babbitt metals, oils, and other supplies, electric railway men seem to have preferred to experiment for years rather than follow methods adopted by steam roads. It seems reasonable, therefore, that in certain directions of this kind steam railroad practice might be studied to advantage.

Steel Rails

The paper and discussion at the last meeting of the New York Railroad Club on steel rails are suggestive of the troubles accompanying the proper maintenance of the permanent way and the tendencies of the time towards the modification or annulment of these troubles. Attention was called to an old John Brown rail that had done good service for thirty-four years, and how other rails of more recent date had failed when laid beside it. The contrast between the two was further emphasized by the microstructure of the metals. In the one there was a low carbon content of but 0.33 per cent, while in the latter rails the carbon rose to 0.62 per cent. In the one there was fineness of grain, in the other coarseness, yet as subsequent tests showed, mere fineness is not a sure guarantee of increased durability. There must be a hardness, a high limit of elasticity and a fineness of grain resulting from finishing at the proper temperature, all combined in order to obtain the best possible results.

To achieve this the carbon has been raised in the rail just as it has been in the wheel, until an exceedingly hard material is obtained, with a high limit of elasticity and a low percentage of elongation. This metal is far better adapted to resist the abrasion and indentation of the wheels than the softer qualities that gave such excellent results when wheel loads were lighter and the requirements less. It has taken much time and possibly more argument on the part of those who had the courage of their convictions to bring engineers to approve of specifications calling for so high a percentage of carbon that the product must necessarily be hard and unyielding. To rise to carbon at 0.90 per cent from 0.33 per cent is a long step, and fears of brittleness would seem to be well founded. But brittleness may be due to other causes than high carbon. Mr. Job reiterated the well-known fact that in "the Bessemer rail the hardness, with the proportion of phosphorus usually present, cannot be increased much beyond present practice without causing undue brittleness, hence advantage has been taken of the basic open-hearth process by which phosphorus and sulphur can be nearly eliminated." It is this elimination of sulphur and phosphorus or at least the prevention of its segregation that calls for the cropping of the ingot down to sound metal prior to rolling.

Mr. Job does not seem to think that there is much in the "flow of metal," as such, to account for the breaking down of the rails, but his statement that favorable results have been obtained with rails of 0.90 per cent carbon leads one to think that a high limit of elasticity so as to be able to resist the effect of a highly concentrated wheel load is a good thing. With low carbon rails, a wheel of great hardness has such an advantage at the point of contact that even a static load will produce a permanent indentation, so that we can look either for a flow of metal, if it can flow, or a cracking if this cannot take place.

Most of the matters discussed are troubling the electric roads but little at present, but with the increase of speed and wheel loads the time is rapidly approaching when they must share these burdens with their brethren engaged in steam and heavy traffic work. As a starter the paper that has here been under review is full of suggestions and information.

The Publicity Agent

While street railway men cannot perhaps be fairly accused of hiding their lights under a bushel, it is still a fact that in two particulars a little more study of the value of publicity might bring happy results. Very many roads, especially interurban lines, now advertise freely in the local papers and take other means of bringing their advantages before the public eye. Seldom, however, do they come to the point of having a general agent charged especially with keeping in close touch with the public personally and through the press so that every one may have a kindly eye on what the road is going to do next instead of abusing it as a condemned monopoly that grubs for nickels and says nothing. We believe that there are numberless cases in which a passenger and publicity agent in one or two persons, as the case may be, could do an immense amount of good and bring in returns far above his salary. In the first place, the experiment where tried has very generally succeeded. In the second place, it is bound to succeed if carried out through the proper man.

One of the first duties of the publicity agent is to act as a solicitor of traffic. The steam roads have developed this branch of their business very fully and successfully, and their experience should weigh heavily in street railway policies, in this matter as elsewhere. They have found that an active passenger agent and a shrewd press agent mean bigger traffic. The case of the tramway is, of course, somewhat different, but close and agreeable relations between it and the public are even more important than in case of the steam road. Take for instance the cultivation of through traffic over interconnecting lines, to which we have many times directed attention. In the big systems of the Middle West this field is being worked successfully. Most cities, however, have the opportunity and lack the results.

They have about them a really elaborate network of lines which might, and do not, get the traffic that comes from interconnection. One wishes, for instance, to run out to that interesting suburb, Pogueheim, a dozen miles distant and well known to be reachable, if not accessible, by electrics. He knows the Blink Avenue line runs out in that direction, and asks the first conductor for information. Conductor thinks he crosses a line that goes somewhere out that way, at unknown intervals of time. He next goes to the starter, who sympathetically advises a ride out to the car house and further inquiries there—and so on until the inquirer seeks the steam railway station and waits for the first train. Now a proper passenger and publicity agent would see to it that every starter, and conductor, for that matter, had a compact and carefully worked out schedule of times and connections so that he could tell at once that the way to Pogueheim was via Blank Avenue, transfer (free) at Steenth Street to westbound car (every seven minutes), change at Schweinhurst to blue north-bound car (runs on quarter hour), twenty-one

minutes to Pogueheim, and there you are! Still further, the agent would see that every real estate agent in beautiful Pogueheim was kept posted on changes of time and provided with schedules so that his every victim should go via electrics. If electric routes were kept steadily before the public the amount of general travel outside of the rush hours could be very greatly increased in many localities. In some cases roads do prepare schedules, but as a rule they are not kept up to date and are more honored in the breach than the observance. Again, every change of schedule or improvement of service ought to be widely known. If a road inaugurates a new transfer station it should get some degree of credit for it. As it is the only unofficial notice is generally in a local paper to the effect that the Blank Street road after many protests from indignant citizens has at last put a transfer station at Waggles Road, where it should have been put five years ago. If the publicity agent were wide awake there would be a quarter column explaining the new transfer system and its convenience to the dwellers in that locality, so that the public should understand that the road was well disposed and meant to extend all reasonable facilities.

Relations With the Daily Press

It is a most important thing in the railway business to make the public understand what is generally the fact, that the road intends to give everybody a square deal and that if it has sometimes to deny requests does so regretfully and with good reason. In this particular nothing counts for more than friendly relations with the newspapers and a readiness to give them information. Take the matter of accidents, for instance, which are bound to happen on the best managed roads. If the reporter of the local paper knows that he will get an absolutely reliable statement of facts from the road he will be the less likely to publish a half column of hysteria from excited bystanders. If he finds that the road will dispense no facts beyond a very evidently guarded disclaimer, he cannot be blamed if he grows suspicious and starts a search that gives sensationalism its opportunity. Many a time sentiment against a road is worked up to a serious pitch merely because a secretive policy is assumed to be an unfriendly one. Right here is the value of a proper campaign of publicity that will make evident the good feeling that should exist between the community and one of its most useful institutions. If any man stops to think of it he is getting in his two or three or five miles' ride a bigger equivalent for his nickel than he can find anywhere else, and there is something wrong with the advertising work of the road if he is not made to stop and think of it. A great deal gets into the newspapers merely to make copy at so much per line, and this matter may just as well be helpful as harmful if there is somebody to look after it a bit. Every road does things and experiences things that are of legitimate public interest, and there is seldom good reason for keeping them to itself. Let the publicity agent do his duty and comment can be made friendly most of the time. Most roads are too cautious in taking the public into their confidence. Very often, as we have indicated, the passenger agent and the publicity agent may wear the same hat. The main thing is to have some one who makes it his business to keep closely in touch with the public that uses his line, and to win them over to a friendly point of view. The task is not so hard as it sometimes seems, but it cannot be accomplished by one who is badgered about twenty-five hours per day by the petty details of operation—it should be the especial work of a competent man, amiable and resourceful.

Relations With the Public

To those entrusted with the management of large corporations the present restlessness of the public as evidenced in the latest political campaign is a source of no little anxiety. The baleful influence of yellow journalism is making it harder than ever for those in control of the policy of transportation companies to retain or even secure the confidence of the less-informed portion of the public, and the agitation of self-seeking demagogues has, in some parts of this country at least, attained proportions which no large street railway company can afford to ignore. Since the cooling down of the municipal ownership bugaboo in Chicago and its decisive defeat in Seattle, this phase of the popular unrest has not been as prominent, but there are still reasons why street railway managers should not cease endeavoring to put themselves right with the public and assist in the formation of its opinions from time to time.

There is no denying the fact that the fundamental cause of most of the present social unrest is the considerable increase in the cost of living during the past decade. It is most gratifying to be able to point out on the basis of solid facts that, as a very general rule, the prices charged for electric railway transportation have decreased rather than increased, as the prices of other necessities of life have advanced. Every one who stops to think of the matter must realize at once that the purchasing power of a nickel in street railway transportation is constantly enlarging. The extension of present urban systems into suburban communities, the addition of transfer privileges, the purchase of swifter and more comfortable rolling stock and the enlargement of private or semi-private right of way mileage all contribute to the improved service and greater facilities offered the public for a single fare than was the case ten years ago. Bearing these facts in mind we must confess that there is little reason for complaint against the service and general policy of many companies, yet no election is held without the usual crop of demagogic howls about "traction grabs," "street railway trusts," etc., etc. We believe that the plain, hard, meaty facts of the service now given in comparison with that of some years ago ought to be presented to the public in cases where the road is not being rightly understood, either through the newspapers, by addresses, or even by succinct, pithy notices in the cars. For this service the publicity agent is of great assistance. Given good service, and a disposition on the part of the management to put its reasons for various policies in cold, pointed type, and there will be less of this irresponsible agitation which is of such immeasurable damage to the good will assets of a misrepresented company. On some roads it is becoming a frequent practice for the officials to come in frequent touch with the public through the press and through various social clubs, and lectures are sometimes given on certain features of the system which are of general interest. All these man-to-man and straight-from-the-shoulder meetings, as well as the course suggested in the previous editorials, help to clear away the fog of illusions created by the self-seeking demagogue, and are the basis of lasting good will. The power of straightforward publicity is yet to be appreciated at its full value.

ELECTRIC RAILWAY POWER AT RUTLAND, VERMONT

The city of Rutland, Vt., with a population of about 12,000 inhabitants, is the commercial center of the southern part of the Green Mountain State. The electric railway, light and power service, as well as the gas supply of the community, is now controlled by the Rutland Railway, Light & Power Company, which is headed by G. Tracy Rogers, of Binghamton, N. Y., as president; Leo H. Wise, of New York City, vice-president; C. H. West, of Rutland, secretary and treasurer, and David Fox, Rutland, general manager. For a city of its size—including a suburban population of about 10,000 in the towns of Fairhaven, Castleton and West Rutland—the street railway service is unusually effective, and an important factor in this condition of affairs is the new power development of the company in the valley of East and Otter Creeks, from 6 to 11 miles from the city.

Fig. 1 is a general plan of the territory served by the company. The local trolley service in Rutland is handled by a double loop known as the "North and South Belt" lines, while fers are given to points east of Center Rutland and vice-versa, from the loop cars. The company's present trackage is 25 miles in length.

Fig. 1 also shows the extensive hydraulic development that the company has planned in connection with its power system. In the heart of the mountains, at an altitude of 1600 ft., lies the Chittenden Reservoir, with a drainage area of 15 sq. miles, and an area of about 800 acres. The storage capacity of this reservoir is 135,000,000 cu. ft. of water. Five miles southwest of the Chittenden reservoir another storage, of 63,000,000 cu. ft. has been created in a 320-acre reservoir known as the East Pittsford, which has a drainage area of 9 sq. miles. About a mile and a half south of the lower end of the East Pittsford reservoir a power house has been erected as shown in Fig. 2, at Mendon, and a steel penstock connects the lower reservoir with this plant. As yet, power is developed only at the Mendon end of the water course, but in the future it will be a simple matter to establish a second plant between the two reservoirs. The available head between the upper reservoir and the power house is 697 ft.,

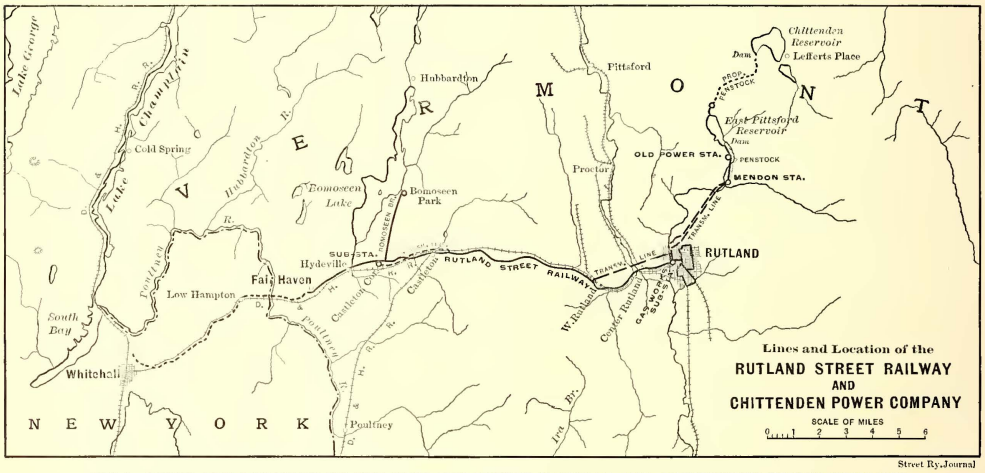


FIG. 1.—LINES AND LOCATION OF THE RUTLAND STREET RAILWAY AND CHITTENDEN POWER COMPANY

the suburban service is taken by a through line running 16 miles westward to Fairhaven. At Castleton Corners a branch line runs to Lake Bomoseen, one of the most beautiful sheets of water in the Green Mountain district. A heavy park traffic is handled between Rutland, Fairhaven and the lake in the summer season, the fare between Rutland and Lake Bomoseen being 25 cents in each direction. The North and South Belt lines enable the visitor to obtain an excellent idea of the city for a single 5-cent fare, transfers being given freely from one line to the other. Each loop contains about 3 miles of track, and the running time is twenty minutes, with a twenty-minute interval between cars. On the South Belt the car passes in full view of Mt. Killington, which has an altitude of about 4000 ft. In the future an extension of about 8 miles to Whitehall is planned, as shown on the map. The company owns twenty-six cars at present, of which fifteen are of the open type. Four large double-truck interurban cars are in service, equipped with four GE-64 motors each, and there are ten double-truck, fifteen-bench open cars. Sixty-lb. T-rail is used in the tracks. The company makes a specialty of renting cars for excursions, picnics and dances. Besides the transfers from one belt line to the other, trans-

but at present only 222 ft. is utilized at the wheels. The balance of 475 ft. represents the head between the upper reservoir and the lower one.

The estimated annual rainfall in the area which drains into the two reservoirs is 45 in. About 70 per cent of this has been found to run off from the Chittenden reservoir. The water in the upper reservoir is held back by a dam 750 ft. long and 54 ft. in maximum height. One hundred ft. of the dam is occupied by a waste weir, the balance serving a single retaining wall. The dam is of earth with a masonry core wall except at the waste weir, where it is built of stone masonry. The core wall extends to within 3 ft. of the top of the earth embankment. The East Pittsford dam is 585 ft. long, including a 111-ft. spillway. The balance is earth embankment, which is 31 ft. high. The crest of the spillway is 5 ft. below the top of the earth embankment. All but 52 ft. of the embankment contains a masonry core wall which extends from the foundation to within 3 ft. of the level of the embankment. The core is 30 ins. wide at its top, and the embankment varies in width from 12 ft. at the top to 108 ft. in the deepest portion. The crest of the spillway is built of concrete and overlaid with stone on both the up and down-

stream faces. The upstream face of the embankment is also paved with stone to a point several feet above the water line, and in the deepest section the downstream face of the dam is lined with rock. Beneath a gate house on the embankment is a 5-ft. steel pipe which cuts through the embankment about 15 ft. below the flow line, the gate house well is lined with brick, and into this well water from the forebay enters over a rock with a two-to-one slope.

Waste water is carried through the dam and discharged into the bed of the creek on the downstream side by a 24-in. steel pipe. Both the pipes are provided with valves, and that of the 60-in. pipe is water-operated. The 60-in. penstock is 8000 ft. in length, and it terminates in the cases of the turbines at the power house. The thickness of the pipe sheets varies from ¼ in. at the upper to ⅜ in. at the lower end, and both inside and out are coated with tar and pitch. The lower part of the penstock is coated with cement, on the inside, and the entire penstock is covered by an earth trench which has a minimum depth of 15 ins. The pipe line is lap welded and double riveted in all seams toward the latter end of the run, and it is lap welded with a single row of rivets at the head of the run.

An important feature of this plant is the large percentage of the available flow of the area drained which is stored. The natural flow of the stream itself is too small to be of great value for all the year round use. The topography of the country permits the storage of so much of the rainfall

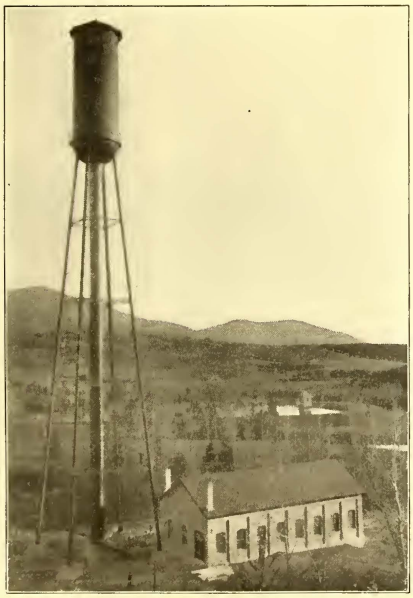


FIG. 2.—RUTLAND RAILWAY, LIGHT & POWER COMPANY'S POWER HOUSE

that after due allowance is made for evaporation and seepage enough remains to furnish ample power all the year round. About Jan. 1, 1907, the old steam plant of the Rutland City Electric Company will probably be thrown entirely out of commission. At present the railway load is the principal burden of the Mendon plant.

The pipe line is carried along the side of the station, branches being taken in to the wheels. Water hammer is eliminated by the installation of a regulating tower 220 ft high, having a tank of sufficient capacity to relieve the wheels of fluctuations of pressure in the pipe line. The tank is supported by a steel tower mounted on concrete foundations, a standpipe being carried up from the penstock to the tank. The tank is 15 ft. in diameter and 50 ft. high, the riser pipe being 36 ins.

FIG. 3.—EXTERIOR OF POWER STATION

in diameter. It is built of riveted steel plates with a hemispherical bottom, and is frost-proofed by a wooden casing. The top of the standpipe and water tower is 17 ft. above the flow line of the lower reservoir. The space between the frost-proofing and the steel tank is supplied with heat by a steam pipe running from a heater located in the power house, to prevent freezing of the water in the winter time. Both the standpipe and the water tank are of double structure, each having an inner and an outer part with a space between. The exterior of the standpipe has a diameter of 5 ft. 8 in., the inside diameter being 3 ft. The outer tank is 18 ft. in diameter. There are 265 sq. ft. of heating surface disposed of in 2-in. steam pipe in the annular space between the outer and inner pipes and tanks. In case of a sudden increase in the loading of the power house generators the stored water in the tank at the top of the standpipe is sufficient to prevent more than a small drop in head. In case of a sudden reduction in load the surplus energy of the water column is expended in overflow from the inner to the outer tank of the standpipe. This overflow then passes to the tail race beneath the power station through the outer pipes. The bottom of the tank is surrounded by a platform which is reached by climbing the lateral braces on one of the columns.

The power house is a brick structure with concrete foundations, concrete roof and steel trusses. There are no purlins in the roof construction, as the concrete slabs were molded in forms set up on the ground, and after hardening were transported to the site of the power house, removed from the forms, hoisted to the roof and attached to the steel trusses. After being leveled the joints were pointed up with cement and a finished covering of roofing felt and asphalt compound installed. The roof slabs are 4 ft. wide, 8 ft. 6 ins. in length and over 3½ ins. in thickness, reinforced with 3 ins. of No. 10 expanded metal, and are composed of one part cement, two parts coarse, sharp sand, and three parts clear crushed stone or gravel. Considerable gravel was used in the concrete work for foundations, floors and roofing for the building, as gravel was readily obtainable from the beds of two creeks which flowed, one on each side of the power house. The sand for construction purposes was also conveniently located, as a bank was found close to the power house site and on top of the adjoining hill. In order to utilize this sand

it was only necessary to install a sheet-iron chute, which deposited the sand at the desired location.

The power house is 37 ft. 3 ins. x 79 ft. 9 ins. over all. A concrete pit 10 ft. wide and 14 ft. deep below the floor level runs along the side of the station nearest the pipe line. Each turbine receives its water through a 30-in. supply pipe which connects the wheel casing with the penstock. These pipes

FIG. 5.—STORAGE BATTERY INSTALLATION

pass through the upper part of the pit, and the lower part is used as the tail race. At the downstream end of the station the pit connects with an open conduit which leads the discharged water into the bed of the creek once more. The power house contains room for four turbine and generator units, but as yet only three machines are installed. Each of these consists of a 400-kw, 13,200-volt, 25-cycle, three-phase General Electric revolving field generator direct coupled to a horizontal double-discharge 90-in. turbine manufactured by the S. Morgan Smith Company, of York, Pa. In each wheel the water enters through an opening in the case which is placed between the supporting beams. The runner discharges into two elbows and two draft tubes, which prevent unbalanced end pressure. The center of each wheel is 12 ft. 6 ins. above the level of the tail water, and 18 ft. above the bottom of the pit. Type Q Lombard governors are used. The exciters consist of two 45-kw, 125-volt dynamos, each of which is direct driven by a 34-in. horizontal turbine designed for 725 r. p. m. and controlled by a Lombard governor. An 18-in. branch pipe supplies the exciter wheels. Fig. 3 represents a rear view of the power house and a side of the steel frame which supports the relief tank and standpipe, and Fig. 4 shows the interior of the station.

Indicating devices for recording head pressures, head of tail water, etc., are installed and an indicating and recording tachometer is provided for each wheel. From the generators and exciters cables run in clay conduits beneath the concrete floor to the switching apparatus, which is located behind the switchboard panels shown in Fig. 4. Each generator has an oil switch operated by a handle on the front of the corresponding panel, and the outgoing transmission lines are also provided with oil switches. There are two three-phase lines of No. 4 copper carried on separate poles with about 100 ft. between the parallel circuits over the 4 miles between the Mendon power house and the main distributing sub-station at Rutland. The poles are of chestnut and from 30 to 45 ft. in length. Each of the outgoing circuits passes from the oil switches to a choke coil, thence to the lightning arresters shown in Fig. 4 on the wall behind the switchboard, and out of the building through porcelain tubes in the wall. The oil switches are mounted in concrete cell compartments. Besides the generator, exciter and line panels the switchboard carries a regulator panel with a Tirrell regulator for voltage control mounted upon it. All of the cables in the building are encased in lead coverings and each has a capacity of twice the load under which it normally operates. The power house lighting circuits are entirely encased in iron conduit, forty 16-cp incandescent lamps being used to illuminate the station. The porcelain tubes which carry the 13,200-volt lines through the building are spaced 18 ins. apart on centers. The station wall is 13 ins. thick except at abutments, where the thickness is 30 ins. A hand-power traveling crane sweeps the entire generating room. The lines are transposed twice between Mendon and Rutland. There are two twelve-hour shifts daily at the Mendon power house.

The old power house of the Rutland City Electric Company contains about 1000 hp in steam and electrical equipment, and there was also an old street railway plant at West Rutland which was shut down in December, 1905. It contained 400 kw in 500-volt generators.

Power is now distributed from a main sub-station at Rutland and from one at Castleton Corners, to the street railway trolley circuits. The Rutland sub-station is a one-story building, 30 ft. x 32 ft., with concrete foundations and floor, brick walls and a roof of concrete and expanded metal. The floor is 6 ins. thick and the roof 3½ ins., supported by 55-lb. I-beams 18 ins. high, cross-laid with others 8 ins. high and 18 lbs. weight per linear foot. A concrete block addition is now being made to this sub-station to house a motor generator and frequency changer set to be used in connection with the company's lighting business. The Rutland sub-station contains three 125-kw, 13,200-volt to 380-volt transformers, and two 150-kw, 600-volt rotary converters, the usual oil switches and switchboard instruments. A short distance away is a

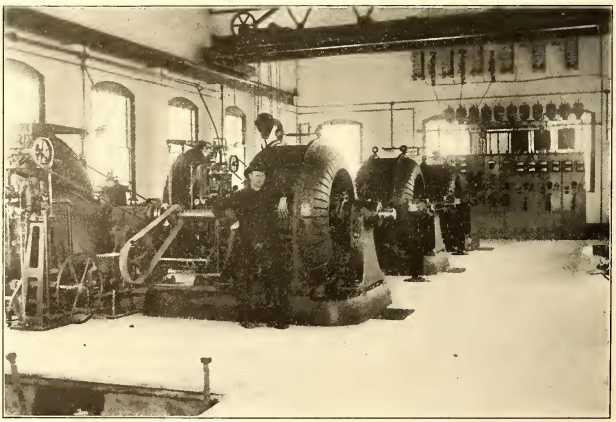


FIG. 4.—INTERIOR OF THE RUTLAND RAILWAY, LIGHT & POWER COMPANY'S POWER HOUSE

battery house containing 280 cells supplied by the Gould Storage Battery Company, of New York. The battery house is 30 ft. x 56 ft., is one story high, and has a roof of concrete slabs with expanded metal, laid on 60-lb. rails used as rafters, with 6-ft. centers, and covered on top with tar, felt and gravel. The floor is of concrete, 3 ins. thick, and the walls are of brick. The capacity of the battery is 400 ampere-hours, with an 800-amp. capacity for twenty minutes and 900 amps. for five minutes without injury to the plates. By means of a rectifier and booster sets the battery is arranged to absorb the fluctuations of both the railway and a. c. power systems. An interior view of this battery house is shown in Fig. 5.

The Castleton sub-station is connected with the Rutland sub-station by a single three-phase line of No. 4 copper, 12.5 miles in length. In the Castleton sub-station are three 150-kw transformers and two rotary converters of 150-kw and 200-kw capacity respectively; the blowers in both the Rutland and the Castleton sub-stations are motor-driven. The contractor for the power station, sub-stations and their equipment was J. G. White & Co., of New York. The first cost of these to the company, exclusive of the hydraulic development, was about $125,000. The engines were made by French & Bryant, of Boston. The standpipe and tank were designed by the Chicago Bridge & Iron Works.

DEPRECIATION AS APPLICABLE TO ELECTRIC RAILWAYS

In view of the attention which is being given to depreciation among American electric railway companies, it may be interesting to refer to the extent to which the subject has been considered by electric railway companies in Europe. The practice of Continental roads was summed up in a paper presented in 1904 at the Vienna meeting of the International Street and Interurban Railway Association by Mr. Haselmann, manager of the Aachen Street Railway Company. Mr. Haselmann's report, considerably abstracted, follows:

DEPRECIATION ON THE RAILWAYS OF CONTINENTAL EUROPE

The electric railway companies of Continental Europe are practically unanimous of the opinion that a depreciation fund is necessary. Nearly all of them have such a fund and recognize the necessity of making annual appropriations to it. The replies received explain the necessity of this fund in different ways, such as: "to replace certain parts of the installation which do not wear out each year"; "to take care of the annual depreciation on different parts of the installation"; "to avoid an exaggerated operating expense charge in certain years, in other words, to secure uniformity in the results of opration in different years." Most of the companies prefer to take care of this situation by the establishment and maintenance of a depreciation fund. A very few companies prefer to accomplish the same result by means of amortization of the account. The former method is preferable for it retains a statement in the balance sheet of the first cost of the equipment.

The next question is to what extent the establishment of a depreciation fund is required by law, by the charter of the company and by its own by-laws. Prussia and Switzerland seem to be the only countries which have taken legal cognizance of this question. In these countries the question of the establishment of a depreciation fund by the railway companies has been left by statute to the local authorities, although they have not usually exercised jurisdiction. They have, however, in the case of the following companies: Aachen, Barmen, Hanover, Königsberg and Geneva, but in most instances with the consent and approval of the company affected. The states of Alsace-Lorraine and Baden have also imposed certain obligations of this kind on the Strassburg Street Railway Company. In certain other cases the charter or franchise prescribes certain payments to the depreciation fund, but in most instances there is simply a provision that such a fund must be established, all details being left to the company. This silence in the charter or franchise on this subject is explicable by the fact that for business reasons and in their own interests the street railway companies in Continental Europe have generally established funds of this character. Again, it is possible that omission of any reference to this subject in many charters may also be attributable to the difficulties of outlining a satisfactory system for the establishment of such a fund in enterprises of such new character as electric tramway companies.

Among the companies whose franchises include clauses calling for the establishment of depreciation funds are those in Crefeld, Leipzig, Linz, Liegnitz, Munich, Nordhausen, Riga, Solingen, Wurzburg, Zurich and Zwickau. In these cases the clause was introduced in view of the ultimate purchase of the enterprise by the municipality. Other companies have incorporated in their constitutions certain regulations on this subject to agree with certain statutes. Examples are Berlin, Brussels, Czernowitz, Dessau and Lyons. Similar regulations adopted by the municipal council of Mannheim are incorporated in the by-laws of the municipal road in that city. In addition many street and interurban railway companies have adopted the practice of having a depreciation fund and making regular payments to it, although not so required by law.

The next point to be considered is the basis of payments to the depreciation fund. Briefly, those companies which have adopted regular percentages of the investment cost of the property have adopted certain percentages applicable to the following main divisions: track construction, overhead and conduit construction, rolling stock, power station.

An important point is the difference between depreciation and repairs. A distinction should certainly be drawn. The Tessin Company says: "We charge to the depreciation fund the cost of entire renewals, and charge to the repair account partial renewals, the latter being part of the operating expenses. While in some cases this plan might not be entirely logical, yet any attempt to divide a charge between repairs and renewals would be apt to introduce confusion into the accounts, and the personal equation of the accountant and his point of view would enter so largely into the matter that the hard and fast line mentioned is perhaps more satisfactory."

This consideration is interesting and shows how useful it would be to limit, so far as possible, discretion in the division of charges between the maintenance and depreciation accounts. This, in fact, is the crux of the whole question which is now under consideration by the International Street and Interurban Railway Association, viz: the proper distinction to draw between maintenance and depreciation.

One method of maintaining a depreciation fund is by crediting annually to that fund certain percentages of the cost values of the different portions of the equipment. Table I. shows the various percentages charged off by the different companies which follow this method of keeping up a depreciation fund. These percentages vary as follows: Track construction, 1 per cent to 10 per cent; feeder system, 1 per cent to 8 per cent; rolling stock, 1.25 per cent to 10 per cent; power station, 2.5 per cent to 10 per cent.

Table II. gives a list of six companies whose depreciation

fund is maintained by annual payments based on percentages on the entire investment. As will be seen, the percentages vary from 1.5 per cent to 3.5 per cent.

Table III. is a statement of four companies whose depreciation fund is maintained by payment of percentages of the gross receipts.

From what has preceded, it will be seen that it is difficult to formulate any rule or derive any basis for calculating the proper amount to be charged off for the depreciation fund. One method of attacking the question is to pro-rate the payments over a period based upon the life of the different parts of the system. A summary of the lives of various portions of the equipment as calculated by five companies, all members of this association, is presented in Table IV. Even here, however, it is a question as to the extent to which the lives of the parts should be determined from present standards of wear. According to the managers of the systems of Cologne and Linz, the fact that portions of the equipment may become obsolete more rapidly than they wear out should also be considered as a factor in calculating their life, because conditions may arise under which existing portions of the equipment, which may not yet have been covered by amortization or a depreciation fund, have to be replaced by more modern and more economical apparatus. It is questionable, however, whether this is not stretching the principle too far. If the new apparatus is so much more economical than the old as to justify an abandonment of the latter, should not the difference in cost be properly considered as a capital charge?

Referring again to Table IV., it will be noted that the lives of parts estimated by the different companies do not correspond in all cases. This is logical. The wear on track is due largely to the density of traffic and number of wheels run over it, while in other portions of the equipment depreciation is more a question of time. Every one will recognize, therefore, that the main object before the association is not so much to determine an absolute basis for the payments to the depreciation fund as it is to establish certain principles which have received the sanction of experience and

TABLE II.

Statement from Roads Whose Depreciation Fund is Maintained by Percentages on the Entire Investment.

NAME OF COMPANY.	Percentage Charged.	Is the Depreciation Fund Credited With the Amount of Old Material?	These Percentages Are Prescribed by
Berlin II.	1.5	No	The company.
Erfurt.	2.0	No	The company.
Königsberg.	1.5	No	Authorities.
Solingen—City system.	3.5	No	Franchise.
Wurzburg.	1.6	No	Franchise.
Zwickau.	2.0	Yes	The company.

TABLE III.

Statement of Four Companies Whose Depreciation Fund is Maintained by Payment of Percentages of Gross Receipts.

NAME OF COMPANY.	Percentage Charged.	Is the Depreciation Fund Credited With the Amount of Old Material?	These Percentages Are Prescribed by
Crefeld.	6.0	Yes	Franchise.
Linz.	5.0	Yes	Franchise.
Munich.	6.0	(?)	Franchise.
Solingen—Suburban system.	10.0	No	Franchise.

TABLE IV.

Life in Years of Different Parts of Equipment as Estimated by Different Companies.

NAME OF COMPANY.	Track Construction.	Feeder System.	Rolling Stock.	Power Station.
Brussels I.	25	Poles 25 Feeders 25 Trolley wire 10	25	25
Elberfeld.	15	8–10	Motor cars 15 Trail cars 20	..
Heidelberg.	Double track 25 Single track 17	10	Motor cars 17 Trail cars 25	(?)
Lyons.	15	25	15	15
Nuremberg.	20–25	(?)	15–20	(?)

TABLE I.

Statement of Companies Whose Depreciation Fund is Maintained by Payments of Percentages on Separate Divisions of the Equipment.

NAME OF COMPANY	Track Construction.	Percentages Charged Off.			Is the Depreciation Fund Credited With the Amount of Sales of Old Material?	These Percentages are Prescribed by
		Feeder System.	Rolling Stock.	Power Station.		
Aix-la-Chapelle.	1.5	1.0	Motor cars 2.5 Trail cars 1.25 Freight cars 1.25	4.0	Yes	Authorities.
Barmen.	2–2.25	Poles 1.5–2.0 Trolley wire 5.0–6.0 Feeders 1.0–1.25 Cables 3.0–5.0	Motor cars 5.0–5.5 Trail cars 1.25–1.50 Freight cars 3.0–3.5	5.0–5.5	No	Authorities.
Cologne.	(?)	(?)	8.0	(?)	No	The city.
Czernowitz.	1.5	1.5	3.0	2.5	No	Statute.
Frankfort I.	5.0	5.0	6.0	7.0	Yes	The city.
Glasgow.	10.0	Poles and rosettes 3.0	7.33	5.0	No	Authorities.
Leipzig I.	2.0	4.0	8.0	8.0	Yes	Franchise.
Liegnitz.	1.0	(?)	Motor cars 2.0 Trail cars 1.5	(?)	Yes	Statute.
Mannheim.	5.0	Poles and rosettes 3.5 Trolley wire 8.0 Cables 5.0	Motor cars 7.0 Trail cars 5.0	(?)	No	The city.
Nuremberg I.	(?)	5.0–8.0	(?)	5.–8.	Yes	The city.
Remscheid.	2.0	3.0	10.0	6.0	No	Society.
Riga.	1.0	2.0	4.0	4.0	Yes	Franchise.

which will allow different companies a latitude in determining the size of their payments to the depreciation fund.

Table V. shows the amounts in cents per car-mile which the companies designated charged off to their renewal funds:

TABLE V.

SHOWING AMOUNT OF PAYMENT TO DEPRECIATION ON CAR MILE BASIS:

Company.	Cents per car-mile.	Company.	Cents per car-mile.
Aix-la-Chapelle	.96	Liegnitz	.472
Berlin I.	1.68	Manheim	2.16
Berlin II.	2.24	Nordhausen	1.6
Dessau	1.48	Nuremberg I.	2.4
Frankfort I.	1.2	Solingen	1.72
Frankfort II.	1.2	Wurzburg	1.
Hamburg	.56	Czernowitz	2.5
Hamm	1.40	Geneva	0.8
Leipzig I.	1.872	Lyons	1.23
Leipzig II.	1.2	Zurich	1.32

Twenty-one companies credit their depreciation fund with the sums received from the sale of old material. Those which follow this policy are: Aix-la-Chapelle, Crefeld, Dessau, Dresden, Elberfeld, Frankfort I., Frankfort II., Geneva, Glasgow, Hanover, Heidelberg, Leipzig I., Leipzig II., Linz., Liegnitz, Lyons, Nuremberg I., Riga, Strassburg, Zurich and Zwickau. The greater part of the remaining companies carry these sums to the credit of their operating expenses. The remainder carry it as a credit to either their cost of first installation or as a credit to some other account.

Table VI. is a suggested form of keeping track of the amounts to be charged to the depreciation fund.

This report will be concluded by reviewing briefly the principles determined by the writer's study of this question.

CONCLUSIONS

(1) The maintenance of a depreciation fund by annual payments is to be recommended for every street and interurban railway company. It is necessary when there is no sinking fund to cover the original investment.

(2) In electric railway operation the depreciation fund should supply the money necessary to renew (a) track construction, (b) the distributing system, (c) rolling stock, (d) power stations and, where conditions require, (e) miscellaneous.

(3) The depreciation fund can be charged with the cost of renewals (not including labor) for work of considerable importance, such as (a and b) entire sections of track and overhead construction; (c) complete cars, car bodies, trucks, motors; (d) engines, boilers, and important parts of the steam equipment. All other repairs and renewals ought to be charged to the operating expenses.

4. The depreciation fund ought to be credited with (a) the sums secured from the sale of old material, (b) interest earned by the fund itself, and (c) by an annual payment based out of operating expenses.

5. The amount of the payments mentioned above under (c) paragraph 4 depends upon local conditions, but should be based upon the following considerations:

(a) For track and overhead construction, probable life and ton-miles or car-miles run, quality of material, resistance to wear, section used, condition of track, expense of maintenance, traffic conditions in streets, profile, guarantees supplied by the manufacturer, greater or less magnitude of the work, etc.

(b) Rolling stock: Condition of car bodies, car-miles run, number of cars and motors kept in reserve, and their probable length of usefulness, based largely upon whether they are of old or new design.

(c) Power station, date and character of installation, amount of machinery kept in reserve, output, hours per day in use.

6. The percentages or amount of the annual payments ought to be revised at regular intervals. This revision ought to take into account any changes in the art and in price.

7. The depreciation fund ought to be kept distinct from the other funds of the enterprise.

8. The sums assigned to the depreciation fund, when they are not to be immediately utilized, should be employed in the purchase of interest-bearing securities.

9. Payments to the depreciation fund can be reduced or

TABLE VI.

DIVISIONS.	First Cost Value in Francs.	Value of New Apparatus Reduced by the Sale of Old Apparatus in Francs.	Length of Service Estimated.	ANNUAL PAYMENTS. Total in Francs.	ANNUAL PAYMENTS. In Per Cent of the Cost Value.	Remarks.
Track constuction, rails ties, switches, cross-overs*, roadway, etc.	1,000,000	Rails..... 750,000 Less..... 350,000 400,000	20	14,000	1.9% of 750,000 fr.	*To the main track and sidings.
Overhead constuction poles.	375,000	Poles..... 200,000 Less..... 25,000 175,000	40	2,000	1.0% of 200,000 fr.	
Overhead conductors*, cables, etc.	.....	Wires..... 100,000 Less..... 50,000 50,000	10	4,000	4.0% of 100,000 fr.	*Feeders, trolley wires, etc.
Cars—Motor cars, trail cars, baggage cars, etc.	600,000	First cost... 600,000 Less..... 200,000 400,000	25	10,000	1.7% of 600,000 fr.	50% of the cars in reserve.
Generating apparatus—Boilers, engines, generators, storage batteries, etc.	400,000	Apparatus.. 250,000 Less..... 50,000 200,000	15	10,000	4.0% of 250,000 fr.	

suspended when the total reaches an amount considered sufficiently large.

10. A certain sum ought, however, always to appear as a liability in the balance sheet, even where the company will not have the benefit.

11. During prosperous years the payments to the depreciation fund can be increased.

DISCUSSION

In the discussion of this report the fact was brought out that the German Street Railway Association was studying the question of the proper percentages, and it was therefore decided to postpone action on this subject until a decision should be reached by this latter association. At the subsequent meeting of the German association, however, the attempt to fix definite percentages for different portions of the installation was abandoned.

SUBJECT OF DEPRECIATION IN ENGLAND

The Municipal Tramways Association, of Great Britain, has also discussed the subject to a considerable extent. The subject was first brought before the association in 1902 by James Dalrymple, who suggested percentages varying from 4 to 8 per cent on the cost value of the equipment of the line. It has been more recently considered at the fifth annual meeting of the same association held Sept. 19 to 21, this year, when G. W. Holford, general manager of the Salford Tramways, presented a paper on the subject. In British municipal accounts, the capital account is amortised yearly, as in our own. Mr. Halford did not take up the subject, therefore, from the standpoint of the balance sheet as with a private company, but more with regard to the provision of a fund to cover the cost of renewals which will be required in a municipal tramway undertaking before the period for which the borrowing powers have been allowed should expire.

In regard to rolling stock, he believed that, taking into consideration the period generally sanctioned by the Board of Trade of Great Britain for the repayment of money borrowed by municipalities to cover this expenditure, there will not be required within that period any abnormal expenditure for renewals, provided careful attention is paid to the maintenance of the rolling stock. Under these circumstances the rolling stock should outlive the period of the borrowing power.

Respecting buildings, these also, he thought, should certainly outlive the period of the loans, and the British standardized accounts already provide for their proper maintenance out of revenue account.

Overhead equipment can also be maintained out of revenue; that is to say, the poles should outlive the loan period, provided that they are painted at regular intervals, and although the trolley wire, etc., will require renewal from time to time, the cost of this periodical renewal is not a very serious item when the price obtainable for copper as scrap material is taken into consideration.

He therefore confined his attention to the remaining portion of the equipment, that is, track construction, and its probable life, which he estimates at approximately twelve years. That is to say, where the traffic is not less than every five minutes it would average about fifteen years, and on a line of a heavy traffic ten years. This life depends largely upon joint maintenance and future improvements in the art of supporting the joints may, and probably will, increase the life of the rail.

Out of sixty municipal tramway enterprises in England, the following, or nineteen in number, have established no depreciation fund: Ashton, Barking, Belfast, Blackburn, Bournemouth, Chester, Colchester, Darlington, Doncaster, Gloucester, Keighley, Kilmarnock, Lincoln, Lowestoft, Maidstone, Pontypridd, Rochdale, Southend and Wigan.

The following, or fifteen in number, charge off all of the net profits to a depreciation fund, and the amount of such fund on March 31, 1906, is given after the name of each city:

City.	Amount of Fund.	City.	Amount of Fund.
Aberdeen	£14,379	Preston	£4,000
Birkenhead	11,465	Reading	5,115
Bradford	48,469	Rotherham	4,980
Brighton	2,766	Southampton	Not stated
Burnley	11,796	Stockport	5,941
Bury	4,342	Walsall	6,163
Halifax	10,221	Warrington	220
Leicester	27,558		

Table VII. shows the companies with the number of cars, miles of track, which charge off a fixed amount to the depreciation and renewal funds, as well as the total amount of such fund on March 31, 1906:

TABLE VII.

Statement of Companies Which Charge Fixed Amounts or Percentages to a Depreciation Fund.

NAME OF COMPANY.	No. of Cars.	No. Miles of Track.	Annual Contribution to Depreciation and Renewal Fund.	Total Amount of Such Fund on March 31, 1906.
Ayr	17	7½	3% less cost of renewals	£9,021
Bolton	86	42	Track £360 per mile. Overhead 5%. Cars, etc., 10%. Depots, 3%.	33,928
Darwen	15	7½	£170 for cars	5,250
Derby	30	8¾	Intend to use all profits	6,529
Glasgow	783	158¾	Track £500 per mile. Poles, etc., 3%. Cars, 7½%. Depots, 2½%.	905,253
Huddersfield	70	30	3% of total capital expenditure	44,268
Kirkcaldy	22	7½	3% on cars and tools	858
Leeds	270	94¾	Track, £11,565. Overhead, 2½%. Cars, 5%. Depots, nil.	118,493
Manchester	542	142	Track, £400 per mile. Overhead, £50 per mile. Cars, 5%. Depots, nil.	249,212
Sheffield	257	66	£20,000	108,478
Southport	26	19½	£1,053	5,477
Sunderland	64	19½	£6,400	25,166
Wallasey	35	12	1.47d. per car mile	15,466

The following have no fixed amount, but the total depreciation fund on March 31, 1906, is given after the name of each city:

City.	Amount of Fund.	City.	Amount of Fund.
Blackpool	£6,342	Newport	£1,000
Dundee	20,992	Northampton	2,070
Great Yarmouth	1,200	Oldham	2,375
Hull	63,000	Salford	30,439
Ilford	5,636	West Ham	10,092
Liverpool	214,398	Wolverhampton	13,498
Newcastle	28,658		

THE DISEASES OF STEEL WHEELS

It frequently happens in the operation of a car that some trouble will be hastily diagnosed as a wheel defect or disease that may properly belong to some other part of the mechanism, just as one organ of the human mechanism may suffer in sympathy with a diseased part, or a pain may manifest itself in a place remote from the real seat of the trouble, as acute indigestion may develop intense pain in the chest or back. So when steel wheels are failing abnormally it is not always safe to jump to the conclusion that it is the fault of the wheel itself.

For example, sharp flanges are frequently attributed to inequality in the hardness of the metal of the two wheels on the same axle. It is easy to say, if the treads are not of the same hardness, the softer one will wear away more rapidly, and that its flange will be crowded against the rail by its larger mate; a soft flange would run sharp under such conditions, and therefore, as the flange does run sharp the wheel must have been soft. So the circle of logic is complete, the wheel is condemned, the maker is asked to replace it, and the process is repeated until it dawns upon the man in charge that possibly the real ailment may be elsewhere. As a matter of fact, it is doubtful whether any one of the thousands of claims of soft wheels causing sharp flanges was ever sifted to the bottom to ascertain whether there really was any difference in the hardness of the wheels or not. Probably when this is done the result will be a surprise, as it may indicate there was no difference between the two, or that the more badly worn wheel was the harder.

Hard spots do, however, appear in steel wheels and ties, but they can more frequently be traced to the service to which the wheel has been subjected rather than to inherent qualities of the steel itself. Steel as now made and rolled into ties is remarkably homogeneous, and we have a metal available for tires that was undreamed of forty years ago. So, while no claim can be made that the hardness and wearing qualities of all parts of a wheel will be identical, to say nothing of those of the same lot, the differences are slight and can scarcely be counted upon to affect the wearing qualities. There is, however, a wide difference between wheels of the several makers, and care should be taken that no two are put upon the same axle. The carbon content and resultant physical conditions range between very appreciable limits, running from .55 to .70 per cent. Of course wheels of these varying characteristics cannot be expected to run well together. But, when an off-hand diagnosis of variation of hardness is given in explanation of abnormal wear or performance, the statement should not be accepted until proof of its soundness is produced.

FIG. 1.—SPECIMEN OF BURNED STEEL

It must not be supposed, from what has been said, that variations of hardness do not occur. The temperature to which a tire is heated, its manipulation under the hammer and the rolls, as well as the finishing temperature, have much to do with the final physical condition. In short, as a general proposition, it may be stated that the finer the grain the better the physical and mechanical properties of the steel. This fineness depends primarily upon the finishing temperature and the annealing temperature. So carelessness in attending to either of these two points will cause changes of structure that in turn will vary the hardness in the way so often claimed and so seldom proved.

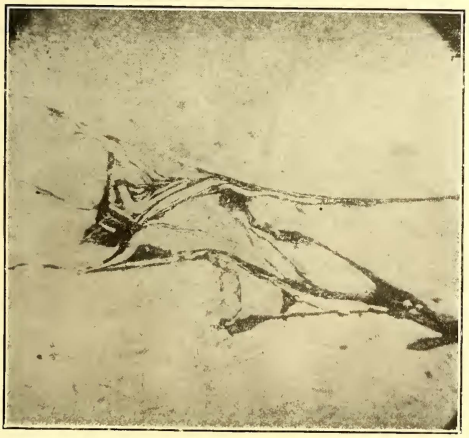


FIG. 2.—SLAG FLAW IN STEEL TIRE, SHOWING FOLD OF METAL NEAR THE SURFACE OF THE TREAD

FIG. 3.—SLAG CRACK IN STEEL TIRE

The same carelessness of manipulation that may result in a variation of the hardness of one or a lot of wheels, if extended to the heating of the tire, preparatory to rolling, may produce very bad results. It causes a burning of the metal, reducing the carbon content locally, and after melting the pure iron that is so produced may develop an oxide of iron, as in the dark spots shown in Fig. 1. These spots cannot be

FIG. 4.—FERRITE SHELL ABOUT STEEL TIRE

seen with the naked eye, but must be looked for with a microscope of high power. Ordinarily they are too small to be indicated even by a trace in a chemical analysis, though they will manifest their presence in a tensile test through a weakening of the metal by a percentage much above their own proportion of the cross-section of the material. External inspection is of no use in detecting this defect, and the testing of one tire from a lot offered for shipment will do no good; for it is usually a case of individual treatment affecting a single tire only, or possibly a few heated at the same time.

The shelling out of steel tires, like the similar phenomenon in the case of cast-iron wheels, is due to a defect of the material's structure. It is more apt to appear in wheels made direct from castings than in tires rolled from a section of an ingot. In the steel casting it is exceedingly difficult to produce a blank entirely free from blow-holes and quite impossible to detect their presence in the finished wheel, when they do not reach the surface, without destroying the whole. So, when such a defect exists and the metal is subjected to a rolling or hammering process, these blow-holes are squeezed out into fine thin lines, forming an incipient crack down in the body of the metal that eventually will reach the surface and cause a fracture. When it causes merely a chipping off or shelling out of a small piece from the tread it is called by the latter name; but the same kind of original defect may result in a broken flange. When the steel casting is not subjected to any mechanical treatment after having been poured the wearing qualities are invariably deficient and the wheel is uneconomical, though of ample strength to sustain the stresses imposed.

Shelling-out of steel tires is also apt to occur where they have been subjected to a heat treatment subsequent to their original finishing, whether this be done in the course of making them into wheels or prior thereto. This treatment may be an overheating by which the metal is burned, or it may induce such stresses and internal strains that fine cracks are formed on the surface or down in the body of the tire. These latter cracks eventually reach the surface and show themselves either by the loosening of a small piece, which is called "shelling out," by the breakage of a flange or, more rarely, of the rim.

The final and more common cause of shelled-out and cracked tires is probably slag in one form or another. In making the ordinary tire, the top end of the ingot is cut off in the usual way to remove the piping and segregation occurring immediately below it, together with the slag gathered in and on the upper portions. A saving of metal is gained in comparison with that necessarily removed for rails and plates by cutting the ingot across in sections and punching a hole through the center.

The material removed in punching this hole cuts away around the piping and may remove the segregated portions entirely, so there is an inducement to use a larger proportion of the ingot for tires than would be possible were not this central core removed. The result is that in crowding up towards the top of the ingot for material for tires, metal is apt to be cut off in the sections for use that has either entrapped some slag within or is coated with it on the outside.

In the hammering and rolling to which the metal is subjected in the making of the tires, this slag is driven into the interior and, having been squeezed into a fine hair line, forms the incipient and invisible crack no inspection can detect, and which afterward, by the rolling action of the wheel, is to elongate, reach the surface and manifest itself in shelling-out or cracking.

Again chemical analysis is of little use. The particles of slag are usually too minute to show even a trace, though they are frequently quite sufficient to cause a difference of

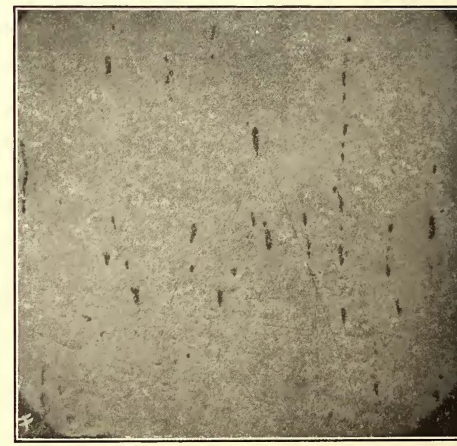


FIG. 5.—SLAG SPOTS IN STEEL TIRE

20 per cent in the tensile strength of two specimens taken an inch apart from the same piece of metal.

When the slag occurs in the body of the tire it usually appears as a thin streak, forming a lamination with a number of branches that give it a rough appearance. Sometimes it will show as a single stem, but usually there are two or more together and approximately parallel as though formed by a single bubble of slag that had been divided by the pressure of the sound metal and the two or more parts so formed rolled

out in parallel lines. At other times the slag will appear in the form of small flattened dots arranged in parallel lines with more or less regularity. But whether in continuous or dotted lines, the direction is generally parallel to the surface of the tread.

When the slag occurs at or near the surface of the tread, the appearance is quite different. It will then show in folds and twists illustrating the directions of flow of the metal into which it has been forced or with which it has moved under the direct action of the rolls or hammer. Sometimes such slag flaws drop down, practically at right angles to the surface, and again they are so twisted that they shoot off into the metal at all conceivable angles. Such flaws do not necessarily develop into visible cracks any more rapidly than those that are buried more deeply and lie parallel to the surface. In fact such flaws have often been found in what appeared to the eye to be perfectly sound portions of a tire that had developed shelled-out spots in other places. In this connection it may be stated that the mere fact that but one or two shelled-out spots have appeared on the surface of a wheel is no sign of that being the only defective portion. If such a tire is examined, it will usually be found that the slag flaws extend throughout its whole extent, at least near the surface, so it is defective through and through. It is therefore only a matter of time when the whole surface would be mottled with shelled-out spots if the running could be continued until that time.

While slag flaws and their later development, the crack or the shelled-out spot, are peculiarities in the way of a disease that belongs to the steel tire, the trouble has not as yet manifested itself to any great extent upon electric railways. The metal of which these tires are made is exceedingly strong and durable. Running as it does with a carbon content of more than .60 per cent in American tires the tensile strength will range from 110,000 lbs. to 124,000 lbs. per square inch of section. It is also very hard, and naturally the cold rolling of this metal to elongate the flaw takes time and power. The power can be obtained only in connection with a wheel pressure on the rail, so that light equipment suffers but little. The spot most affected in railway service is under the tenders of large engines, where the wheels are small and the loads excessive. On locomotive driving wheels the trouble is rare, probably due to the employment of carefully selected material and the large diameter of the tread, by which each portion is brought into contact with the rails less times per mile than is the case of those under the tender. With heavy electric cars running on city streets the trouble with shelling-out will be more frequent, and this frequency will be increased by the use of short wheel bases and numerous crossings, by both of which the blows received by the wheel will be increased, the one adding to the intensity and the other to the frequency. A combination of the two naturally will lead to the quickest results. In concluding this portion of the subject it may be stated that when a shelled-out spot appears in a steel-tired wheel the owner may look for slag with the almost absolute certainty of finding it.

It often happens that when a steel-tired wheel has been in service for a time the rim will be rolled over into the form of a head on the outside. This may or may not be indicative of a softness. All steel tires have a certain amount of ductility ranging from 10 to 18 per cent of elongation in a tensile test specimen. The rolling and pounding to which the wheel is subjected in service naturally causes the metal to flow, and the only direction in which such a flow can take place is toward the outer face of the rim where a head may be formed. The heavier the car and the greater the amount of pounding the sooner the head will be formed, while the more ductile the material the larger it will become before it finally cracks and splinters off.

Sometimes this formation is helped by the heat treatment accompanying the making of the tires. It often happens that a very thin shell of ferrite or pure soft iron is formed around the outside of the tread. The result is that this is quickly rolled out into a head when it is put in service, as it is very ductile. Where this ferrite extends to any great depth the rate of wear and the rolling out would be correspondingly rapid, but this rarely occurs and the ordinary steel structure will be found at once. It is never found in tires that have been turned before using. This ferrite shell is also apt to be broken by slag enclosures that quickly scale off after the manner of shelling-out, but such spots are usually very small and can only be seen by an immediate inspection before the surface has had a chance to be rolled out smooth. Under the microscope this ferrite appears as a thin white band outside the steel, and is shown in Fig. 4.

From what has been said it will be seen that, while the diseases of steel-tired wheels are very insidious and difficult to detect until they have reached their full development, they do not involve any serious menace to the property equipped with them. That they seldom occur is due to the care with which the product is made, and that they can be obviated is evident, provided the same care is extended all along the line of the manufacture of the steel and the rolling into shape. This is evidenced by the rarity of the manifestation of these diseases, for a search through thousands of new wheels might, and probably would, fail to bring a single case to light. It is this fact, coupled with the good wearing qualities of the wheel, its safety and its capability of keeping a car at work and out of the house for wheel repairs, that has led managers to regard it as an economical one for heavy urban and interurban service.

TESTING FOR LIVE AND GROUNDED CAR PARTS

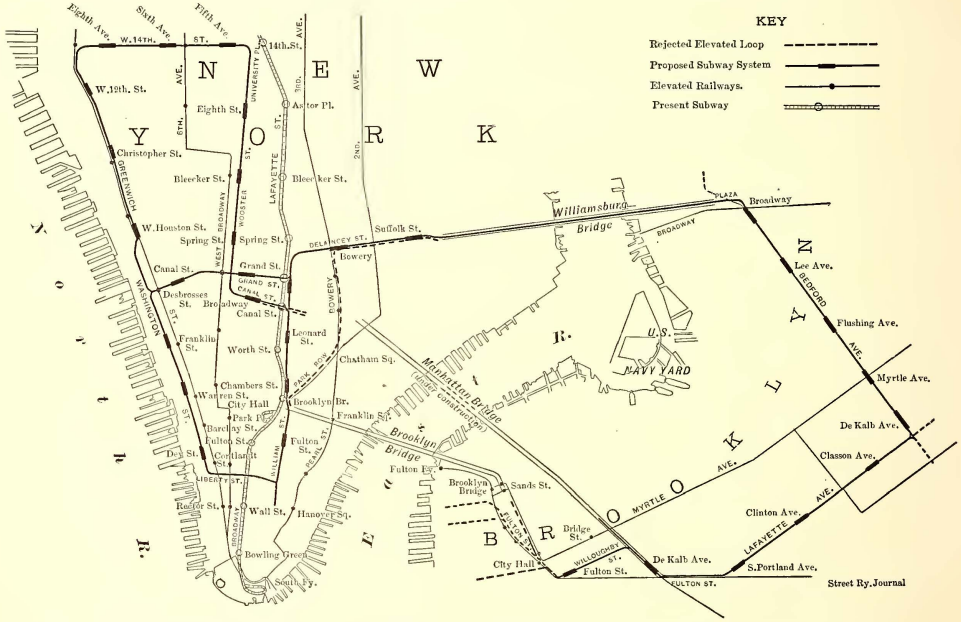
Car parts normally intended to be charged in operation may become grounded and cause irregular action therefrom; similarly, car parts normally intended to be grounded in operation may produce complications as a result of becoming charged. Thus, the resistance metal of a starting coil is normally charged in operation; if it becomes grounded, the starting current will pass to rail without reaching the motors and any effort to start the car will blow the fuse or breaker. The operating controller frames are normally intended to be grounded so that should internal controller insulation become defective the frame will not become charged and shock a person touching it and a grounded part at the same time. The first condition of ground is dangerous, because the resistance hangers and supporting bolts become charged and able to shock or burn a pitman working under the car; also under special conditions passengers in the car may be shocked. A charged controller frame jeopardizes the safe handling of the car by the motorman and is a litigation-breeding menace to passengers boarding and alighting. In case of either charged or grounded condition, the exact location of the fault can be determined with a voltmeter. To test for a grounded part, connect one end of the voltmeter to trolley and use the other end to explore the suspected area and its connections, after all intentional ground connections to that area have been disconnected. The instant the exploring end touches a grounded part, the voltmeter will deflect, because current from the trolley passes through the meter to and through the fault to earth. To test for a charged part, ground one end of the meter and explore with the other. Contact with a live part will cause deflection because the live part becomes grounded through the meter.

PROPOSED SUBWAY SYSTEM TO CONNECT THE BROOKLYN AND WILLIAMSBURG BRIDGES

For nearly half a generation efforts have been made to relieve the passenger congestion at the New York end of the Brooklyn Bridge caused by the home rush of the many thousands of Brooklynites employed in New York. The terminal facilities have been enlarged several times, so that now elevated trains are operated on 55 seconds headway and the surface cars form an almost continuous chain broken only by the eight loading loops at the New York terminal. All of the elevated cars over this bridge, including the local service, are operated by the Brooklyn Rapid Transit Company, while the surface cars are operated by the Brooklyn Rapid Transit Company and the Brooklyn & Coney Island Railway Company.

It was hoped that the completion of the Williamsburg Bridge with its four surface tracks and elevated railway structure would afford great relief to the older bridge. This, however, did not prove to be the case. The Williamsburg Bridge simply opened a new territory which hitherto had been served chiefly by the ferries. The old bridge is in the center of New York's down-town business district, which through its many sky-scrapers has an abnormally high business population for its small area. The new bridge terminates in the "East Side" tenement district, almost a mile from the offices and stores. Owing to franchise difficulties between the city authorities and the local railway companies, the elevated tracks on the new Williamsburg Bridge are not connected to either of the elevated systems in New York and Brooklyn. The New York surface cars run over the two tracks on one side of the bridge, carrying passengers to the plaza at the Brooklyn terminal, while the Brooklyn local bridge cars run on the two tracks on the other side to the New York end, but as there are no loops at either end the number of surface cars operated is far below the maximum. In fact, traffic congestion began at this bridge from the day it was placed in service. The continuation from the Williamsburg Bridge roadway on the Manhattan side is Delancey Street, which has been widened up to the Bowery for parkway purposes.

It is apparent that if the two existing bridges had some form of railway connection, passengers desiring to ride over either would not have to go to the terminals, and thus the congestion at those points would be reduced. To accomplish this purpose alternative plans were proposed as follows: Brooklyn interests advocated an elevated railway through several East Side streets as far as the Brooklyn Bridge; New York residents, particularly those of the East Side, bitterly opposed the suggestion for an elevated railway, and favored a subway route that could go also through streets not available either for elevated or surface operation.



MAP OF PART OF MANHATTAN ISLAND AND BROOKLYN, SHOWING PRESENT AND PROPOSED RAPID TRANSIT LINES

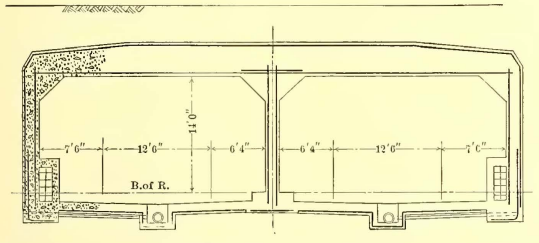
After several hearings, the New York Rapid Transit Board, at its October meeting, definitely rejected the elevated scheme and ordered specifications prepared covering the down-town subway route shown in the accompanying map, presented by George S. Rice, chief engineer to the commission. This decision was based very largely on a report submitted by Mr. Rice on Sept. 13, 1906, of which an abstract appears in the following paragraphs:

ELEVATED RAILWAY PROPOSAL

The suggested elevated railroad connection was to start at the Williamsburg Bridge, pass through Delancey Street to the Bowery, thence through the Bowery and Park Row and North William Street to the Brooklyn Bridge. Surveys were made of the elevated structure as it exists along the Bowery and Park Row, and designs for a structure to take care of the travel between the bridges. On Delancey Street it was proposed to construct an elevated railway with columns

about 22 ft. apart near the curb of the parkway, occupying the center of the street. Along the Bowery and on Park Row it was considered preferable to reconstruct the elevated railway instead of adding new columns by so strengthening the structure that it would have been capable of caring for a double-deck railway, the lower level carrying the local tracks and the upper deck the loop tracks. Provision was also made to have the upper deck removed eventually without disturbing the lower tracks.

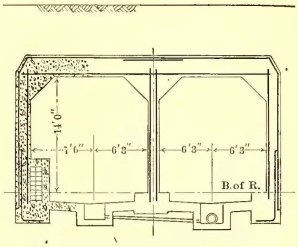
A station was contemplated at the intersection of Delancey and Allen Streets, the Bowery and Grand Street, and another at Chatham Square, all conveniently connecting with the present stations on the Third Avenue Elevated Railroad; also a station on Park Row near Duane Street, to connect with the Brooklyn Bridge terminal. The cost of this structure was estimated at about $1,800,000 for construction. The values of abutting property was estimated at about $14,000,000, and taking 12½ per cent of this as an approximate value of the damage caused along the whole route, according to Mr. Rice, the total cost of an elevated connection would be $3,550,000. This elevated loop, after the necessary legal steps had been taken, could have been built in one year.



Cross-Section of Four Track Subway.

Scale ⅛" = 1 ft.

Street Ry. Journal



Cross-Section of Two Track Subway.

SECTIONS OF PROPOSED INTER-BRIDGE SUBWAY

LINES OF TRAVEL

Some studies were made during the greater part of August in connection with the travel and lines of distribution of the passengers on the Manhattan side of the Brooklyn and the Williamsburg Bridges. It was found that during the two morning and evening rush hours, from 7 a. m. to 9 a. m. and from 5 to 7 p. m., respectively, about 20 per cent of the people using the Brooklyn Bridge depart from or arrive at the bridge entrance upon the subway, elevated and surface cars. The remaining 80 per cent walk to and from the bridge entrance. Of these latter 65 per cent are from the districts to the east, south and west of the bridge entrance. The remaining 15 per cent come from the north through Park Row and Center Street. This 15 per cent is the only class that would be accommodated by an elevated loop through the Bowery and Park Row.

At the Williamsburg Bridge about 40 per cent of all people using the bridge in both directions cross it in the New York cars. Of the remaining 60 per cent, 25 per cent would be accommodated by the elevated loop. The remaining 35 per cent come from territories north, south and east of the bridge entrance.

THE PROPOSED SUBWAY SYSTEM

A subway connecting the Williamsburg and Brooklyn Bridges would be made a part of the comprehensive system laid out by the Rapid Transit Board and set forth in its 1905 report. Any part of it could be constructed as additional rapid transit facilities where demanded by the increased traffic between New York and Brooklyn. The subway system as laid out has the advantage of distributing the passengers in both boroughs and carrying them to or near their destinations instead of unloading them at one or at a few stations a long distance from the goal of the greatest number of passengers. The elevated scheme, it was thought, would cause a congestion of traffic at the few stations available.

In the plan submitted by Mr. Rice, the subway lines form a complete system of connection between the two bridges and with provisions for future connections in Manhattan Borough and with additional routes between Manhattan and Brooklyn, namely, on Fourteenth Street, Maiden Lane and Old Slip, as well as at Brooklyn Bridge.

The route for Manhattan is laid out as follows: Beginning at Williamsburg Bridge, it passes through Delancey Street to Center Street, through Center Street to Brooklyn Bridge; under Park Row to William Street, and through William Street to the neighborhood of Wall Street; from Centre Street and Grand Street, through Grand Street and Desbrosses Street to Washington Street, through Washington Street and Liberty Street to William Street; from Centre Street and Canal Street, through Canal Street to Wooster Street, thence through Wooster Street and Washington Square East and University Place to Fourteenth Street, through Fourteenth Street to Greenwich street, and through Greenwich Street and Washington Street to Desbrosses Street. The estimate for this portion of the subway route is as follows:

BOROUGH OF MANHATTAN

A 4-track subway from the Williamsburg Bridge terminal, which is now under construction, to the Brooklyn Bridge	$3,400,000
Change of Brooklyn Bridge approach to connect to subway	750,000
A 2-track subway from the Brooklyn Bridge through William Street to a point north of and near Wall Street	700,000
A 2-track subway on Grand Street and Desbrosses Street, from Centre Street to Washington Street	1,530,000
A 2-track subway on Liberty Street and Washington Street, from William Street to Desbrosses Street	2,100,000
A 2-track subway on Washington Street from Desbrosses Street through Greenwich Street, Ninth Avenue, Fourteenth Street, University Place, Washington Square East, Wooster Street and Canal Street to Centre Street	5,600,000
Easements (estimated)	2,000,000
Total	$16,080,000

In Brooklyn, the plans submitted show a loop connection between the two bridges, with provision to connect with the future lines from Manhattan, as mentioned above. The route in Brooklyn is laid out as follows: Beginning at Brooklyn Bridge, descending from the elevated tracks on the bridge,

utilizing the bridge storage yard parallel with Washington Street for the descent, it passes through Washington Street to Fulton Street; thence through Fulton Street and Willoughby Street, and Flatbush Avenue Extension to Fulton Street; through Fulton Street to Lafayette Avenue; through Lafayette Avenue to Bedford Avenue; through Bedford Avenue and Bedford Avenue Extension, and across Williamsburg Bridge plaza to the Williamsburg Bridge. The connection from the elevated tracks at the Brooklyn end of the Brooklyn Bridge to the subway in Fulton Street is a new addition to the system, and was not included in the routes previously laid out by the Board.

The estimated cost of constructing the lines as described above is as follows:

BOROUGH OF BROOKLYN

A 2-track connection from the elevated tracks on the Williamsburg Bridge to the subway at the intersection of Bedford Avenue and Broadway	$420,000
A 4-track subway on Bedford Avenue and Bedford Avenue extension, from Broadway to Lafayette Avenue	2,520,000
A 4-track subway on Lafayette Avenue from Bedford Avenue to Fulton Street	2,050,000
A 4-track subway on Fulton Street from Lafayette Avenue, through Flatbush Avenue extension, Willoughby Street and Fulton Street to Myrtle Avenue	1,830,000
A 2-track connection from the subway at Myrtle Avenue and Fulton Street to the elevated tracks on the Brooklyn Bridge	410,000
Easements (estimated)	200,000
Total	$7,430,000

Any part or the whole of this subway, in both Manhattan and Brooklyn, can be constructed in two years after the time of letting the contracts.

Attention is called in Mr. Rice's report to the fact that the greater part of this subway loop has been presented to the Appellate Division of the Supreme Court for its decision, in lieu of the consents of the property owners, and it is expected that a decision will be rendered about the end of this year.

It is interesting to add here that on Nov. 20 the New York State Railroad Commission at a hearing in New York City issued the following statement with reference to the "L" loop.

"No favorable action has been taken on the board's suggestion for the construction of an elevated connection between the New York ends of the Brooklyn and Williamsburg Bridges. The construction of such a connection would enable the operation of elevated trains in both directions over these bridges, and the present location of elevated structures in the Borough of Brooklyn is such that trains could be so operated as to make a circulating medium through the business and outlying residential sections of that borough. The method of operation would obviate delay and inconvenience caused by the transfer now made at the Brooklyn end of the Brooklyn Bridge, and prevent the congestion which now occurs at the New York end of both bridges in certain hours of the day."

On the same day a meeting was called by several civic organizations in Brooklyn to consider ways and means for hastening the building of an inter-bridge connection. Particulars of this meeting will be published in the next issue of the Journal.

The United Railways Company, of St. Louis, has inaugurated a new express car service over the St. Charles line. The express makes two round trips daily. The new car has all modern improvements and is said to be one of the finest of its kind.

STEEL RAILS *

BY ROBERT JOB

Twenty or thirty years ago steel rails did not cause the difficulty which is found with the present product. This condition, which is only too familiar to every railroad man, is due to a number of causes.

In the first place, a vastly greater tonnage is handled to-day by the mills, and the same care is not used in the preparation and cropping of the ingots, while in the rolling much higher finishing temperatures are maintained, resulting in coarser structure with relatively rapid wear. In many cases the composition is better to-day than formerly, yet in spite of what under present practice would be considered dangerous composition, it is a well-known fact that the old rails gave generally excellent service, this being due largely to thorough working of the steel down to a low finishing temperature. In Fig. 1 we see the structure of an old 67 John Brown rail rolled and laid in 1864, and in track for thirty-four years. The composition was as follows:

	Per Cent
Carbon	.330
Phosphorus	.039
Manganese	.390
Sulphur	.030
Silicon	.070

The sections of photomicrographs throughout this paper are taken from the center of head and are magnified fifty diameters.

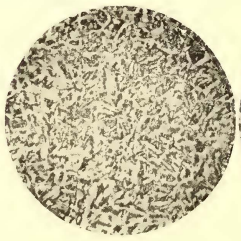


FIG. 1

FIG. 2

Fig. 2 shows the structure of an 80-lb. rail of somewhat the same general composition as that above, namely:

	Per Cent
Carbon	.396
Phosphorus	.072
Manganese	.660
Sulphur	.033
Silicon	.286

This rail was rolled a few years ago and gives a good indication of the far greater coarseness of structure of present practice. Under the same traffic the one has given long service while the other would cut out rapidly.

Fig. 3 represents about the coarsest structure obtained at present practice, 90-lb. section, the composition being:

	Per Cent
Carbon	.620
Phosphorus	.094
Manganese	1.000
Sulphur	.033
Silicon	.100

Such a rail wears relatively rapidly, tending to brittleness when the steel is unsound.

Fig. 4 shows about the average of the better grade of present practice, 90-lb. rail. Structure of this character is much tougher and safer than that indicated by Fig. 3.

* Abstract of paper presented at the meeting of the New York Railroad Club, Nov. 16, 1906.

On noting the vast differences which have been shown, the question at once arises, why is not the former close-grained show wearing structure produced to-day? Is the change due merely to the insistent efforts of the mills for higher tonnage or do other elements enter into the case. The answer is complex. In the first place the increased weight of the present sections of 90 or 100 lbs. per yard instead of 60 or 65 lbs. has radically upset the ratio between the various components of the area of the rail, that is, head, web and flange. The former is far thicker and of much greater mass than formerly, while the other parts in many cases have increased but little in thickness or even have decreased. As a result of these changes the flange gets to the lowest temperature at which it can be rolled long before the head reaches the same temperature, so that even though the flange be fine grained and tough, as fine even as was obtained in the old practice, the crystals of steel in the head may be very coarse, since they were growing in size from the time that pressure upon them in the rolls ceased until the steel at that point had fallen below a dull red heat. This condition would mean relative rapid wear and brittleness.

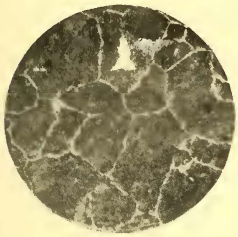


FIG. 3

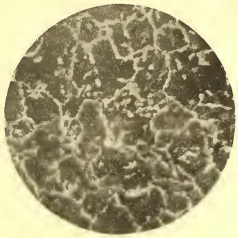


FIG. 4

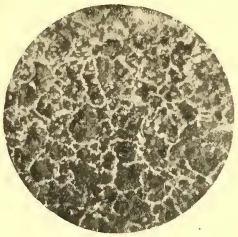


FIG. 5

FIG. 6

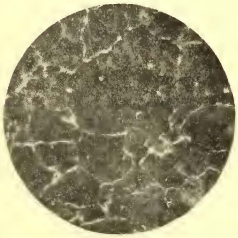


FIG. 7

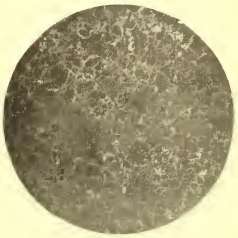


FIG. 8

From the above it is evident that in order to get fine grained structure clear to center of head two courses are open. First, to rearrange the proportions of the rail in such manner that each component part shall reach the critical temperature at more nearly the same time, as in the old sections, or, secondly, to change the heat treatment given the steel, either during the rolling or subsequently. By the first method the large crystals would be prevented from forming, while by the second, even though formed, they would be broken up by the reheating.

In some mills it is common practice to hold the rail before the last pass with the object of giving greater toughness and better wearing qualities to the steel owing to the finishing at a lower temperature. Unluckily the plan is of little benefit, since thereby a fairly fine granular structure is produced to a depth of only about an eighth of an inch from the surface. This, in service, is quickly worn away, exposing the coarse structure beneath. The general character is clearly shown in Figs. 5, 6 and 7; Fig. 5 represents the condition immediately at the surface of a 90-lb. rail; Fig. 6, ⅜ in. from the top of head, and Fig. 7, ¾ in. from the top, or at about the center of head. What is needed is thorough working of the steel throughout its mass at a temperature as near as possible to its critical point.

Annealing will remove the coarse granular structure and give an appearance similar to Fig. 8, but will also lower the elastic limit and produce a rapid wear. Unfortunately, annealed rails, with their freedom from brittleness and from internal strains, are of hardly more than theoretical interest, since they cannot be obtained in any considerable quantities under present conditions.

The form of section also has a decided influence upon the mechanical strength of the rail, that is, with steel of precisely the same composition and degree of porosity one section will tend to support loads better and show greater freedom from crushing and splintering than will another section of the same weight per yard. This square-headed rail like the A. S. C. E. section will hold its angle for only a comparatively short time under heavy traffic, and it is also a matter of frequent observation that when porosity of the steel is present, rails of the square-headed type have a much greater tendency to sliver and crush along the outer edge than do rails with a more angular head, the reason evidently being that the mass of metal supporting the edge is very much less in the former than in the latter. A typical case of this breaking down of the outside edge of an unsound rail of the A. S. C. E. section is shown in Fig. 9. This rail, and a number of others rolled at the same time, had gotten into this condition after service of only two months, while other rails in the same lot and immediately adjoining the defective ones were unaffected. Etching of the surface showed, as seen in this figure, that the difficulty was due to defective manufacture, unsound steel, while those which gave good service were found to be practically free from porosity.

The appearance of the fracture of a rail which has failed owing to overloading is distinctive, and is shown in Fig. 10. The fracture generally takes place immediately over a tie, due, of course, to the repeated straining of the metal beyond its elastic limit. At first, merely a hair crack is found. This, with repeated bending, gradually extends into the rail and the broken surfaces become smooth and darkened by oxidation, as shown in the figure. Finally, the remaining metal is too slight to support the weight of a passing load, and the final fracture occurs. We have taken one of these light rails from the track, broken it under the drop, and found one of these typical cracks developing over each tie, showing clearly the need of close watchfulness in the maintenance of track subjected to heavy traffic. The rails here exhibited were of 79-lb. weight.

We have referred above to the necessity of avoiding porosity and unsoundness of steel if good service is to be obtained. Curiously enough a frequent characteristic of nickel steel is somewhat allied to this condition. It is a matter of general observation that nickel steel rails have not given the service

which was anticipated and hoped for, but that there has been a tendency to sliver and to have a life not at all proportioned to the cost. Several years ago while investigating some of these rails we came upon a condition which seemed to account fully for this unfortunate behavior. The rail had the following composition:

	Per Cent
Carbon	.530
Phosphorus	.093
Manganese	.940
Sulphur	.040
Silicon	.082
Nickel	3.480

Upon taking a portion of this rail at center of head, etching and magnifying fifty diameters, we found that the greater part

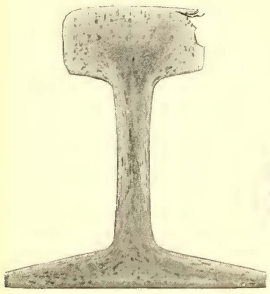


FIG. 9

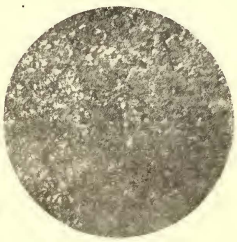


FIG. 11

of the area was exceedingly fine uniform structure, as shown in the upper left-hand part of Fig. 11; there were, however, occasional patches of metal in which relatively large silvery granules appeared, as at the lower right-hand part of the figure, showing that the nickel had evidently not thoroughly melted and diffused through the heat. Consequently the strength of the metal under lateral stress was deficient owing

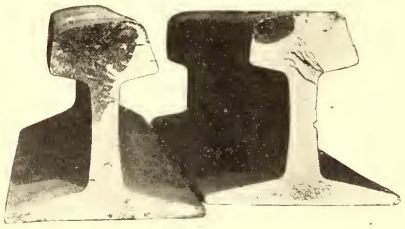


FIG. 10

to the seam lines, although if subjected to direct longitudinal force as in the ordinary tensile test it undoubtedly would have been normal and high.

The important question remains, how can better rails than are now secured be obtained. We have already suggested that by modifying the section of the rail a finer granular form with its inherent toughness and tenacity may be obtained. By insisting upon cropping of ingots clear to sound metal, and by testing a rail-butt which is certainly known to have been taken from the top of an ingot, so that if marked unsoundness be present, the heat may be rejected by the drop test, a reasonable degree of soundness can be secured, and slivering and crushing largely prevented. By increasing the hardness of the rail as much as is compatible with the character of the roadbed, the rate of wear may be decreased, but we believe that further aids are necessary and can before long be obtained. Bessemer rail has filled an important need, particularly in the days of light, easily rolled sections and light wheel loads. Under present conditions, however, there is urgent demand for harder, tougher steel. In the Bessemer rail the hardness, with the proportion of phosphorus usually present, cannot be increased much beyond present practice, say 0.60 or 0.65 per cent carbon, without causing undue brittleness, and hence advantage has been taken of the basic open hearth process by which phosphorous and sulphur can be nearly eliminated. With these elements of brittleness largely removed the proportion of carbon has been increased safely and with very favorable results to nearly 0.90 per cent, thus securing great hardness, together with great tenacity and a very low rate of wear. Bessemer rails will undoubtedly continue to be used for the lighter sections and in locations where traffic is light, but we believe that under the more exacting conditions this quality will before long disappear, replaced by the harder, tougher steel of the basic open hearth process.

WHAT IS AN ENGINEER-CONSTRUCTOR?*

BY GEORGE A. DAMON,
Managing Engineer of the Arnold Company, Chicago

One prominent element of modern industrial life is bigness. We have large business corporations, combined railway systems, extensive manufacturing concerns and comprehensive enterprises in all lines of commercial activity. Another dominant element is efficiency, which may be taken as the key word of modern business life and engineering practice. The constant aim is not cheapness in construction or equipment, but effectiveness, the greatest return for the outlay. These two elements chiefly have brought about a condition in which we have the necessity for a technical organization ready to produce large results in an effective way. Between the desire for bigness and efficiency and its fulfilment, is the field of operation for the creative and constructive abilities of the engineer-constructor.

An engineer-constructor is an organization, and not an individual. It makes possible the most effective combination of technical theory with practical experience, and provides for the use of "team work" in connection with the designing and building of properties. The engineer-constructor should be prepared to carry the proposition through from beginning to end without technical assistance from outside the organization. To be most effective, such an organization should have at its command the technical knowledge and experience of the past; the ability to analyze situations, and discover the truth from conflicting testimony; the imagination to conceive unprecedented results and courage to overcome obstacles; the ambition to improve existing systems, and the honesty to spend money without favor or graft; and finally loyalty to itself and to its client, which will protect in every way the interests of all concerned. The expression that "the team plays as one man" suggests the comparison of the ideal engineer-constructor organization to a modern football team, and, as this idea grows upon one, considerable instruction and inspiration can be found in the analogy.

All the things that might be said in regard to getting together and developing a winning football team could be applied equally well to the building up of an organization to do the work of an engineer-constructor. To carry the illustra-

*Abstract of paper presented before the Electrical Section, Western Society of Engineers, Nov. 16, 1906.

tion further, suppose that the candidates for this new kind of team are lined up; they will be found to include a civil engineer, electrical engineer, mechanical engineer, structural engineer, sanitary engineer, chemical engineer, gas engineer, fire protection engineer, hydraulic engineer, mining engineer, architect, industrial expert, statistician, purchasing agent, construction superintendent, operating engineer and accountant. The efficiency of such an organization for the purpose for which it is created depends upon, first, the perfection of its individual parts; second, upon the skill with which these parts have been brought together; and, third, upon the absence of any unnecessary friction during operation. Such an organization should not be the maker or manufacturer of any equipment, nor be connected with the exploitation of any system of apparatus, nor interested in the introduction of any patented devices. In its highest stage of development it will not be connected except in a technical way with the financial interests which control the enterprise.

In playing an entire game from start to finish, different men will have the ball in nearly every play, but the precision of the team work should be so perfected that every man will be in every play. To assist is fully as important as actually carrying the ball.

To show the possibilities of such an organization, let us pick out a team for the building of some large proposition, for instance, the design and construction of a steam railroad locomotive repair shop, involving the expenditure of from two to three million dollars. The selection of men with their chief duties will then be as follows:

Industrial Expert.
- Designing layout of shops.
- Planning method of handling work.
- Arrangement of tool and transportation equipment.

Electrical Engineer.
- Providing power and lighting equipment.
- Laying out transmission systems.
- Planning telephone and signal systems.

Mechanical Engineer.
- Design of power plant.
- Plan of heating and ventilating.
- Laying out air, gas and steam systems.

Structural Engineer.
- Building foundations.
- Designing steel structures.
- In charge of reinforced concrete construction.

Architect.
- Designing building superstructure.
- Choice of fixtures.
- Laying out landscape work.

Civil Engineer.
- Directing grading.
- Testing of soil.
- Construction of track.

Sanitary Engineer.
- Design of sewage system.
- Construction of waterworks.
- Choice of plumbing.

Purchasing Agent.
- Selecting markets for material.
- Checking bills of material.
- Arranging for delivery of material.

Constructing Superintendent.
- Organization of construction force.
- Consideration of time element in construction.
- Settling labor difficulties arising in connection with construction work.

Operating Engineer.
- Consideration of economies in operation.
- Securing reliability in operation.
- Insuring effectiveness in operation.

Accounting Department.
- Keeping pay rolls.
- Making record of costs.
- Preparing progress reports.

The line-up of the team may be shown by Fig. 1. Here are eleven men, each one selected for his particular ability to solve the problems suited to his individual training and experience. Each man has won his position as the result of a gradual growth which has demonstrated his reliability and resourcefulness. Many of these men have played this game before, and together, and are always eager for a proposition which will tax their strength and skill.

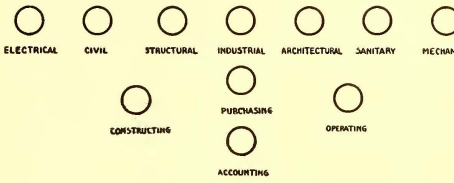


FIG. 1.—LINE UP OF AN ENGINEER CONSTRUCTION TEAM FOR BUILDING A RAILROAD REPAIR SHOP

Let us watch the play. First will come a number of preliminary studies, showing the proposed sizes, designs and relative arrangements of the buildings. There will next be forthcoming a carefully prepared report, showing the advantage of the finally selected arrangement, and the suggested construction of each of the buildings, together with a description of the equipment required. An important part of this preliminary report is an approximate estimate of cost, based upon a careful consideration of all the items involved in the construction.

With the general layout and the preliminary report and estimate approved, the next move is to prepare the plans and specifications. To indicate the scope of this work, the following illustrative classification is shown, the numbers being the key which is placed in each drawing, specification, data sheet, report, or letter which may be originated as the work progresses.

CLASSIFICATION FOR BATTLE CREEK (MICH.) SHOPS, GRAND TRUNK RAILWAY SYSTEM

Contract No. 74. General Index

Sections of Classification

74,000—Organization.
74,100—Building structures.
74,400—Track.
74,600—General equipment.
74,700—Power-plant equipment.
74,800—Tool equipment.

Parts of the Work

A—Yard.
B—Power house.
C—Store house.
D—Oil house.
E—Office building.
F—Locomotive shop.
G—Forge shop.
H—Iron foundry.
I—Pattern shop.
J—Frog shop.
K—Car machine shop.
L—Truck shop.
M—Coach and paint shop.
N—Freight car shop.
O—Planing mill.
Q—Dry kiln.
R—Scrap platforms, sheds, etc.
S—Turn-tables.
T—Yard crane.
U—Pipe tunnel.

Detail Classification

74,000—ORGANIZATION.
74,001—Contract.
74,002—Home-office fixed charges.
74,003—Legal expenses.
74,004—Preliminary reports.
74,005—Surveys.
74,006—Engineering.
74,007—Accounting.
74,008—Construction tools.
74,009—Construction-office supplies.
74,010—Temporary construction.
74,011—General construction labor.
74,012—Superintendence.
74,013—Insurance.
74,014—Traveling and living expenses of representatives.
74,015—Tests.
74,016—Preliminary operation.
74,605—Piping system (except for heating system).
74,606—Lighting system.
74,607—Power system.
74,608—Telephone and signal systems.
74,609—Transportation systems:
Transfer tables.
Turn-tables (large).
Yard cranes.
74,700—POWER PLANT EQUIPMENT.
74,701—Machinery foundations.
74,702—Coal and ash-handling apparatus.
74,703—Grates and stokers.
74,704—Boilers and settings.
74,705—Breeching and connections.
74,706—Stacks and draft equipment.

Detailed Classification—Continued

74,100—Building Structures.
74,101—Preparation of site.
74,102—Excavation and fill.
74,103—Piling.
74,104—Foundations.
74,105—Superstructure masonry.
74,106—Structural steel and iron work.
74,107—Carpenter work.
74,108—Mill work.
74,109—Roofing.
74,110—Sheet metal work.
74,111—Plastering.
74,112—Painting and glazing.
74,400—Tracks.
74,401—Preparation of right of way.
74,402—Grading.
74,403—Tie and track laying.
74,404—Switches and special work.
74,405—Ballasting.
74,406—Fencing.
74,407—Cattle-guards, crossings, signs, etc.
74,408—Bonding.
74,600—General Equipment.
74,601—Drainage system.
74,602—Plumbing and lockers.
74,603—Water system.
74,604—Heating system.
74,707—Heaters, superheaters and economizers.
74,708—Water-softening plant.
74,709—Pumps.
74,710—Air compressors.
74,711—Engines.
74,712—Condensers.
74,713—Piping and covering.
74,714—Generators, compensators, transformers and exciters.
74,715—Switchboard and generator leads.
74,800—Tool Equipment.
74,801—Line shafting and all shafting and motor supports.
74,802—Forge shop blast and exhaust ducts.
74,803—Individual cranes and hoists.
74,804—Traveling cranes.
74,805—Work benches and material racks.
74,806—Fire protection apparatus (except piping).
74,807—Foundations for machine tools.
74,808—Machine tools.
74,809—Erection of machine tools, countershafts, etc.
74,810—Planing-mill shavings exhaust system.

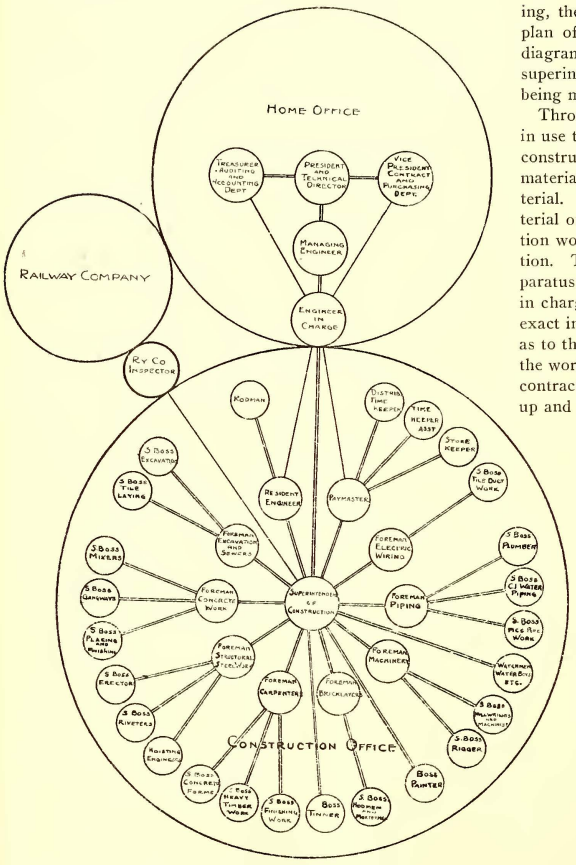


FIG. 2.—ORGANIZATION CHART

The plans should preferably be drawn upon one size of paper and every drawing should be numbered to correspond to the classification. A border and a standard title printed by a draughting room outfit gives a finished appearance to each drawing. Specifications can now be printed very quickly, and when at least twenty copies are required they can be produced in this way as cheaply as by carbon copies, or the better method of blue-printing from a typewritten record.

In purchasing, the engineer-constructor should find some advantage over an occasional buyer. He is in the market constantly, is favorably known by the manufacturer of standard equipment, and buys apparatus delivered f. o. b. cars, doing all erection work as far as possible with his own experts, and calling on the factory for assistance only when necessary.

There should be the greatest unity between the engineering, the purchasing and the construction department. The plan of organization to secure the results is shown by the diagram Fig. 2. It is always better to have the construction superintendent in the office while preliminary decisions are being made and bills of material are being prepared.

Throughout the entire progress of the work, systems are in use to keep all concerned informed as to each move. The construction office is advised by the home office as to the material ordered and as to the probable delivery of this material. The home office is advised as to the receipt of material on the job, as well as to the progress of the construction work, and any reports and advices as to the labor situation. To accomplish the former copies of contracts for apparatus and orders for material are sent to the superintendent in charge of construction. Such reports and orders contain exact information as to the material covered by them, as well as to the time at which this material is expected to arrive on the work. A card system in which are entered all orders and contracts is used in the home office, and is designed to follow up and secure prompt delivery of all material, and apparatus.

In case of any changes in time of delivery of material, the construction superintendent is advised in advance, and is thus in position to make any alterations necessary in his program. The importance of promptly delivering the material on the job cannot be overestimated, and the value of a system that will provide for the delivery of the materials in accordance with an approximate schedule previously arranged for will appeal to all interested in construction work.

Practically all of the material is ordered by the home office. In case, however, it is more advantageous to order small quantities at the seat of the work, such orders are issued by the superintendent, a copy of all such orders being sent to the home office, after which they are recorded and handled in all respects similar to orders issued from the office.

Records of all material received on the job are kept by the superintendent in the form of a material report. These reports are written out in a duplicate book as each shipment is received, and one copy is sent without delay to the main office. This serves to keep the home office very closely in touch with the field work, so far as the receipt of material is concerned.

In construction work consisting of a great many items, such as will be found in railroad shops, it is very desirable to know with a fair degree of accuracy the exact progress of the work. Certain lines of work, such as the delivery and installation of machinery, are dependent upon the progress of

other work, such as the completion of the buildings and foundations. In order that this information may be always at hand, progress reports from the work are received at stated intervals, usually two weeks apart, giving in detail the progress of the work under each classification head. This information is kept in form for convenient reference, and is useful in a variety of ways. Not only do these reports keep the engineering force in touch with the progress of the work, making it possible to more efficiently insure the work coming in proper sequence, but they also provide the information necessary to make decisions as to changes in detail, in case such are found necessary after the work has been begun. These progress reports, together with a record of moneys expended for material and labor at any date, give timely information as to the actual cost of the work as compared to the estimated cost. As such reports are made on the work under each classification heading, any variation of the cost from the estimate is at once detected. This is of importance to the constructor who proposes to complete a certain improvement within a definite estimated cost, and to the client's official who may be charged with the responsibility of protecting a definite appropriation.

Wherever it is possible, curves or diagrams are used to represent the condition of affairs of which record is to be kept. A chart showing the progress of the work on building construction is easily made, and shows very clearly at a glance the exact condition of the work at any time. Such a chart is shown in Fig. 3, which indicates the progress of the work on one of the buildings at the time of completion of the fifth payroll. On this chart the base represents the total estimated cost, and is divided into the various classifications covering the cost of this particular building. In this case these classifications cover excavation and fill (about ⅔ per cent of the total cost), concrete footings and piers (about 6⅔ per cent of the total cost), while the other divisions, such as engine pits, underground heating ducts, concrete superstructure, and so on make up the total cost of the building. At the end of each two-weeks period, the total expense that has been incurred during the two weeks previous is plotted under each classification head, and this area on the chart indicated in such a way as to designate the progress made during the particular period in question. A glance at the chart will show the total amount completed under each classification represented on the chart at the time the last entry was made, as well as the amount of work that was done during the various classifications during each period considered.

Moreover, it is at once evident that, during the period of the fifth payroll, about 10 per cent of the work on the engine pits, 20 per cent of the concrete superstructure, 36 per cent of the brick work, 15 per cent of the sills and coping, 40 per cent of the windows and small doors was completed, and no work was done on the smoke-jacks and ventilators, none on the roofing, and none on the sash operators and foundations. In other words, these progress reports become the graphical history of the job. After having made out the necessary reports covering both the material and the labor that have been used on the work, it is a very simple matter to embody these results in the chart. A copy of this chart is then sent to the main office, where it remains until the time for the next report, at which time it is sent back to the job for the additions that have occurred during the period.

In addition to these some other curves, showing the progress of the work, may be of interest. These contain in

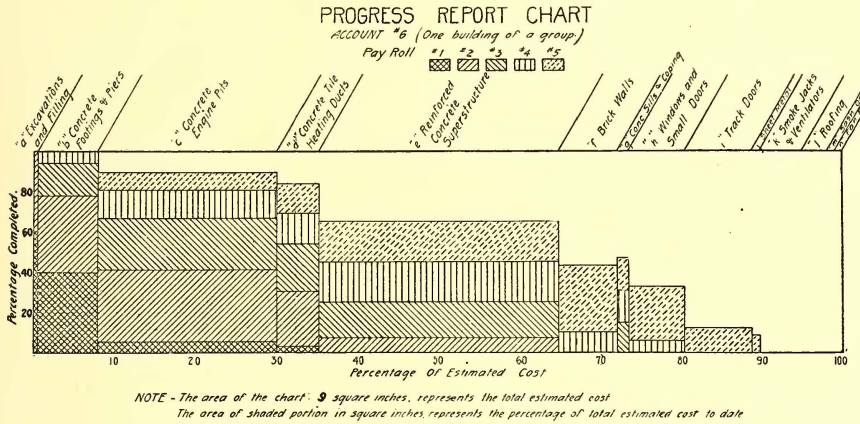


FIG. 3.—TYPICAL PROGRESS SHEET

graphical form a record of the number of workmen employed on the work at all times, together with information as to the number of carloads of material received, the weather conditions, and other matters of interest.

Progress photographs are taken of the work at intervals of about two weeks. These show at a glance not only the general progress of the work, but many construction details as well which are of interest and value. These photographs are of standard size, and mounted on cloth, so as to be bound in convenient form for reference. All the reports just referred to, viz., the progress reports, charts and diagrams, while very easily obtained, and requiring but little work in their preparation, supply a great deal of valuable information, and are of worth far exceeding the trouble and expense contracted in securing them.

Although every facility is provided for keeping the main office and the construction office in close touch, it should not be understood that the engineering is done at arm's length, and that all plans and specifications are devised and completed by an engineering force in the office to be sent down to the construction superintendent on the job for his execution. A competent engineer is in charge of all construction work, and spends a certain amount of time in the field, thus

putting him in close touch with the situation, and enabling him to more efficiently direct the detailed engineering work that is done in the main office.

It would be a big mistake to think that such an organization as is outlined could be got together and perfected in its work in a short time. A winning team is not made in a week, a month, or even a year. It takes time to find the men, to break in raw material to perfect the plays, to develop a system, and to create a loyalty, both inside and outside the team. In the case of the engineer-constructor parallel it will probably take years, and it is evidently for this reason that this very inviting field is occupied by so few organizations who are really prepared to do the work justice. Football players have learned the benefits of concentrated co-operative efforts when applied to their sport much sooner and better than have technical teachers and graduates recognized the same truths as applied to their life work, and yet the advancement of technical progress is certainly more important than the perfection of the game of football. The technical student of to-day is to be congratulated upon having before him such a splendid opportunity in a field which has not been worked harder than that occupied by the engineer-constructor.

It will be instructive to study the development of at least one company which is now prepared to play at this new game of engineer-constructor.

Ten years ago the president of this company was a consulting electrical engineer,—an expert on electrical questions, and in a consulting capacity only. Then came the natural addition of mechanical problems,—still in a consulting capacity. The introduction of the system of rotary converters for electric railway work, and of an improved system of power plant construction, made it necessary to take two contracts in which the results of these two systems, which were advised by the consulting engineer, were guaranteed. Thus a contracting company was formed and a construction department organized. This move developed the fact that the same brains which made the plans for an installation could be mixed with some enterprise and business ability, and thus actually bring about a complete result.

This worked so well that other contracts for complete electric systems were sought and secured, sometimes as engineers, sometimes as constructors, occasionally as both. Civil, structural, architectural, industrial and hydro-electric departments were added as the business grew. Systems of carrying on the work were perfected as experience dictated, and weak parts were made stronger. To-day this company has on its payrolls a technical force of over eighty men, and often employs on its construction enterprises thousands of skilled mechanics, experienced foremen, and unskilled laborers.

Most of the work of this company is done on the basis of "cost plus a percentage," that is, the work is done at actual cost, and then the engineer constructor gets a percentage fee for his services. By an arrangement such as this, the client or purchaser is relieved of the necessity of organizing a technical force of his own, or of employing a number of individual specialists. If the actual construction work is turned over to the engineer-constructor, then the client is relieved of the inconvenience of obtaining proposals and awarding contracts to a large number of separate contractors, with the attendant delays, conflicts and "extras," which the closest supervision will hardly avoid.

The difference between the "cost plus a percentage" and the "cost plus a fixed sum" plans is not generally understood. If an engineer-constructor is thoroughly trained in drawing plans, has sufficient actual experience to make a reliable estimate, is absolutely honest in all things, and has complete control of a competent construction organization, then the "cost plus a percentage" arrangement is the better; but if the work is planned by an engineer and architect, and the actual building work is turned over to a separate construction organization, thus maintaining the old relationship of engineer and contractor, then the "cost plus a fixed sum" plan, no doubt, has advantages. The "percentage" plans express a shade more of confidence between the client and the builder than the "fixed sum" basis.

If the duties of making a preliminary report, preparing a careful estimate, drawing up the plans and specifications, purchasing the materials, building and structures, erecting the equipment, and installing the machinery is turned over to one reliable engineer-constructor organization on a "cost plus a percentage" plan with the privilege to the client of canceling the arrangement at any time, if the progress, quality, or cost of the work should prove to be unsatisfactory, it is hard to conceive of a more effective way of getting results, and it is very probable that much of the important work of the future will be done upon this basis.

Such a business as has been outlined can only be built up by the demonstration of unquestioned ability, and the possession of not only absolute honesty, but also of those qualities which insure what has become known as the "square deal."

NOTES FROM SAN FRANCISCO

As regards the work that is being done at present in San Francisco on the lines of the United Railroads, General Manager Mullally is quoted as follows: "We have more than 1300 laborers at work restoring roads and laying track in this city, and we have a force of 200 down on the San Mateo suburban line fitting it for high speed. Everywhere the work is being rushed. Men are at work repairing the cable roadbed on Powell Street, just as the California cable road had to be repaired. That road, like the east and west lines over the hills, will be restored as rapidly as possible. We are putting in a connection at Haight and Market Streets, and building a trolley line out Haight Street as rapidly as possible. By Dec. 10 the Haight Street trolley will be in operation as far as Scott.

"We have forty-two of the new Chicago cars, and within two weeks we shall have a dozen new suburban cars completed. They are big ones, to accommodate forty-eight passengers. Trolley cars are now being run on Sacramento Street, between Fillmore and Devisadero Streets. By Feb. 1 the Powell Street cable cars will be running, and probably the Jackson and Washington lines will by that time be reconstructed for the proposed cable system, necessary to the hill district on those streets, as far out as Steiner, where connection will be made with the trolley system."

The new loop at the Ferry Building at the foot of Market Street has been completed and is now in successful operation. It has resulted in relieving greatly the congestion at this important terminal. Two inside tracks are used for storing cars and for additional switching. It is also planned to install two inner loops, somewhat on the plan of the terminus at the Brooklyn Bridge in New York, the cars of the different lines being assigned to their particular loop.

The Valencia Street line has been placed in operation, the old rails being used for present operation. Two lines run over Valencia Street—the Twenty-Ninth and Noe Street line and the San Mateo Cemetery line. These both connect with Market Street and give ready access to the ferries.

After the Sutter Street line is finally in shape, work will be started on the Polk and Larkin Streets line.

The steel car described in the STREET RAILWAY JOURNAL for Oct. 13 has been received and will be put in service as soon as it can be fitted up. The car was made by the Pressed Steel Company, of Pittsburg, and was ordered as an experiment. If it proves a success it may become the standard type of car to be ordered in the future.

The United Railroads has installed temporary lights along Sutter Street, and soon will have the lights as far as Valencia Street, on Market Street. As soon as possible the company will install permanent lights on ornamental poles. The lighting of these streets by the company is the result of the agreement entered into by the company in return for the permit to use the overhead trolley system. The officials say that the cost of maintaining the lighting system will more than pay for what the permit would be worth to the city.

Plans are now being made by the United Railroads to take care of the rush during the holidays. The Tenth Street line will be put in operation to take care of the shoppers from the Mission who wish to get to the new retail district of the city. The new cars will start at Brannan Street and run along Tenth Street, across Market Street at Polk Street, and then on by way of Polk and Grove Streets to Larkin Street and on to Post, where they will turn and reach Sutter Street by way of Polk Street. They will run out Sutter to Devisiadero Street. This plan the officials hope to have in full swing before the holidays.

The United Railroads has resumed service on the California Street and Cliff House line, which runs from Presidio Avenue and Sutter Street via California Street and Bakers Beach to Sutro baths and the ocean. The road has been shut down since April 18.

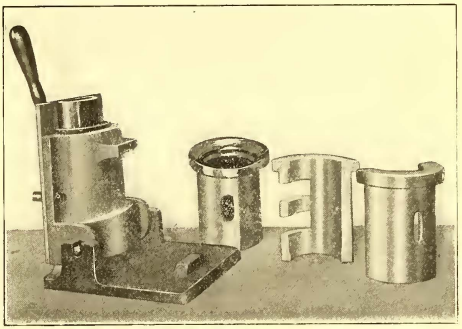
The Parkside Transit Company, organized by the Crocker and other interests of the Parkside Realty Company, has made preliminary petition to the Board of Supervisors for a twenty-five year franchise to construct and operate a street-car system over the following route: From the juncture of Ocean and Corbett Avenues through private ground to Nineteenth Avenue, and crossing the latter, in a westerly direction to what would be the line of Market Street extended; along Market Street's western terminus; thence through private ground northwest to the Great Highway. Also along portions of W, V and T Streets and Thirty-Third, Thirty-Fifth and Forty-Sixth Avenues. Also along Nineteenth Avenue from H Street to its southern terminus. At a meeting of the Board on Nov. 5 the realty company was granted the temporary right to lay tracks and run cars upon a gridiron of streets in the Sunset District, including the entire stretch of Nineteenth Avenue. The application of the transit company for a permanent franchise is still before the Board, however.

La Campania Industrial Jalisciense, of Guadalajara, is reported to have closed a contract through B. Targa, its electrical engineer, with Geo. Ulrich, a contractor, for the construction of an electric line running from Epigmenio Gonzalez Street, through Calle de Presa to Agua Azul, thence to Alameda, Independencia and Moro Street, passing in front of the cemetery to Atemajac. From there it will proceed on to La Experiencia Street This entire portion of the line is situated in one of the most beautiful and picturesque parts in the entire country. The large avenues passing through great groves of trees form one of the most interesting bits of scenery, equally appealing to local residents and tourists.

A MOLD FOR BABBITTING BEARINGS

The Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y., has recently brought out a very simple babbitting mold which is especially useful for babbitting the bearings of railway motors. Many of these molds have already been sold to electric railway companies.

The body member of the mold is a semi-cylindrical structure trunnioned on a base plate. The interior of this structure is adapted to hold the journal to be babbitted. After the journal is in position the top plate is locked over the recess and the entire trunnioned portion raised to a vertical position, both operations being performed with the handle. The babbitt metal then is poured through one hole at what is now the top of the semi-cylindrical section, while the air escapes through another vent at the same end. After restoring the mold to the horizontal position, the cover is unlocked and the babbitted bearing removed.



MOLD FOR BABBITTING BEARINGS AND COMPLETED BEARINGS

COURT TO HEAR CONEY ISLAND CASE IN DECEMBER

A hearing in the case of a five-cent fare to Coney Island over the lines of the Brooklyn Rapid Transit Company before the Court of Appeals in Albany, is set for Dec. 3. If it is determined by this court that the company has not the legal right to demand a ten-cent fare to Coney Island, the Brooklyn Rapid Transit will be called upon to redeem the thousands of receipts for fares which it has been issuing to those traveling to the Island since the compromise was effected with the company by the acting Mayor last August. It has been estimated that the establishment of a five-cent fare to the Island would mean an annual loss to the company of $500,000.

The Chicago & Milwaukee Electric Railway on Nov. 6 shipped its first carload of through freight in connection with a steam road. It was a carload of cabbage from Racine to St. Louis. It goes from Chicago via the Illinois Central, it being the only steam road that has so far consented to do business with the new electric road, and the first to issue a joint tariff. It is said to be the first joint tariff on record between a steam and an electric railroad, and was secured only after a hard fight. It may be the entering wedge to securing more such tariffs in the future.

TRAIL CAR OPERATION OF THE NEW YORK CITY RAILWAY

The New York City Railway has in operation on its 125th Street line two multiple-unit trains, each made up of two cars. One train is fitted with the Westinghouse air brakes and the other with Christensen air brakes, both with a train pipe so that the brakes can be applied to both motor car and trail car. It is the intention of the company to test train operation of this kind on both its uptown and downtown crosstown lines. As soon as terminal facilities are completed on certain downtown lines, like the Twenty-Third Street and the Thirty-Fourth Street lines, the company proposes to transfer these multiple-unit trains to these lines and conduct an elaborate service test with them.

ANOTHER IMPROVEMENT IN SEMI-CONVERTIBLE CARS

Any improvement in the Brill semi-convertible car merits attention, as the type is among the foremost of the day and has been furnished to many of the important systems throughout the country. During the eight years of its use the genearl arrangement of the system has remained as originally planned, but the details have been altered several times to simplify the construction and improve the method of operation. Last year an important change was instituted which eliminated the grooves in the posts formerly necessary to guide the trunnions controlling the movements of the sashes, and the type has since been known as the "grooveless-post" semi-convertible. The principal feature of this arrangement consists of a pair of bow-shaped flat-steel guides extending from the letter plate at the mouth of the pocket to the lower ventilator rail; the upper sash is connected to these guides by small roller attachments. The sashes are joined by brass tongue-and-groove slides attached to the stiles which allow the lower sash to ride upon and connect with the upper, and thus require but one motion to raise both sashes. The sashes, therefore, being held together and suspended, as it were, from the guides within the pocket, it was only necessary to place parting strips on the posts to prevent dislodgement of the lower sash when drawn down. The parting strip, or parting bead, is a piece of wood ½ in. thick which is screwed

SECTIONAL VIEW OF SEMI-CONVERTIBLE CAR POST, SHOWING OMISSION OF PARTING STRIPS

to the side of the post and extends from the window sill to the curtain roller. It is so called as it serves as a distance-piece between the sash and the curtain. The parting strips have proved somewhat objectionable for two reasons: first, they must be removed to take out the sashes, and secondly, the appearance is not altogether satisfactory on account of not providing a finish to cover the ash posts.

A change in the details of construction has been recently adopted which obviates the parting strips and adds much to the utility of the system as well as to its appearance. The sash lock bolts are made a trifle longer and arranged to extend ⅝ in. when retracted for the purpose of serving as trunnions or guiding pintles. The grooves in which these trunnions move are ½ in. wide and run nearly straight up the post and as high as the top of the upper sash when the sash is lowered. These grooves are of the same width for their entire length and there is but one groove to each side of the post. It will be understood then that the sash trunnions and grooves accomplish the same purpose as parting strips. The sash locks are made to be readily removed, and by taking one off the lower sash can be lifted out; the upper sash is detached as heretofore by unscrewing the guides.

The new arrangement permits the posts to be veneered on both sides to accord with the finish of the car. The builders formerly endeavored in a number of cases to improve the appearance of the posts by finishing the sides with the same material as the rest of the interior woodwork, but because of the parting strips were unable to do so satisfactorily. They are therefore much pleased with the new arrangement, which makes it possible to hide the ash posts completely with veneer instead of stain. Another advantage gained by omitting the parting strips is the narrower and more graceful appearance

SHOWING APPLICATION OF IMPROVEMENT IN COMPLETED CAR

of the posts. The parting strips are ½ in. thick, therefore the thickness of the posts is reduced from 3¼ to 2¼ ins.

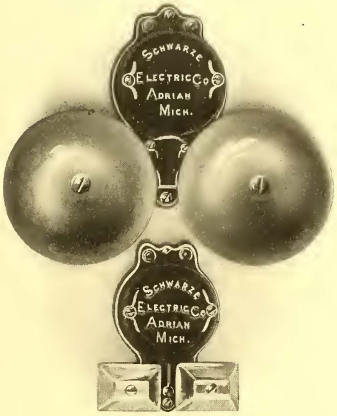
The illustrations will assist in understanding the improvement and its relation to the general plan. Attention is directed to the sectional view of the post in which the sash lock bolts are shown in their retracted position serving as trunnions; the absence of parting strips will also be noted. Sash lock stops are set in the grooves at convenient intervals.

The view is of the post immediately above the window sills. As stated before, the grooves for the trunnions are the same width for their entire length.

The improvement described applies also to the Brill convertible car, which has the same window system as the semi-convertible and in addition has flexible metal panels arranged to slide on guides attached to the posts, into the same pockets which contain the sashes when raised.

AN ECONOMICAL BELL

One objection to the use of electric bells in connection with push buttons on electric cars for giving stop signals is that the batteries are worn out so frequently that the service given is often unreliable. A bell adapted for this service, and which is claimed to have a current consumption of 80 per cent less than the ordinary one, is the closed-circuit low-voltage Schwarze universal type manufactured by the Schwarze Electric Company, of Adrian, Mich. On a large railway system,



ELECTRIC BELL FOR STOP SIGNALS

aside from the greater reliability of the stop signal system when equipped with a current-saving bell, the actual cost of the batteries saved must not be overlooked. The advantages of such a bell are at once very evident. The bell is constructed on a principle quite different from that of other bells. A horizontal armature pivoted at its central point carries the bell clapper, which oscillates between two gongs. When current is supplied to the bell, magnets under each end of the armature are excited alternately and cause the clapper to swing between the gongs.

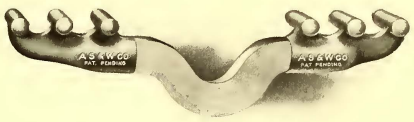
This company manufactures several other bells built on the same principle and adapted for use in connection with signal systems in shops, power houses and highway crossings (using high-tension current), telephones, loud-ringing extension service for magnetic telephones, in fact, for any service where an electric bell can be used.

Transfers from United Railways cars to Suburban cars and vice-versa will be issued to passengers beginning Jan. 1, when the United Railways Company, of St. Louis, will take control. Plans will also be adopted to decrease traffic over the downtown loop on Fourth Street, between Locust and Olive Streets, and to save time by shortening routes.

MULTI-TERMINAL RAIL BONDS AND TRACK DRILLS

Forestalling the now rapidly growing demand for large capacity rail-bonds and bonds with greatly increased contact areas, the American Steel & Wire Company has produced a new line of which one style, the "Triple Terminal" bond, is shown in the accompanying cut.

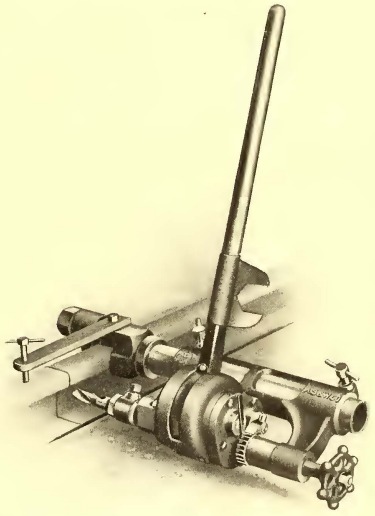
One-half-in. copper studs, two, three or four to a terminal, are compressed into corresponding bottomed holes drilled into the outside of the head of the rail. The contact areas thus provided are several times the maximum areas possible for single-stud bonds. Under repeated hammer blows the



TRIPLE TERMINAL BOND

copper at the orifice of each hole becomes so dense and the two metals are forced into such intimate contact that the bond holes are sealed completely and permanently. Just within the opening to each hole a groove in the steel, cut with a milling tool, permits the copper under compression to form an anchoring ring which also effectively supplements the external sealing of, and positively excludes all moisture from, the holes.

The number of terminal studs is proportionate to the capac-



TRACK DRILL

ities of the flexible conductors, which are made in all sizes up to 1,000,000 circ. mils, so that the carrying capacity of a single bond may equal that of the rail to which it is attached.

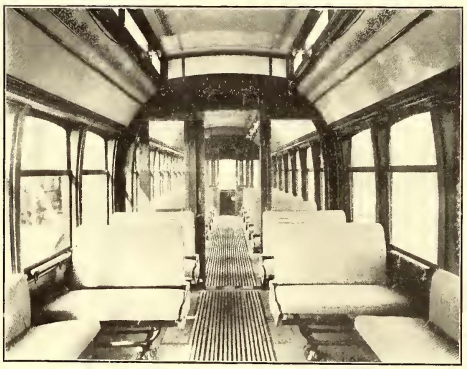
In the new track drill exhibited at the convention by this company, and illustrated herewith, is offered a tool for which railway men have been insistently calling. This tool is rigidly attached to the rail and bores rapidly holes which are always cylindrical, accurate in diameter, and placed at a

uniform height in the web of the rail. It is fastened to the rail by powerful clamps which are so quickly adjusted or detached that car service need not be delayed. The drill is operated by a double-acting lever, has ball bearings, positive automatic feed and a quick return.

The same manufacturers have also developed a complete line of multi-spindle drills operated through mechanisms which are merely modifications of the effective devices used in the track drill just described. These drill simultaneously two, three, or four holes and are used to prepare the rails for the multi-terminal bonds mentioned above.

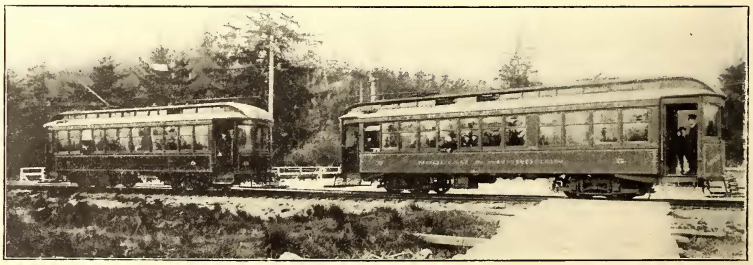
MORE CARS FOR GRAYS HARBOR, WASHINGTON

The Grays Harbor Railway & Light Company, operating between Aberdeen, Hoquiam and Cosmopolis, Wash., is drawing up plans for the continuation of the tracks in Hoquiam and Aberdeen to better the purely local traffic. Each extension will be about one mile long. The railway management also caters to a large class of passengers who ride solely for pleasure and whose enjoyment has been greatly enhanced since the company laid out its amusement park. The beautiful nature of the site chosen for this enterprise did not require very skillful treatment to be readily formed into a perfect natural playground. A feature of its broad acres is the enclosure for deer and elk.



INTERIOR OF COMBINATION CAR

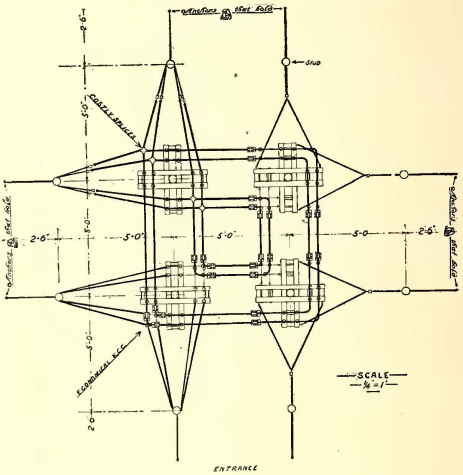
To provide for increased traffic the company has added a combination passenger and smoking car made by the John Stephenson Company. The new car is similar to the two cars shown in the illustration, lately purchased from the J. G. Brill Company. Cars of the passenger and baggage type, of the latter company's manufacture, are also operated. The latest car—like its predecessors—has the grooveless-post semi-convertible window system and is mounted on No. 27-G1 trucks. The length over the end panels is 31 ft. 8 ins., and over the vestibules 41 ft. 1 in.; width over the sills, including the sheathing, 8 ft. 6 ins.; size of the side sills, 4 ins. x 7¾ ins. The seats are 37 ins. wide; the aisle space is 24 ins. The inside finish of the car is in cherry. The trucks have a wheel base of 4 ft. The tracks carry four 55hp motors.



INTERURBAN CARS IN SERVICE ON THE GRAYS HARBOR ELECTRIC RAILWAY

THE VALUE OF A WORKING EXHIBIT

At the late Columbus convention much money was spent on exhibits by the different manufacturers. Inquiry developed the fact that many of them thought that orders could not be expected from railway officers and purchasing agents, as they had no time to examine into the merits of the devices exhibited. The consensus of opinion seemed to be that the main object of an exhibit was to have a place to sit down where the salesman could become acquainted with the buyer and thus facilitate the securing of an order the next time he called at railway headquarters. While this view has some truth in it, at least one exhibitor found that large sales can be made on the spot provided the devices offered for sale are displayed to show immediately the utility of the article and convince the buyer then and there of his great need for it and the money to be saved by its use. The example in mind is that of W. N. Matthews & Brother, of St. Louis, who did not have a very prominent space, but whose exhibit was so interesting that even the immediate financial results were entirely satisfactory.



PLAN OF MATTHEWS' COLUMBUS EXHIBIT

This exhibit covered 400 sq. ft. and contained four half-size corner poles installed with all of the appliances that make up a good lineman's job. Four 600,000-circ.-mil cables were used, and the advantages of employing the Kearney cable clamp in preference to the old style "cut and make up" corner were very clearly shown. The plan of the exhibit reproduced in the cut shows in the upper left-hand corner an old "cut and make up" corner with its great waste of expensive cable, labor and time. The money value of the copper wasted on a corner like this is said to outweigh the cost of the eight clamps necessary to accomplish the same result better. It is stated that the cost of this corner, including waste cable, extra labor, tape, blow torches, solder, broken saw blades and gasoline, would pay for making the three other corners shown and in less time than one could be made by the old system.

Another saving that is effected by the use of this cable clamp, and a loss often little suspected, is the "line loss" which occurs in the best-made splice or tap. It is impossible to make a perfect soldered or mechanical joint, as there is no way to get the solder to penetrate all parts of the joint. This "line loss" goes on continually and adds up as the years roll on.

The pole in the lower left-hand corner illustrates one way of getting the same results as on the one above it without any waste time, labor or material. Eight cable clamps are used and the strain is taken off of them directly to the guy stubs, which relieves the cables of any strain at the turn. The stubs were anchored by 6-in. Stombaugh guy anchors.

The two poles on the right show a method of "bridle guying" that is an idea of James R. Kearney, the inventor of the clamp. In this instance the strains on the cables are taken from the clamps to the cross arms and transmitted through eye-bolts to the stub by means of a "bridle" or "Y" guy. Mr. Kearney has this method in general use on the corner poles of the Topeka Railway Company, of Topeka, Kan. This method of guying has many advantages which become apparent upon examination of the diagram. It cuts out the use of glass insulators on the inside of the cross-arms and needs but one strain insulator and one-half the guy wire. The strain is more evenly distributed.

ELECTRICALLY-WELDED RAIL BONDS

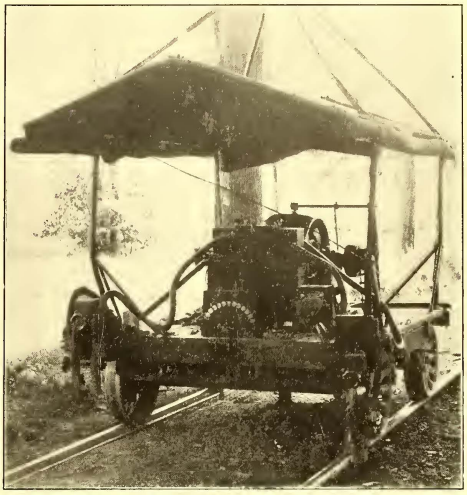
The Electric Railway Improvement Company, of Cleveland, is successfully introducing its method of welding rail bonds by current. The company is doing bonding work on the Cleveland & Southwestern Railway, the Cleveland Electric Railway and several other well-known roads. The outfit

ELECTRICALLY WELDED BOND

consists of an inverted rotary converter and a step-down transformer mounted on a small four-wheel car as shown in the illustration. The rotary converts the 550-volt direct current from the trolley to 350 volts alternating current, which is then stepped down by a 16-kw transformer to 5 volts at about 2000 amps.

To weld a bond, two copper plates with high-resistance carbons are placed next to the continuous strand bond to be attached, and a brass cap formed around the terminals. The capped portion is then clamped to the rail and the current turned on until the brass melts and adheres to the rail and bond. About two minutes are required to apply both ends of a U-shaped bond.

The car has a jack under the floor so that if found necessary the vehicle can be raised, then swung on the jack as a pivot and rolled from the tracks. To make the car self-propelling a clutch connected to the shaft of the converter can be thrown in to transmit power by bevel gears to the wheels whenever the car is to be moved along the track.



COMPLETE WELDING APPARATUS

ELECTRIC RAILWAY MILEAGE IN MICHIGAN

According to a statement made by Railroad Commissioner Atwood, of Michigan, there are 819 miles of electric railway in operation in that State. The Detroit United Railway leads with 279 miles, and the Michigan United, which includes lines out of Lansing, Kalamazoo, Battle Creek and Jackson, comprises 151 miles. There are 83 miles of electric roads surrounding Grand Rapids, 87 in the Detroit, Ypsilanti & Ann Arbor line, and 66 in the Detroit, Monroe & Toledo system.

PORTLAND TERMINAL PLANS

South Portland property amounting to $325,000 has been purchased by the Oregon Electric Railway Company for terminals and warehouses. The property consists of thirteen city blocks lying along the right of way, mapped out for the Oregon Electric Railway Company, and is close to the Southern Pacific's Yamhill Division tracks. The property just bought will in all probability prove ample for all terminal purposes contemplated by the new traction road, and will give it an excellent entrance into the city from the south, as in some cases, where surveys run from one street to another, private right of way must be used to avoid the sharp corners of streets. G. B. Moffatt & White, of New York, are financing the road, and William S. Barstow is the consulting engineer.

FINANCIAL INTELLIGENCE

Wall Street, Nov. 21, 1906.

The Money Market

Although the monetary situation, both here and abroad, has experienced a decided change for the better during the past week, the improvement has not been reflected in any material decline in rates for money in either the New York or London money markets. At the close of a week ago call money was lending in the local market at 20 per cent, but the heavy influx of funds attracted here from out of town caused a sharp reaction to below 5 per cent, but as soon as the supply of funds from that source ceased, the rate again advanced to 12 per cent. Time money likewise eased off about ½ per cent at the beginning of the current week, but later hardened, and at the close the prevailing bid quotations were 7 per cent for 60 and 90 days, 6½ per cent four months and 6¼ per cent for five and six months. The higher quotations were due in part to the increased activity and strength in the securities market, the demand from Stock Exchange houses being more urgent than for some time past. The New York City banks, however, have not been disposed to put out their funds, especially for fixed periods, despite the fact that their position has been materially strengthened during the week. The demand for money to finance the grain crops has not only ceased, but money is again moving to this center from Western cities. During the week ended Nov. 17, the local banks gained substantially on the currency movement, this being the first gain recorded by the banks since early in August. In addition to this the local institutions are gaining cash on their operations with the sub-treasury, the gain so far this week amountng to nearly $1,300,000 as compared with a loss of $1,231,000 in the preceding week. Against this, however, must be reckoned the demand for money to move the cotton crop, which is now progressing on a large scale, the preparations for paying the December 1 interest and dividend disbursements, which promise to be larger than in the corresponding period of 1905, when they exceeded $56,000,000. In addition, the January 1 disbursements, which will probably break all previous records, must also be provided for. The situation at London rules somewhat easier in tone, but there has been no appreciable change in discount rates. The Bank of England maintains its minimum rate at 6 per cent, although it has been strengthened to some extent by the arrivals of gold from South Africa, and by the release of more than $1,000,000 American gold by the Bank of France. This gain in gold by the Bank of England has been partly offset by the shipments of $2,500,000 of the yellow metal to Brazil, and it is expected that further shipments to South America will be necessary.

Local bankers are gratified at the progress made by the currency reform committee, which has been in session in Washington, D. C. It is likely that the plan decided upon by the committee will be introduced in Congress during the coming session and pushed by the banking interests of the country.

The bank statement published on last Saturday was better than generally expected. Loans decreased $6,100,400. Cash increased $2,817,300, or more than three times as much as indicated by the preliminary estimates. The reserve required was $1,068,500 less than in the previous week, which, added to the gain in cash, wiped out the deficit of last week and created a surplus of $2,371,675. In the corresponding week of 1905, the surplus was $2,915,150; in 1904, $9,589,700; in 1903, $3,911,350; in 1902, $19,529,975; in 1901, $14,486,925, and in 1900, $7,669,775.

The Stock Market

Developments during the week were of a character favorably to influence speculation in securities and prices moved upward in a rather sensational manner under active short covering, and on buying, due to the more favorable monetary situation. The recent downward movement eliminated all weak, long accounts, and resulted in placing stocks in strong hands and the creation of a large short account. The decline in the call money rate from 20 to under 5 per cent, followed by the very encouraging action of the bankers convention in adopting a plan for currency reform, which will be introduced in Congress and pushed aggressively by the banking interests of the country, caused a change in speculative sentiment, and if the plan becomes a law it will give elasticity to the currency and obviate the necessity of treasury relief measures whenever stringency develops in the money market. The news from Washington stimulated active buying of the standard shares and carried prices to a higher level. Other influences were the more favorable railway labor situation and the persistent rumor of important developments in connection with the future of the St. Paul road. The heavy buying of the stock, coincident with the movement in Union Pacific, was attributed to financial interests identified with the latter, although the rumor that control of St. Paul will go to the Southern Pacific is regarded with skepticism. The Hill stocks advanced sharply on reports that the Great Northern will increase its capital and give to its shareholders the privilege of taking the new issue at par. The rumor that the Great Northern will purchase from the Northern Pacific the latter's interest in the Burlington was also a factor in creating a better feeling. In the industrial list, Amalgamated Copper was prominent and the price was advanced on heavy buying. The declaration of a dividend of $20 per share by the Calumet & Hecla led to the expectation that dividends on both Anaconda and Amalgamated will be increased before the end of the year. The United States Steel stocks have ruled strong and the buying is generally regarded as accumulation. Sharp advances were recorded for American Smelting, the railway equipment shares, United States Rubber and Virginia Iron, Coal & Coke. The coal stocks all made substantial gains, and Delaware & Hudson was bought on a rumor of important developments pending.

The local traction stocks were active and moved with the general market. Brooklyn Rapid Transit was bought on the assurance of a new express service to the seashore in the near future and on the statement that the company is rushing work on improvements with all possible speed. Opinion is more friendly to the Interborough shares and little attention is paid to talk of an investigation of the methods of the local companies by the new State administration. Public interest in mining stocks has not abated, and new companies are being floated in a manner which cannot fail to bring a day of reckoning. The enlarged production of gold, silver and copper, and the urgent demand for all metals furnishes a safe basis for investment in good mining stocks backed by responsible and well-known people. Speculation in stocks will now be governed by developments in the money market. The latter is not in a condition to warrant speculative activity without bringing about higher rates for money.

Philadelphia

Philadelphia Rapid Transit continued to furnish the overshadowing feature in the market for traction shares during the past week. Dealings in the stock were considerably larger than in the preceding week, while the price sustained a severe decline. Opening at 25¼, the stock declined under heavy selling and although excellent support was rendered at times, it was not sufficient to check the downward movement. The close was at 23⅛, the lowest price recorded for this stock for a long while. Upwards of 23,000 shares were dealt in. Another striking feature of the trading was the weakness in Union Traction, of which more than 2000 shares changed hands at from 64¼ to 62⅞. Otherwise the trading was quiet and prices were not materially changed. Transactions included American Railways at 52, Consolidated Traction of New Jersey at 77¾, Philadelphia Traction at 97¼, United Traction of Indiana at 35, Philadelphia Company common at 48¾ to 48½, Philadelphia Company preferred at 48¾ to 48⅞, and Lehigh Valley Transportation preferred at 24¾ to 25.

Baltimore

Trading in the Baltimore market for traction shares was rather quiet, but without significant price changes. United Railway 4s sold at 89¼ to 88⅞ for about $40,000, and the certificates representing income bonds deposited brought 69¾ to 69¼. The new refunding bonds sold at 89⅛ to 89¼ for small amounts. Baltimore City Passenger 5s sold at 103, and City & Suburban 5s brought 110½. Other sales included Charleston Street Railway 5s at 106½, Norfolk Railway & Light 5s at 98¼ to 97⅞ to 98, and United Railways free stock at 15⅜ to 15⅞.

Other Traction Securities

Trading in the Chicago traction shares was extremely quiet, and apart from the pronounced strength in Metropolitan Elevated Railway issues, which was based upon reports of record-breaking earnings, prices showed very little change from those prevailing at the close a week ago. Metropolitan common, after selling at 25, rose to 26⅜ and closed at 26, while the preferred advanced from 66 to 68½. South Side Elevated sold at 91 and at 90 for odd lots, and small amounts of North Chicago Street Railway changed hands between 40¼ and 37. Northwestern Elevated sold at 25. In the Boston market interest centered largely in Massachusetts Electric issues, both of which were fairly active and strong. The common, after an early advance from 18¼ to 19¼, ran off to 18¾, while the preferred advanced from 69 to 70½ and closed at 69¾. Boston & Worcester common was fairly active at prices ranging from 28⅛ to 27 and back to 27¼, while the preferred sold at 80. Boston Elevated declined from 154¼ to 153½, but later recovered to 154. West End common sold at 93¾ and at 94 and the preferred at 110.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Nov. 14	Nov. 21
American Railways	52	52
Boston Elevated	154	a154
Brooklyn Rapid Transit	77⅞	78¼
Chicago City	170	150
Chicago Union Traction (common)	4¼	4½
Chicago Union Traction (preferred)	14½	15
Cleveland Electric	—	—
Consolidated Traction of New Jersey	77½	77½
Detroit United	86	86
Interborough-Mctropolitan	36½	36¾
Interborough-Metropolitan (preferred)	76¼	76½
International Traction (common)	a66½	65
International Traction (preferred), 4s	86½	86¼
Manhattan Railway	142	143
Massachusetts Electric Cos. (common)	18½	19
Massachusetts Electric Cos. (preferred)	69	69¾
Metropolitan Elevated, Chicago (common)	25	26
Metropolitan Elevated, Chicago (preferred)	65½	66
Metropolitan Street	106	106
North American	88½	88
North Jersey Street Railway	—	—
Philadelphia Company (common)	48½	48½
Philadelphia Rapid Transit	24⅞	23¼
Philadelphia Traction	97½	97¼
Public Service Corporation certificates	65	65
Public Service Corporation 5 per cent notes	95	95¼
South Side Elevated (Chicago)	91	92
Third Avenue	120	121
Twin City, Minncapolis (common)	110	110¼
Union Traction (Philadelphia)	64	63½

a Asked.

Metals

According to the "Iron Age," the leading sellers of lake ores have booked orders for the full output of their standard grades for the season of 1907-1908, and in certain Bessemer grades some premiums over the prices recently established have been paid. The Eastern pig iron markets continue quite active. The markets for domestic and foreign foundry irons are stiffening, and the spot demand remains keen, in spite of the very high prices. Steel continues very scarce and is stiffening in price. There has been a heavy business in steel bars during the past week.

Copper metal continues strong and unchanged at 22¼ to 22½c. for lake, 21¾ to 22c. for electrolytic, and 21½ to 21⅞c. for castings.

BROOKLYN RAPID TRANSIT SUBSIDIARY COMPANY EARNINGS QUARTER ENDED SEPTEMBER 30

The "Wall Street Journal" has gone to the trouble of combining the separate reports for the quarter ending Sept. 30, 1906, of the Brooklyn Heights Railroad Company, Nassau Electric Railway Company, Brooklyn, Queens County & Suburban Railway Company, and the Coney Island & Gravesend Railway, operating a majority of the line controlled by the Brooklyn Rapid Transit Company. During the quarter the combined gross earnings of the four companies increased only 6.48 per cent over those of the same quarter in 1905. Larger percentage increases in operating expenses and fixed charges more than wiped out this increase in gross, causing a decrease in the combined surplus after charges of 19.33 per cent. In all probability, the troublesome times the Brooklyn Rapid Transit experienced in August over the 5-cent fare to Coney Island question is in a large measure responsible for this poor showing. The gross earnings of the four companies for the quarter compared to those of the corresponding 1905 quarter and the increases are as follows:

	1906	1905	Increases Amount	Increases Per Cent
Brooklyn Heights	$3,754,535	$3,508,181	$246,354	7.02
Nassau Electric	940,195	911,118	29,077	3.19
Brooklyn, Queens County & Suburban	422,931	391,535	31,396	8.03
Coney Island & Gravesend	38,396	31,154	7,242	23.24
Totals	$5,156,057	$4,841,988	$314,069	6.48

The operating expenses of the companies for the two quarters, with increases, are as follows:

	1906	1905	Increases Amount	Increases Per Cent
Brooklyn Heights	$1,940,900	$1,722,144	$218,756	12.70
Nassau Electric	526,532	462,193	64,339	13.92
Brooklyn, Queens County & Suburban	228,238	174,008	54,230	31.16
Coney Island & Gravesend	14,517	12,036	2,481	20.61
Totals	$2,710,187	$2,370,381	$339,806	14.34

The total net income of the companies for the two quarters, with increases, are as follows:

	1906	1905	Increases Amount	Increases Per Cent
Brooklyn Heights	$1,863,145	$1,814,715	$48,430	2.67
Nassau Electric	442,936	468,152	†25,216	†5.39
Brooklyn, Queens County & Suburban	201,629	219,303	†17,674	†8.07
Coney Island & Gravesend	24,438	19,333	5,105	26.40
Totals	$2,532,148	$2,521,503	$10,645	.42

† Decrease.

After deducting charges, the surplus of the companies for the two quarters, with increases, compares as follows:

	1906	1905	Increases Amount	Increases Per Cent
Brooklyn Heights	$521,767	$668,774	†$147,007	†22.00
Nassau Electric	174,299	217,893	†43,594	†20.09
Brooklyn, Queens County & Suburban	90,162	100,616	†10 654	†10.39
Coney Island & Gravesend	12,558	2,890	9,668	334.53
Totals	$798,786	$990.173	†$191,387	†19.33

† Decrease.

The revenue from these four companies, says the "Journal," comprises the larger portion of the revenue of the Brooklyn Rapid Transit. The revenue derived by it from other sources during the quarter is not known and consequently its total earnings cannot be given. As it is also not possible to eliminate the charges between the parent company and subsidiaries, making it impossible to show just what part of the amounts under the heading of charges reverted to the treasury of the Brooklyn Rapid Transit, the earning power of the Brooklyn Rapid Transit stock cannot be ascertained.

OBSTRUCTION REMOVED TO NEW $8,000,000 BRIDGE TERMINAL IN NEW YORK

Mayor McClellan, of New York, stated Monday, Nov. 19, that the city had finally adopted the plan which was originally proposed by Bridge Commissioner Lindenthal to build an immense loop terminal at the Manhattan end of the Brooklyn Bridge, which will be a railroad station and an office building in one. The Mayor said that all the legal formalities had been complied with and the injunctions which were obtained by several people whose property is to be taken have been dissolved. The estimated cost will be approximately $8,000,000.

According to the plan, the terminal will extend from William Street to Centre Street, and from Chambers Street to the present terminal of the bridge. It is proposed to erect a building which, from an architectural standpoint, will be one of the most imposing in the city. There will be two separate stories of loops for the operation of elevated trains. Under these will be loops for the surface cars. The plans are so designed as to provide for a distribution of the traffic, which will practically eliminate all congestion during the rush hours. Almost every line will have a platform for itself, and people boarding and those leaving cars will not come in contact with each other.

NEW BUILDINGS FOR LINE AND TRACK DEPARTMENTS IN BROOKLYN—INCREASED SERVICE

Plans have been adopted and ground is soon to be broken for the new central station which the Brooklyn Rapid Transit Company is about to erect for its line and track departments on the west end of the block bounded by President and Carroll Streets and Nostrand Avenue. The new structure, or rather group of structures, will extend practically the whole block front on Nostrand Avenue and back some 400 ft. on each of the side streets. Fireproof construction is to be adopted, and the cost of the buildings is estimated at about $300,000. While the 211 ft. of frontage on Nostrand Avenue will have practically the effect of a single handsome commercial structure, the plant itself will be divided into three buildings, running east from Nostrand Avenue. In the two yards between the buildings will be service tracks and sidings connected with the surface tracks in the avenue and again connected by a loop at the rear of the center building.

The south building will be assigned to the track service department. It will contain the roadmaster's offices for the entire system on its avenue frontage, and back of them locker rooms and tool rooms for men of the department. On the second floor of the building will be an electrical workshop and a paintshop. The center building is designed for the joint service of the two departments and will be chiefly used for storage. It will be 50 ft. x 168 ft., and back of it will extend storage decks for another 150 ft. These storage decks will be divided into compartments and assigned for the storage of reserve supplies of sand and cement, ties and poles, wire and cable and the like. In order that these heavy supplies may be handled expeditiously a traveling crane will reach each compartment and the surface-car tracks at the end of the loop. The second floor of the center building will be devoted to a giant blacksmith shop and this will be connected with the second floor of the other two main buildings by heavy enclosed bridges, making the entire second floor of the plant suitable for the mechanical exigencies of the two departments.

The north building will house the line department. The ground floor is designed for offices, with extensive wagon rooms in the rear. On the second floor will be more offices, a drafting room, horse-shoeing room, and the stalls for the 230 horses of the department. All of the stable facilities are to be of the most modern type. Concrete sanitary floors are to be laid throughout, the walls porcelain tiled and a complete flushing and cleansing system introduced.

Just east of this north building will be a three-story structure also of fireproof construction and of similar architectural appearance, which is to be devoted to the emergency line wagons for the district. The arrangement of this structure will be similar to that of a firehouse. The ground floor will be given over to the wagon stand, with its quick-hitch devices, and the stalls for the team that hauls the wagon. The second floor will contain the dormitories for the wagon crew, while the third is to be arranged as an attractive home for the foreman and his family.

This whole group of yards and buildings where not enclosed from the street by the structures themselves is to be bordered by a high brick wall. Against this wall will be the oil house and the housing accommodations for the tower wagons and reserve trucks of the two departments. They are to be so placed as to be ready of access at all times.

Work on the excavations for this group of buildings is to be pushed during the winter and it is hoped to have them in use by early summer. The two departments have been located in upper Herkimer Street, but these accommodations have been so cramped as to offer a severe handicap to the proper administration of these branches of the service.

Announcement has recently been made by the company that a greatly increased elevated and surface car service will be put into operation on the South Brooklyn Railroads. Trains on the Sea Beach line are hereafter to be operated separately from Park Row, Manhattan, during non-rush hours and on a 15-minute headway. The increase in population upon what has hitherto been solely regarded as a short-cut line for Coney Island business makes this change possible. Many new houses have sprung up in Gravesend farm lands and have begun to give the Sea Beach road a permanent winter patronage. During rush hours, when the headway in Adams Street is at a minimum, separate operation of Sea Beach trains is out of the question. A Sea Beach car was formerly attached to the West End Coney Island trains and slipped off at Fifty-Eighth Street. Under the new schedule the West End trains will be lengthened and run independently from Park Row. Bath Beach trains and Sea Beach trains will be coupled together in rush hours. All of these trains branching off through New Utrecht Avenue will run express through Fifth Avenue in rush hours. In order to give a better service through this last street at busy times, a short line local service is to be installed, running between the Bridge and Thirty-Sixth Street only and making all stops. All midnight service will remain unchanged. All of this new service on the elevated lines represents the limit of service on a double-track line. With a third track in Fifth Avenue a bettered express service would immediately be possible. The new surface car service involves four lines.

WAGES INCREASED IN BOSTON

Under the provisions of a new order promulgated by the directors of the Boston Elevated Railway Company Friday morning, Nov. 16, and which goes into effect with the opening of the new year, 5300 men employed by that company on its elevated and surface lines are to receive an increase in their daily pay, the increase varying in different instances from 10 cents to 25 cents or more. The total amount of the increase as announced means an annual additional expenditure for salaries of upward of $160,000. This new wage scale in no way affects the present system of reward for good conduct, which has been in vogue for the past few years, and which in itself entails an expenditure of about $60,000 a year, nor the pension system, established three years ago, by which aged and infirm employees are guaranteed a sufficient sum to keep them from want when unable to work. The new wage scale, as contained in the official statement, is as follows:

SURFACE LINES

Conductors and Motormen	Per Day
First and second year	$2.30
Third, fourth and fifth year	2.35
Sixth to tenth year	2.40
Eleventh to fifteenth year	2.45
Fifteenth year and later	2.50

ELEVATED LINES

Brakemen	Cents per Hr.
First and second year	19
Third, fourth and fifth year	19½
Sixth to tenth year	20
Eleventh to fifteenth year	20½
Fifteenth year and later	21
Guards	
First and second year	21½
Third to fifth year	22
Sixth to tenth year	22½
Eleventh to fifteenth year	23
Fifteenth year and later	23½
Motormen	
First year	23½
Second year	24½
Third, fourth and fifth year	26
Sixth to tenth year	26½
Eleventh to fifteenth year	27
Fifteenth year and later	27½

All other blue uniformed men, as well as elevated station masters, get, according to their length of service, a corresponding increase. In addition to the increases for the regular men, the company also announces that all extra men on both elevated and surface lines will at the same time receive an increase of 25 cents per day in their guaranteed minimum pay. Thus an extra surface conductor or motorman, who is now guaranteed $10.50 a week whether he works or not, provided he reports for duty as required, will be guaranteed by the new arrangement $12.25 per week. If he works, he will naturally be paid according to the regular established rate.

The company has also recently established a class of men who are known as instructors, men whose duty it is to instruct the new men taken on by the road. These men receive 10 cents a day additional pay, so that a surface conductor or motorman who becomes an instructor, and who also benefits by the annual reward, may receive as high at $2.65, and an elevated motorman $2.90 per day. For snow work and extra hours as high as 40 cents per hour is paid, according to the labor performed.

ARGUMENT BEFORE THE UNITED STATES SUPREME COURT IN CLEVELAND CASES—OTHER MATTERS

Considerable interest is felt in Cleveland as to the forthcoming decision of the United States Supreme Court on the injunction suit of the Cleveland Electric Railway Company against the city and the Forest City Railway Company, to prevent the new company from taking possession of Central Avenue, Erie Street and Quincy Street. The hearing took place at Washington last Monday and Tuesday, when the attorneys for each side presented their arguments. Judge William B. Sanders, for the Cleveland Electric, argued that the Garden Street extension did not expire in March, 1905, as decided in the lower courts, but that the company has the right to occupy the streets in controversy until July, 1914. This was the contention in the lower courts, and its being brought up again indicates that the attorneys have considerable faith in their claim.

City Solicitor Newton D. Baker, of Cleveland, followed Judge Sanders. His brief was in effect a refutation of the claims made by the old company. He argued that the rights of the Cleveland Electric did expire on March 22, 1905, and that the decision of the Circuit Court should be affirmed. D. C. Westenhaver, representing the Forest City Railway Company, took up the thread where Mr. Baker left off and said that the Circuit Court did not err in its decision, as claimed by the plaintiff. He went further and said that the decree of the lower court should be modified so far as it holds that the Cleveland Electric has any property right in its poles, tracks, wires and appliances on the streets in question, after its right to maintain them had expired. Attorney J. W. Warrington, of Cincinnati, made a strong plea in favor of the Cleveland Electric.

While the plan for a referendum vote on the question of which of the companies shall have the right to operate was defeated by the City Council, it is said that Mayor Johnson has a plan to submit the question to a vote of the people as soon as the decision of the Supreme Court shall have been handed down, no matter which way the decision shall be. This plan will provide that if the Cleveland Electric wins on the seven-tickets-for-a-quarter proposition, he will work for its acceptance, but on the understanding that the Forest City Railway shall be left in undisputed possession of all the territory it claims to possess and that all litigation shall be withdrawn. On the other hand, if the Forest City wins, then the Cleveland Electric is to be willing to turn its property over to a holding company based upon the value of the stock as affected by the Supreme Court decision. If that decision should be in favor of the Cleveland Electric, then the value will be $85 or higher, and if against it, the value is to be $70 or lower. The consent of both companies to the terms would be necessary to carry this idea into effect.

Preparations are being made to resume the hearing of the case against the Forest City Railway, attacking the validity of all its franchises on the ground that Mayor Johnson is financially interested in it. Some interesting testimony has already been brought out as to the favors the Mayor has shown the company.

J. J. Stanley, vice-president and general manager of the Cleveland Electric, and C. F. Emery, also of the company, have submitted bids on two lines in the village of Newburg Heights, offering to carry passengers at a fare of 2 cents. The bids were made personally by these two gentlemen, and it is claimed that the company has nothing to do with them. The Forest City Railway Company made a bid at 3 cents, and its officers are now complaining that the bids of the other men were made to block their company. They say that if they get the franchises the forfeits of $10,000 will be lost voluntarily and the lines will never be built. John J. Stanley, however, declares that he will build the road he bid upon if given the franchise only to operate within the village limits. He said he could not state whether it would connect with the city lines if he builds it.

The Forest City Railway Company has placed its cars in operation on a 15-minute schedule on the lines completed.

NEW YORK CENTRAL SEEKS SUBWAY LINE IN NEW YORK

Information to the effect that the New York Central Railroad is considering the building of a two-track subway through Fifty-Third Street, from its tracks on Park Avenue to the proposed freight subway to be built on Eleventh or Twelfth Avenue, to take the place of the surface tracks on the former thoroughfare, was contained in a report of Chief Engineer George S. Rice, made to the Rapid Transit Commission Thursday, Nov. 15, and concerning principally the building of the subway for freight trains under one of the west side avenues mentioned. The report says in part:

"At Fifty-Third Street the New York Central officials wish to construct a two-track spur running east to connect with the Grand Central yard where Fifty-Third Street runs into the same, and operate this spur and part of the line along the river front north of Fifty-Third Street partially as a passenger railroad. This would greatly increase the efficiency of the New York Central in handling its suburban traffic.

"It may be doubtful whether such a subway could be constructed under the terms of Chapter 109 of the Laws of 1906, but it could certainly be constructed under the provisions of Section 32 of the Rapid Transit act. I have indicated in the accompanying plans the beginning of such a subway at the northern and western end thereof. The detailed plans for such a road, if approved by this board, could readily be prepared."

Mr. Rice proposed two alternative routes for the accommodation of the trains now operated over the Eleventh Avenue surface tracks. One route follows the present lines south to Canal and West Streets, and proceeds thence down West Street to Franklin. The other route is under either Twelfth or Thirteenth Avenues and Marginal Street to West Street, and thence south under West Street. The engineer estimates the cost of the first-named route at $20,700,000 and the second at $33,150,000, with an additional cost of $850,000 for spurs to wharves and warehouses.

SUBWAY PROPOSALS IN PITTSBURG

For some months Pittsburg has been agitated by the plans devised for increased transportation facilities. Among these plans were those advocated by the Pittsburg Railways Company, now operating all the lines in the city; a syndicate planning to build subway lines and another syndicate planning to build elevated lines. Quietly has the Pittsburg Railways Company gone about its work, and the plans it puts forth are known only as applying to general betterments. On the other hand, the schemes of the underground and elevated company promoters have been set forth more blatantly during the intermision when their cases were not being pleaded at the State House. Out of all this preliminary skirmishing, as it were, has finally come an application to the Council from the Pittsburg Subway Company for a system of underground lines. It was introduced by M. F. Savage, of the Twenty-Third Ward, and was immediately referred to the rapid transit commission of Councils. This commission is a standing committee of Councils; it can make no official recommendation, but it can thresh out the ordinance, suggest amendments and get it before a committee of Councils that has authority to make recommendations.

It has been made plain by the syndicate in a letter to the rapid transit commission of Councils that it is willing to accept certain amendments; that it feels also that certain concessions are due the company, and that it ought to be given a good franchise. The company last summer made application for a franchise and asked the city to prepare the ordinance. As the city did not intend to build the subway system, it referred the matter back to the syndicate, telling it to state what it wanted, what it would give in the way of concessions, and when the project would be carried out. More exploiting followed, and finally there came into existence an organization known as the Rapid Transit Commission, not the Councilmanic organization, but including in its membership representatives of the Chamber of Commerce and other civic bodies. What this commission did has never been made public. Meanwhile exploiting of the subway project continued. And now comes the ordinance prepared by the syndicate, but not until after another statement was made, in the form of a pamphlet, to the rapid transit commission of Councils.

The ordinance calls for a franchise for 100 years, authorizing the construction of a tunnel loop downtown and to a point near Luna Park, from there over surface routes to the East End and also various feeder lines—constituting one of the greatest traction and subway systems in the country. What it will cost to do this is variously estimated at from $15,000,000 to $30,000,000. F. T. F. Lovejoy is president of the company; Arthur O. Fording, general counsel; E. K. Morse, chief engineer; M. M. Garland, a director.

Meanwhile the promoters of the elevated roads are understood to be quietly at work perfecting their plans preparatory to placing proposals before the Council. Just when these proposals will be submitted depends, so it is said now, upon the closing of certain legal preliminaries at Harrisburg.

NEW YORK NEEDS MORE ROADS SAYS STATE RAILROAD COMMISSION

The New York State Railroad Commission held a session Tuesday, Nov. 20, in New York, at which many problems were considered. The overcrowding of cars on the surface and elevated roads in all the boroughs of the greater city was discussed in a report made by the Commission. Its recommendation for the third-tracking of the Third Avenue elevated was repeated, and it was suggested that the elevation of the tracks of the surface roads over Sands Street, Brooklyn, would do much to relieve the congestion on the Brooklyn Bridge, making possible the operation of 25 per cent more cars across the bridge. The Commissioners also declared that it was absolutely necessary to lay tracks through Livingston Street as soon as possible. As for conditions on the elevated system, the Commissioners said:

"No favorable action has been taken on the board's suggestion for the construction of an elevated connection between the New York ends of the Brooklyn and Williamsburg Bridges. The construction of such a connection would enable the operation of elevated trains in both directions over these bridges, and the present location of elevated structures in the borough of Brooklyn is such that trains could be so operated as to make a circulating medium through the business and outlying residential sections of that borough. The method of operation would obviate delay and inconvenience caused by the transfer now made at the Brooklyn end of the Brooklyn Bridge, and prevent the congestion which now occurs at the New York end of both bridges in certain hours of the day.

"The third-tracking of the Second and Third Avenue elevated roads from points in the business center in lower New York to 129th Street would add 50 per cent to the carrying capacity of these roads in the rush hours, relieving the present overloaded conditions of the trains of these railroads, as well as materially reducing the crowds in the subway."

After quoting figures to show that the growth of New York is rapidly exceeding its rapid transit development, the report says:

"If the present prosperity of the country continues and no material additions are made to the facilities and trackage of the railroads in Greater New York within three years, traffic conditions will be such as to materially affect the business conditions and growth of the city. The contemplated subways which may be constructed and put into operation within the next five years will not properly accommodate the increased travel which will exist at the time of their completion."

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The subjects arranged to be discussed at the meeting of the Central Electric Railway Association, being held this week, are as follows:

1. The discontinuing of free transportation, and to what limit shall same be issued.
2. Impressions from the Columbus Convention.
3. Limited service: does it pay?
4. Automatic couplers.

The date of the meeting was Nov. 22, and the place the Algonquin Hotel, Dayton. The Ohio Railroad Commissioners were invited to be present to consider the first subject. A matter to be considered was the annual meeting of 1907.

NEW YORK CITY CARS TO BE VESTIBULED

Announcement has been made by the New York City Railway Company, which operates all the surface lines in Manhattan and the Bronx, that all its cars will be equipped with vestibules soon.

The news was communicated in the following notice:

"Special notice to all concerned:

"All of the cars of the system will be equipped with vestibules as soon as they can be obtained from the manufacturers.

"The advisability of taking this action has been under consideration for several years, but decision in the matter has been deferred until the present time, as it was feared that such interference with the motorman's vision would result in an increase in the number of accidents to pedestrians and collisions with vehicles."

ILLINOIS CENTRAL FILES TARIFF OF ELECTRIC RATES

The Illinois Central Railroad has filed with the Interstate Commerce Commission a tariff of through rates on freight between points on its line and those of the Chicago & Milwaukee Electric Railroad. This is the first tariff ever published showing an agreement between a steam and an electric road to interchange freight and make through rates. It has been the policy of the steam lines to refuse to go into any traffic alliances with electric roads. Recently the officials of the Chicago & Milwaukee Railroad consulted informally some members of the Interstate Commerce Commission as to whether steam roads could be compelled to interchange freight and make through rates with electric lines. It is understood that the Commissioners expressed the opinion that steam and electric lines were on a parity under the law, and suggested that the Chicago & Milwaukee road tender a proposition for interchange of freight and through rates to some steam road. This proposition was made to the Illinois Central for through rates on vegetables and other farm products. It accepted the proposition, and has just filed the rates in accordance with the law.

ROME, GA., SYSTEM SOLD

The street railway and electric light properties at Rome, Ga., controlled by the City Railway Company, have just been acquired by the Louisville, Ky., syndicate, represented by S. S. Bush, who is in charge of the syndicate's properties at Jackson, Tenn., and Pascagoula, Miss., as general manager, but who has his office at the Columbia Trust Company, Louisville. The Rome properties have for a year past been undergoing rebuilding, including a new concrete power building, with Curtis turbine, condensers, water-tube boilers, super-heaters, economizers, Custodis stack, etc., and the extension of trackage. It is the purpose of the new owners further to extend the mileage so that they will have 11 miles in operation by spring, and to duplicate all machinery at the new power plant and to remodel the old plant, which is in the center of the city, for car house, shop, supply depot and offices; also to inaugurate a "new business" department for a big extension of light and power business. The company also acquired "Mobley Park" and the Driving Park and will develop both. Rome and the suburbs reached by this system take in a population of 25,000, and the city is growing rapidly.

CHICAGO TRACTION MATTERS

A second conference between Mayor Dunne and other city representatives and representatives of the traction companies held Nov. 15 to discuss the traction ordinance submitted to the city recently by the traction companies, resulted in the revision of several sections of the ordinance. In every instance the changes are minor ones.

Mayor Tom Johnson, of Cleveland, spent the greater portion of a day in Chicago during the week in consultation with Mayor Dunne and his traction counsel, Walter L. Fisher. Mayor Dunne stated that the conference in general related to 3-cent fares, municipal ownership, subways and methods of determining the values of street railway property, but he refused to go further into details.

A report of a contemplated merger of the Chicago Edison Company with the Illinois Tunnel Company resulted in an investigation of the proposed deal by the Council committee on gas, oil, and electric light. At the meeting of the committee William G. Beale for the Chicago Edison Company admitted that the company had no authority to lease its rights. He said, however, that he expected the stockholders would get an offer for their stock and that they had a right to sell it if they wanted to do so.

Attorney Henry S. Robbins, on behalf of the North and West Chicago street railway companies and protective committees, finished his arguments Nov. 15 on the pleas filed by counsel for the Yerkes estate. The matter at issue is a claim of fraud in connection with Yerkes' ownership of $6,750,000 of bonds of the Chicago Consolidated Traction Company. Attorneys Clarence Knight and A. J. Hopkins for the Yerkes estate had questioned the right of the clients of Mr. Robbins to bring the suit. Mr. Robbins argues that to determine first this technical question will delay the receivership. Judge Arthur L. Sanborn, of Wisconsin, who has been hearing the arguments, took the case under advisement. It is expected that he will give his decision within a month.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED NOV. 6, 1906

834,961. Emergency Stop; William H. Balch, Brooklyn, N. Y. App. filed Sept. 6, 1905. When air is admitted to an upright cylinder, a piston head is forced downward to drive a rod into the ground.

835,006. Means for Operating the Switches, Frogs and Signals of Electric Tramways; Leonard Atkinson, Christchurch, New Zealand. App. filed April 18, 1906. A hook on the car engages a cam in the roadbed for the purposes, etc.

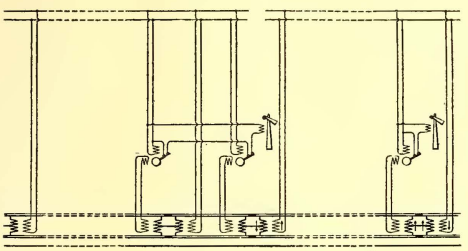
835,087. Rail Joint; Thomas Wignall and John O. Kridelbaugh, Hynes, Ia. App. filed Jan. 22, 1906. The abutting ends of the rails are mitered and seated in a chair which exactly conforms to the contour of the rail.

835,103. Device for Reversing and Automatically Blocking Trains on Electrobynamic Traction Railways; Julien Dulait and Leon Rosenfeld, Charleroi, Belgium. App. filed Feb. 8, 1905. Supplemental conductors or rail divided into sections insulated from each other and connected to the reversing-rail, so that one section of the blocking-rail is electrically connected to the next preceding section of the reversing-rail.

835,110. Combined Rail Joint and Tie; Charles J. Larson, Galesburg, Ill. App. filed July 9, 1906. The tie is provided with a broad end which is grooved to receive the abutting ends of the rails. The tie also has undercut grooves to receive laterally extending flanges on the fish-plates.

835,132. Rail Joint; Horatio G. Gillmor, Bath, Me. App. filed March 25, 1905. The chair has upwardly projecting flanges and locking wedges, each having a projection upon one of its faces adapted to engage with a surface of a flange of the chair.

835,270. Car Brake; Theodore F. H. Zealand, Edgewood, Pa. App. filed March 17, 1906. Relates to that class of brake in which the braking pressure is determined by the load of the car, and consists of live and dead brake levers and mechanism adapted to exert upward pressure on the car body, said mechanism forming a compensating connection between the live and dead levers.



PATENT NO. 835,419

845,384. Electric Signaling System; James S. Anderson, Ames, Neb. App. filed June 16, 1906. In case of accident to a bridge a weight is displaced which actuates a semaphore. Means are also provided for sounding an alarm in an approaching locomotive cab.

835,410. Signal; Charles R. Dowler, Lamar, Col. App. filed Jan. 12, 1906. In case of abnormally high water at a bridge, a signal is actuated by a float in the water.

835,411. Circuit-Breaking Device; Charles R. Dowler, Lamar, Col. App. filed Feb. 9, 1906. Weights are buried at intervals in the roadbed at points where washouts are liable to occur, which weights fall by gravity to actuate suitable signals in case of such an emergency.

835,419. Alternating Current Block Signal System; Max R. Hanna, Schenectady, N. Y. App. filed April 26, 1906. The block sections are energized by alternating current and the signals are operated by secondary circuits therefrom through polyphase relays which are actuated by separate currents from different block sections.

835,456. Tie-Bar; Joseph F. McKechnie, Eleele, Territory of Hawaii. App. filed June 5, 1906. Brackets for engaging the rails have slots therein for the engagement of a bar having hooks at each end, one of the brackets having an integral, and a key adapted to engage the lug and the adjacent hook.

835,463. Brake-Shoe; Anthony G. Olberding, Cincinnati, Ohio. App. filed Sept. 25, 1905. Consists of a steel back having a series of diagonal U-shaped straps struck down therefrom and a cast-metal body joined to the back by the metal passing over and around the straps.

UNITED STATES PATENTS ISSUED NOV. 13, 1906

835,493. Cut-Out; Rollin A. Baldwin, New Haven, Conn. App. filed Sept. 8, 1905. An inexpensive means for automatically cutting into circuit a second signal lamp in case the first lamp is burned out or otherwise fails. Is adapted particularly for lamp signals of street railways.

835,532. Railway Switch Mechanism; Toylar Jackson, Kansas City, Kan. App. filed Sept. 26, 1904. Details of construction of a pair of switch actuating levers mounted at each end of the car, to throw switches at either side of the track.

835,565. Noiseless Railway Crossing; George D. Shoop, Rock Island, Ill. App. filed April 30, 1906. Provides a wheel-flange bearing spanning the space between spaced tread portions of rails and adapted to support the wheels of cars by engagement with the flange portions thereof. The flange bearing is so formed that a continuous bearing for the wheels either at the tread or flange portions is afforded.

835,587. Rail Joint; William C. Weaver, Elizabethville, Pa. App. filed March 23, 1906. The ends of the rails are cut diagonally and are received in a chair which embraces the base and web of the rail. The fastening pins pass through the web of the rail and the chair and consist of a body with a head at one end and a vertical transverse opening at the other in which a pivot-pin is inserted. A cam lever is attached to the pivot-pin.

835,605. Train Annunciator; Edward A. Everett, Detroit, Mich. App. filed May 8, 1906. Lever mechanism of an annunciator drop adapted to be actuated by feeble impulses in a relay magnet.

835,728. Contact Spring for Trolley Harps; John Hensley, Huntington, Ind. App. filed March 22, 1906. V-shaped spring washers are interposed between the jaws of the harp and the wheel in order to secure good electrical contact.

835,730. Railroad Tie; James S. Killen, Darlington, Ind. App. filed May 14, 1906. The tie is made of suitable plastic material and is longitudinally grooved to receive a metallic bar to which the rails are secured.

835,731. Trolley for Electric Railways; Ezra F. Landis, La Salle, N. Y. App. filed Sept. 11, 1905. The trolley wheel has a T-shaped groove and specially formed springs are mounted in the annular extensions of the groove, which springs slide in the groove and close over the trolley wire to hold the same upon the wheel.

835,821. Trolley-Pole Clamp; Hugh W. Fellows and Ira A. Cammett, Los Angeles, Cal. App. filed Sept. 15, 1905. The pole is inserted in a pair of jaws which are forced toward each other by means of a cam lever which has gear teeth thereon engaging a wedge-shaped rack.

835,845. Railway Switch; James Biggs, Fontanet, Ind. App. filed July 6, 1906. Details of construction of a switch permitting a train to freely pass from the siding to the main track in both positions of the switch.

835,896. Means or Appliance for Operating Railway and Tramway Points, etc.; William Taylor, Stapleford, England. App. filed May 10, 1906. Comprises a controlling handle connected to one element of a three-armed lever pivoted from a base-plate, a switch rod attached to a second element, a rod pivoted to a third element of the ehree-armed lever and carrying at its other end a roller-weight turning thereon and an inclined bearing supporting the roller-weight.

835,909. Section Insulator for Trolley Roads; Charles M. Means, Punxsutawney, Pa. App. filed April 9, 1906. Depending from a supporting base is a pair of hangers with specially formed porcelain bushings to furnish the insulation.

835,917. Sand Delivery Box for Railway Cars; Jacob Roediger, St. Louis, Mo. App. filed April 20, 1906. Consists of a hollow main member having a sand-inlet, an air-inlet and a sand-outlet, and a detachable side plate having a deflector and a guard integral therewith whereby said last-named members may both be withdrawn from said main members when said side plate is removed.

835,951. Signaling on Railways; Charles M. Jacobs and Robert J. Insell, Reading, England. App. filed July 2, 1900. The engine is provided with a depending arm which makes electrical connection with a special rail, and signal and alarm circuits are thereby completed to a point in the engine cab.

836,042. Switch-Block for Trolley Tracks; Robert Johnston, Springfield, Ill. App. filed March 5, 1906. A trolley switch having stationary track members, a turnable track member adapted to match the stationary track members respectively, a plate secured on the turnable track member and overlapping the adjacent parts of the stationary track members and blocks secured on said plate and having members adapted to lie across the ends of the stationary track members which are in disuse.

836,062. Circuit Closer for Trolley Signals; Alexander Bevan, Providence, R. I. App. filed Feb. 6, 1906. A casing mounted above the trolley wire has a depending arm adapted to be engaged by the trolley wheel to operate switch mechanism for the signal circuits.

PERSONAL MENTION

MR. HARRY B. HANE, of Marion, Ohio, has been elected secretary of the Columbus, Delaware & Marion Railway Company, in place of Mr. Walter A. Black, of Dayton.

MR. WILLIAM H. FORSE, JR., auditor of Indiana Union Traction, has been appointed assistant treasurer of that company, succeeding Mr. William C. Sampson, resigned.

MR. W. J. HAMMER, consulting engineer, of New York, has just been awarded the Elliott-Cresson medal by the Franklin Institute, of Philadelphia, for his collection of incandescent electric lamps.

MR. J. J. SLOCUM has been elected a director of the Manhattan Railway Company, of New York, to succeed Mr. Russell Sage, deceased. The other directors have all been re-elected to serve for the ensuing year.

MR. GEORGE H. EARLE, president of the Real Estate Trust Company, of Philadelphia, has resigned as a director of the Philadelphia Rapid Transit Company. Mr. Earle also recently resigned from the board of directors of the United Railways Investment Company, due to the pressure of his other business interests.

MR. H. MILTON KENNEDY, at one time connected with the Brooklyn Rapid Transit Company as traffic manager, and more recently identified with the scheme in Brooklyn which has for its end the disposal of ashes and street cleaning by hauling them over the street railway lines, has been appointed secretary of the building bureau of Brooklyn by Borough President Coler.

MR. CHARLES M. JACOBS, consulting engineer of the Pennsylvania, New York & Long Island Railroad Company, and who as such has had charge of the entire work of the Pennsylvania Railroad tunnel under the North and East Rivers and Manhattan, has been retained by the French Government in the undertaking of building a tunnel under the River Seine, from Rouen to Havre.

MR. CLINTON WHITE, of the Massachusetts Railroad Commission, has returned from a trip through several of the Western cities, in an effort to obtain information for the enlightenment of the Commission with reference to what the leading street railway systems are doing with fenders, wheel-guards and other safety devices. Mr. White was away about twelve days, and was accompanied by Assistant Clerk Allan Brooks. He went from Boston direct to Buffalo, thence to Niagara Falls, Toronto, Detroit, Cincinnati and Indianapolis, studying street railway usages and devices in each city. The information which he has obtained will be used by the board in conjunction with data obtained by recent tests and experiments with fenders and wheel-guards on the Newton & Boston Street Railway Company's testing ground on Homer Street, Newton, on the basis of which the Commission is required by a legislative act of last winter to prepare a report and recommendation as to the advisability of requiring street railway companies to equip their cars with fenders and other safety appliances. The Commission expects to give one more test, on Friday, Nov. 23. After that it will devote its attention to getting the report formulated, with the expectation of offering it to the Legislature, as ordered, early in January.

MR. M. G. STARRETT has resigned as chief engineer of the New York City Railway Company and has been appointed consulting engineer of the company and its leased and allied lines. The office of chief engineer of the company has been abolished. Mr. Starrett has been connected with the New York City Railway Company since 1896, when he was appointed assistant chief engineer, and has occupied the office which he has just resigned since 1899. During the ten years which Mr. Starrett has been connected with the system, the two present power stations and all of the sub-stations of the company have been built, and the greater part of the underground conduit electrical lines now in operation were installed. The Ninety-Sixth Street, or main, power station of the company was the first of the large electric railway stations of the country to employ polyphase transmission with sub-stations, and was the first in which generators as large at 3500 kw were used. The problems connected with this work were of a complicated character on account of their novelty, and their successful solution by the engineering department of the New York City Railway Company established the practicability and desirability in large installations of the distribution from a single station rather than from a number of smaller stations. Previous to his connection with the New York City Railway Company and its predecessor, the Metropolitan Street Railway Company, Mr. Starrett was for five years chief engineer of the Brooklyn City Railway Company, and had charge of the electrification of that company's lines and the erection of its two power stations at Kent Avenue and Fifty-Second Street. Prior to moving to Brooklyn, Mr. Starrett was assistant engineer of the West End Street Railway, of Boston.

M. G. STARRETT

MR. THOMAS F. RYAN has resigned as a director from all the railroad and industrial corporations with which he has been associated, and hereafter will retain his official connection only with some of the financial and fiduciary institutions with which he is identified. The reason given by Mr. Ryan for this action is that his accumulating interests and responsibilities render it impossible for him to attend so many directors' meetings and properly to discharge his obligations to the stockholders concerned. Mr. Ryan was a director, all told, of about twenty-five railroad and industrial concerns. The chief of these were the Interborough-Metropolitan Company and a number of its subsidiary companies, the American Tobacco Company, the Consolidated Gas Company, and the Seaboard Air Line Railway. The other companies from which Mr. Ryan is said to have resigned are the Bethlehem Steel Company, the Central Crosstown Railroad, the Consolidated Gas, Electric Light & Power Company, the Cuba Company, the East River Gas Company, the Electric Storage Battery Company, the Fulton Street Railroad, the Havana Tobacco Company; the Hocking Valley Railway, the International Cigar Machinery Company, the Metropolitan Securities Company, the New York Carbide & Acetylene Company, the New York City Railway, the Pine Products Company, the Thirty-Fourth Street Crosstown Railway, the Union Bleaching & Finishing Company, the Union Elevated Railroad of Chicago, the United Lead Company, and the Universal Accountant Machine Company. The financial and fiduciary institutions with which Mr. Ryan is connected as a director include, besides the Morton Trust Company, the National Bank of Commerce, of which he is vice-president; the American Surety Company, the Industrial Trust Company of Providence, the Newport Trust Company, the Union Exchange Bank, and the Washington Life Insurance Company. He has for a long time been intimately connected with the affairs of the Metropolitan Street Railway, now one of the subsidiaries of the Interborough-Metropolitan Company, and from the time of the death of Mr. W. C. Whitney until the merger of the surface lines with the subway and elevated systems he was by far the most conspicuous figure among the financiers identified with the local traction companies. In commenting on Mr. Ryan's action the New York "Times" said that his retirement from the Interborough-Metropolitan Company—the holding company of all the Manhattan traction companies—will be regarded as the most important change brought about by the wholesale resignations announced by Mr. Ryan.